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ABSTRACT

We collected and analyzed samples of sediments and mussels (Mytilus *trossulus)* for alkane and aromatic hydrocarbons from eight sampling stations adjacent to the oil tanker vessel transportation corridor through Prince William Sound, Alaska, during the period from 1977 to 1980, to determine baselines prior to the start of oil tanker movement through the Sound. We' evaluated interannual variability of these analytes using a two-factor analysis of variance of logarithm-transformed hydrocarbon concentrations determined in duplicate samples collected in June 1977 and in June 1978 at six of the stations. Intra-annual variability was evaluated using analyses of duplicate samples collected in May, June, and August 1978 at seven of the stations. In addition, total organic carbon and grain size distribution was determined in the sediment samples, the lipid content was determined in the mussel samples, and the surface seawater temperature and salinity was determined for each sampling station.

The hydrocarbon analyses indicated chronic, low-level hydrocarbon contamination that probably originates from small fuel spills, ballast water discharges, and fuel-combustion exhaust emissions of occasional vessel activity adjacent to three of the sampling stations: Constantine Harbor, Rocky Bay, and Mineral Flats, in decreasing order of contamination, respectively. Sediments at these three stations were contaminated by aromatic hydrocarbons found at concentrations that were generally less than 10 ng/g dry sediment weight, but above detectable limits (< 1.0 ng/g). In contrast, the remaining five stations showed no indication of petroleum hydrocarbon contamination, primarily because detected aromatic hydrocarbons were present only sporadically and at concentrations that were generally near detection limits. Both perylene, which was found at concentrations well above detection limits at all stations outside Port Valdez, and phenanthrene, which was also found sporadically at all sampling stations may have natural sources. Concentrations of aromatic hydrocarbons were frequently too low at most of the sampling stations to allow evaluation of intra- and interannual variability.

Concentrations of individual n-alkanes varied substantially in sediments and in mussels. The most abundant n-alkanes in sediments included normal alkanes with an odd number of carbon atoms and a molecular weight greater than tetradecane (C-14). Concentrations of these n-alkanes were generally in the range of 10 to 100 ng/g dry sediment weight and exceeded 1,000 ng/g at Constantine Harbor. The most abundant n-alkanes in mussels included decane (C-10) through heptadecane (C-17), and pristane, at concentrations generally ranging from 10 to over 1,000 ng/g dry tissue weight.

Sources of alkanes in sediments included terrigenous plant waxes, marine plankton, and possibly marine macrophytic algae at all the stations; petroleum-derived alkanes were also found at Constantine Harbor. Terrigenous plant waxes in sediments were indicated by high abundances of odd-numbered carbon n-alkanes of molecular weight greater than nonadecane (C-19) compared with even-numbered carbon n-alkanes in these sediments, and by slight but significant intra-annual variability of these odd-numbered carbon alkanes in sediments, which probably arose from seasonal deposition of senescent leaves. Marine planktonic and algal sources of pristane and normal alkanes were indicated by the presence of these alkanes in sediments and in mussels, and by the relatively high abundances of pristane; pentadecane (C-15), and heptadecane (C-17) in sediments and in mussels.

The concentrations of pristane, pentadecane (C-15), and heptadecane (C-17) varied significantly in sediments, in mussels, or in both, intra-annually or interannually. Pristane variability in sediments and in mussels was significantly correlated and was probably due to variability of populations of calanoid copepods in Prince William Sound. Neither pentadecane variability nor heptadecane variability were correlated in sediments and mussels, suggesting multiple biological sources of these alkanes.

These results indicate that, except in areas affected by localized vessel traffic, intertidal sediments and mussels in Prince William Sound were remarkably free of petroleum-contaminant hydrocarbons during the period of this study. The hydrocarbons found in sediments and mussels unaffected by vessel traffic can be adequately explained by known, natural sources. As a result, sediments and mussels contaminated by crude oil from the Exxon *Valdez* oil spill should be particularly apparent due to the general absence of other confounding sources of petroleum hydrocarbons.

CONTENTS

INTRODUCTION

The oil spill that resulted from the March 1989 grounding of the oil tanker vessel *Exxon Valdez* provides a unique opportunity for the study of marine oil pollution effects because the spilled crude oil polluted a large geographic area that was previously considered pristine. Large-marine oil spills more commonly occur along well established tanker routes that are already measurably polluted by oil, where the effects of a particular oil spill are confounded with effects of prior spills or of chronic oil pollution sources. In contrast, the Exxon Valdez oil spill is the only large spill along a recently established major oil tanker route, so the fate and effects of the spilled oil should be more clearly discernable.

The only sources of confounding hydrocarbons in the areas of Prince William Sound, Alaska, impacted by the spill are naturally occurring hydrocarbons and anthropogenic hydrocarbons from occasional boating activity in the Sound or due to long-range atmospheric transport. Naturally occurring hydrocarbons may include: alkane hydrocarbons produced from terrigenous and marine biological sources such as plant waxes (Kolattukudy 1976; Eglinton et al. 1962) and phytoplankton (Blumer et al. 1971; Clark and Blumer 19,67); polynuclear aromatic hydrocarbons (PAHs) generated by forest fires (Hites 1981; Farrington et al. 1977; Youngblood and Blumer 1975) and subsequently precipitated into the drainage basin of the Sound; perylene produced from unidentified but probably natural sources (Venkatesan 1988, and citations therein); and aliphatic and aromatic hydrocarbons originating from natural oil seeps. Anthropogenic hydrocarbons in the Sound can result from chronic small spills of fossil fuels associated with boating and shipping directly into seawater, and from fossil fuel combustion products subsequently precipitated that originate from boating and shipping, or from distant industrial centers (Lake et al. 1979; Lunde and Bjorseth 1977).

We sampled intertidal sediments and tissues of mussels Mytilus *trossulus* in Prince William Sound during a 4-year, period beginning in 1977 to establish the levels and variability of hydrocarbons in these matrixes prior to any large-scale pollution 'events. The likelihood of such large-scale pollution events within the Sound increased substantially in, July 1977 with the large volume of crude oil transported after the opening of the trans-Alaska oil pipeline, which connects the Prudhoe Bay oil field with a tanker terminal at Valdez, Alaska.

Our specific objectives were to determine the levels, intra-annual variability, and interannual variability of selected alkane hydrocarbons and PAHs in intertidal sediments and in M. trossulus tissues at a network of sampling stations over the I-year sampling period, and if possible to identify the likely sources of hydrocarbons found. We chose sediments and mussels to facilitate comparison with the large body of data on hydrocarbons in these two matrixes in the literature. We present our results now to facilitate evaluation of hydrocarbon analyses of these matrixes in Prince William Sound conducted in the aftermath of the *Exxon Valdez* oil spill.

MATERIALS AND METHODS

Sampling Stations

Prince William Sound is one of North America's largest tidal estuary systems occupying about 6,500 km on the southern coast of Alaska. There is a mean precipitation of 4.6 m at some locations (Arctic Environmental Information and Data Center 1977) which is sufficient enough to depress salinities within the Sound and influence adjacent oceanic currents. The prevailing ocean current enters the Sound through Hinchinbrook Entrance in the south-central part of the Sound and exits mainly through Montague Strait in the southwest (Galt et al. 1991).

Intertidal sediment and mussel samples were collected from four to eight stations in Prince William Sound, Alaska, during the period May 1977 to August 1980. The latitude, longitude, and collection dates for each station are listed in Table 1, where the station numbers correspond with those in Figure 1, and where entries for sediment temperature and seawater salinity in Table 1 indicate samples were collected. The eight sampling stations bracket the oil tanker route inside Prince William Sound to the Alaska pipeline terminal in Port Valdez (Fig. 1). The eight stations were not all sampled prior to the June 1978 sampling.

The sampling stations are subject to dissimilar environmental influences. Two stations, Dayville Flats and Mineral Flats, are located inside Port Valdez near the oil tanker terminal and the city of Valdez, Alaska, respectively (Fig. 1). The surface waters of Port Valdez *receive* sufficient fresh water from direct precipitation and glacial melt-water to depress salinities substantially, particularly in late summer (Table 1,). In addition, the glacial melt-water bears a high sediment load that is deposited in the Port. Although remote from human activity, the station at Siwash Bay is similarly affected by fresh and glacier melt-water. The other stations are not directly exposed to glacial melt-water.

The stations at Constantine Harbor and at Rocky Bay are exposed to the effects of occasional vessel traffic. Constantine Harbor was the site of an early Russian settlement, and more recently has been used as a port of refuge for vessels seeking

Table 1.--Sample station locations, sampling dates, salinities and temperatures. Salinities (%) and temperatures (°C) are given for each sediment and mussel sample collection date at each sampling station. Missing values for salinity and temperature indicate no samples collected. M= measurement not taken. The sample station numbers refer to those *in Figure 1.*

			1977			1978			1979		1980
Sample station	Latitude (°N)	Longitude (°W)	May 6-12	June 26-31	Oct 10-14	May 5-10	June 19-25	Aug 15-20	May 10-19	Aug 6-13	Aug 23-30
1. Bligh Island	60°52'02"	146°45'20"	23.1‰ 7.7°C	24.8‰ 14.4°C	27.7‰ 9.0°C	25.0‰ 6.5°C	26.9‰ 11.6°C	24.4‰ 14.3°C	28.5‰ 14.6°C	21.3‰ 15.0°C	23.2‰ 13.3°C
2. Constantine Harbor	60°21'20"	146°39'38"	23.1‰ 9.2°C	26.2‰ 13.0°C		24.5‰ 5.1°C	23.3‰ 10.0°C	21.8‰ 14.1°C	23.7‰ 7.9°C	21.2‰ 13.3°C	22.9‰ 13.5°C
3. Dayville Flats	60°05'19"	146°16'40"	M 9.1°C	M 11.5°C	23.5‰ 10.0°C	27.4‰ 7.3°C	10.9‰ 11.6°C	0.7‰ 7.6°C	19.5‰ 14.2°C	5.3‰ 12.2°C	10.1‰ 12.0°C
4. Mineral Flats	60°07'47"	146°25'05"			23.5‰ 7.2°C		8.7‰ 10.8°C	0.1‰ 10.1°C	19.8‰ 11.2°C	4.4‰ 16.1°C	10.8‰ 10.2°C
5. Naked Island	60°39'08"	147°26'14"	31.6‰ 9.0°C	27.6‰ 14.4°C	27.7‰ 9.0°C	29.2‰ 5.1°C	29.3‰ 12.5°C	25.3‰ 13.2°C	30.0‰ 10.0°C	26.5‰ 15.0°C	25.9‰ 13.8°C
6. Olsen Bay	60°44'22"	146°11'53"				27.1‰ 8.0°C	24.8‰ 11.0°C	21.6‰ 14.5°C	26.1‰ 7.1°C	23.2‰ 16.7°C	22.2‰ 14.2°C
7. Rocky Bay	60°20'06"	147°07'43"		27.3‰ 13.8°C		M 6.0°C	28.4‰ 11.4°C	25.0‰ M	27.2‰ 8.5°C	25.7‰* 14.4°C	26.4‰ M
8. Siwash Bay	60°57'12"	147°40'50"		16.5‰ 11.0°C	22.5‰ 8.6°C	22.1‰ 6.2°C	23.2‰ 8.9°C	18.4‰ 9.8°C	28.3‰ 8.5°C	17.6‰ 12.2°C	17.1‰ 10.2°C

*Mussels only collected

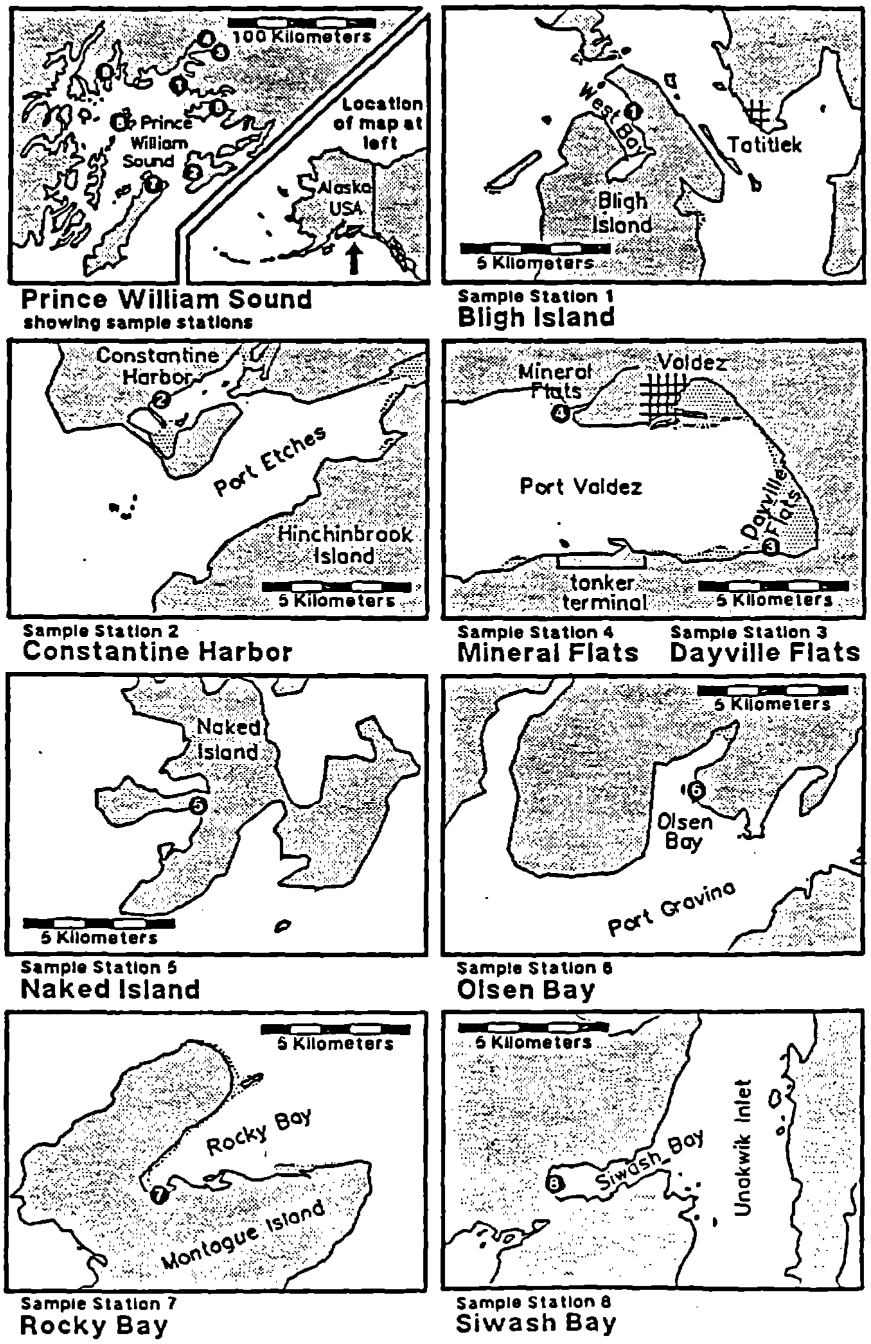

Figure 1.--Maps of the study area and of the sampling stations within the study area. The sample station numbers on these maps are those listed in Table 1.

shelter from the frequent storms in the Gulf of Alaska. Although an excellent harbor, it is very poorly flushed due to its shape. Rocky Bay is fished commercially for several species, resulting in occasionally dense vessel traffic.

The stations at Bligh Island, Naked Island, and Olsen Bay are rarely exposed to human activities and are exposed to similar oceanographic conditions that are typical of most of the Sound.

Sample Collection

Sediment collection transect lines (30 m) were located parallel to the water line from the -0.75 m to +0.75 m tide levels. Sediment cores were collected using a rinsed, hydrocarbon-free stainless steel cookie cutter. Sediment samples were collected in triplicate at each site by compositing 10 cores (diameter 3.2 cm x depth 1.25 cm) taken at random along the 30-m transect for each sample. Composite sediments were placed in dichloromethane-rinsed glass jars and were frozen within 2-3 hours of collection.

Mussel collection transects were located in mussel bands parallel to the water line, usually just above the sediment transects (-+l m tide level). Mussel samples were collected in triplicate by taking approximately 30 2-5 cm mussels (enough to produce $\geq$10 g tissue) at random along the 30-m transect. The collected mussel samples were placed into dichloromethane-rinsed glass jars and were frozen within 2-3 hours of collection.

Sediment - Physical Measurements

Total organic carbon was determined by the method of Jackson (1958). Sediment grain size distribution was determined using standard sieves and pipetting methods (Krumbein and Pettijohn 1938). Sediment dry weight was determined gravimetrically by measuring the weight lost after drying for 24 hours at 100°C.

Mussel Tissue - Dry Weight and Lipid Determination

Mussel tissue dry weight was determined gravimetrically by measuring the weight lost after drying for 24 hours at 120°C. Percent lipid of the tissue was determined by the method of Hanson and Olley (1963) and is reported on a dry weight basis.

Chemical Analysis

Sediment and mussel tissue samples were analyzed for normal alkanes having 10 to 30 carbon atoms (C-10 to C-30), pristane, phytane, and the PAHs listed in Table 2. Pristane and phytane refer to 2,6,10,14-tetramethylpentadecane and 2,6,10,14-tetramethylhexadecane, respectively. Concentrations are reported as ng/g dry weight. Not more than two samples were analyzed from any triplicate of samples collected.

Sediment and mussel tissue samples were processed for analysis in batches consisting of 8-10 samples, a reagent blank, and a spiked reagent blank. The alkane dodecylcyclohexane (DCH) was added to the samples and to the spiked blank, but not to the reagent blank, to verify recovery of alkane analytes. An aliquot of the hydrocarbons listed in Table 2 was added to the spiked blank to estimate losses during analysis. The samples, reagent blank, and spiked blank were processed identically.

Extraction Procedure

Hydrocarbons in sediment samples were extracted using a ball-mill tumbler extraction procedure described fully in Brown et al. (1980). An aliquot of DCH was added to a 100 g wet sediment sample, which was subsequently dewatered by swirling the sample with two successive aliquots of 50 ml methanol per aliquot in a 1 L bottle. The two methanol aliquots were then decanted and combined in a 600 ml beaker, and 100 ml of 2:l dichloromethane: methanol was added to the bottle containing the sediment sample. The bottle was sealed with a Teflon-lined screwcap and rolled on a ball-mill tumbler for 16 hours (overnight). The extract was decanted into the 600 ml beaker containing the methanolic extracts, together with 5 ml dichloromethane used to rinse the sample and bottle. The dichloromethane-methanol sediment extraction step was repeated twice, first for 6 hours, then for 16 hours, with 100 ml each time.

The combined extracts were filtered through a coarse fritted-glass filter into a 1 L separatory funnel and extracted with 500 ml distilled water to remove methanol. The aqueous phase was separated and back-extracted with 20 ml dichloromethane, and the dichloromethane phases were combined and filtered through a 19 mm id chromatography column containing 20 ml of activated silica gel covered with a 1 cm layer of sand. The dichloromethane filtrate and rinses were concentrated and exchanged into 2 ml of hexane under reflux.

Hydrocarbons in whole mussel tissue were extracted using a procedure described fully by Brown et al.. (1979). Whole tissues from samples of mussels were mechanically homogenized for at least 30 seconds. A 10 g aliquot of the homogenate was combined with 6 ml of 4 N sodium hydroxide in a 40 ml centrifuge tube capped with a Teflon-lined screw cap, shaken for 1 minute, and digested at 30°C for 18 hours. A 15 ml aliquot of diethyl ether

Table 2.--Identities and abbreviations of alkane and aromatic hydrocarbon analytes determined in sediment and in mussel tissue samples of this study.

Alkane Analyte	Abbreviation
Decane	C-10
Undecane	C-11
Dodecane	C-12
Tridecane	C-13
Tetradecane	C-14
Pentadecane	C-15
Hexadecane	C-16
Heptadecane	C-17
Pristane	Pris
Octadecane	C-18
Phytane	Phyt
Nonadecane	C-19
Eicosane	C-20
Heneicosane	C-21
Docosane	C-22
Tricosane	C-23
Tetracosane	C-24
Pentacosane	C-25
Hexacosane	C-26
Heptacosane	C-27
Octacosane	C-28
Nonacosane	C-29
Triacontane	C-30
Hentriacontane	C-31

Aromatic Analyte	Abbreviation
iso-Propylbenzene	I-Probz
n-Propylbenzene	N-Probz
Indane	Indan
1,3,5-Trimethylbenzene	Tmebz
Naphthalene	Naph
Benzothiophene	Bzthio
2-Methylnaphthalene	2-Menap
1-Methylnaphthalene	1-Menap
Biphenyl	Biphen
2,6-Dimethylnaphthalene	2,6-DMN
2,3,5-Trimethylnaphthalene	235-TMN
Fluorene	Fluoren
Dibenzothiophene	DBZ
Phenanthrene	Phenan
Anthracene	Anthra
1-Methylphenanthrene	Mephen
Fluoranthene	Flanth
Pyrene	Pyrene
Benzanthracene	Bzanth
Chrysene	Chryse
Benzo-[e]-pyrene	Bzepyr
Benzo-[a]-pyrene	Bzapyr
Perylene	Peryl

was added to the centrifuge tube after it had cooled to room temperature, and the re-capped tubes were shaken for 1 minute and centrifuged for 10 minutes. The ether phase was transferred to a 30 ml bottle, and the sample was re-extracted with 10 ml of diethyl ether. The combined ether extracts were dried with 0.5 g sodium sulfate, transferred to a concentrator tube, then concentrated and exchanged into 2 ml of hexane under reflux.

Fractionation Into Hydrocarbon Classes

Alkane and aromatic hydrocarbons were separated by column liquid chromatography using silica gel. The silica gel (Davison grade 923) was 100-200 mesh activated at 150°C for 24 hours. The chromatography column was packed with 7 g silica gel covered with a 1 cm layer of sand in dichloromethane, and then washed with 40 ml of petroleum ether. The sample in 2 ml hexane was loaded onto the top of the column and eluted with 15 ml petroleum ether, then 3 ml 1:4 dichloromethane:petroleum ether, then 25 ml 2:3 dichloromethane:petroleum ether. The first 18 ml of eluate collected contained the alkane analytes, and the next 25 ml of eluate contained the aromatic analytes. Elemental sulfur was removed from these eluates with copper metal that was activated through rinsing with concentrated hydrochloric acid, then methanol. The eluates were prepared for analysis by gas chromatography (GC) by concentration to 0.7 ml under reflux, addition of 1.0 ml internal standard (4 ng/ul hexamethylbenzene (HMB) in hexane), and re-concentration to 0.7 - 1.0 ml.

Gas Chromatography

The alkane and aromatic hydrocarbon extract fractions were analyzed using GC with a hydrogen flame ionization detector (FID) to measure each analyte. The GC instrument conditions were the same for the alkanes and aromatics. The GC analysis was performed on a Hewlett-Packard model 5840A gas chromatograph equipped with a 30 m long by 0.25 mm id glass capillary column coated with a dimethylsiloxane polymer (SE-30). A 2 ul aliquot of sample was injected into the injection port operated in the splitless mode at 280°C. The split valve was opened after 0.3 minutes. The carrier gas was helium, the initial column temperature was 40°C for 5 minutes, but then was raised at a rate of 4°/minute to 270°C. The detector was operated at 300°C and used nitrogen make-up gas. Analyte peak area response was determined using an electronic integrator.

Hydrocarbon analyte, concentrations in the extracts injected into the GC were determined by comparison of the ratio of analyte FID response and internal standard (HMB) FID response for a sample with the same ratio for a hydrocarbon standard. The concentration of hydrocarbon analyte in the original sample was calculated as the ratio of the amount of analyte present in the original sample and the equivalent dry weight of the sample. The equivalent dry weight of a sample is the product of the sample wet weight and the ratio of wet and dry weights of that sample, which were determined using a 10-20 g subsample for sediments and a 3 g subsample for mussel tissue homogenates.

Detection limits were estimated on the basis of the minimum measurable instrument response, response factors for standards, and sample dry weight. These estimates of detection limit concentrations are indicated by the preceding symbol "<" for each analyte not detected in each sample in Tables A-l through A-4 in the Appendix.

Confirmation of Aromatic Hydrocarbon Analyte Identities by Gas Chromatography/Mass Spectrometry

The identity of aromatic hydrocarbons detected and measured by GC/FID were confirmed by GC/MS analysis in each sample matrix at each sample station.

Data Analysis

Intra-annual trends of selected alkane analytes were evaluated using a two-factor analysis of variance (ANOVA), where factors included seven sample stations and the three sample collection periods listed in Table 1 for 1978. Data from 1978 were evaluated because more of the sample stations were sampled and analyzed in duplicate than in other years, resulting in a balanced ANOVA with maximum power. The sample station not included for the ANOVA was the Mineral Flats station in Port Valdez, which was not sampled in May of 1978. The analytes selected for evaluation included: pristane, phytane, and the normal alkanes from C-12 through C-31 in sediments; pristane and the normal alkanes from C-12 through C-17 in mussels were also included. The remaining alkane analytes and all the aromatic analytes in both sediments and mussels were only sporadically above detection limits, precluding evaluation by ANOVA.

Interannual trends of selected alkane analytes were evaluated using a two-factor ANOVA, where factors included six sample stations and two sample collection periods: June 1977 and June 1978. Data from June of these years were evaluated because more of the sample stations were sampled and analyzed in duplicate than the other months, resulting in a balanced ANOVA with maximum power. The sample stations not included for the ANOVA were the Olsen Bay station and the Mineral Flats station in Port Valdez, which were not sampled in June of 1977. The analytes selected for evaluation included: pristane, phytane, C-

15, and the normal alkanes from C-17 through C-31 in sediments; pristane and the normal alkanes from C-12 through C-17 in mussels were also included. The remaining alkane analytes and all the aromatic analytes in both sediments and mussels were only sporadically above detection limits, precluding evaluation by ANOVA.

The association of an alkane analyte in sediments with mussel tissues was evaluated using the Pearson product-moment correlation coefficient. Data from all the sampling stations and from all the sampling dates were included for the correlation coefficient calculations. Correlation coefficients were determined for C-15, C-17, and pristane because these were the only three hydrocarbon analytes consistently present in both sediments and mussels.

The original alkane concentrations, c, were transformed as ln(c + 1), and the correlation coefficients and the ANOVAs were calculated using the transformed values.

RESULTS

The concentrations of alkane and of aromatic hydrocarbon analytes found in sediments and mussels are listed in Tables A-l through A-4 of the Appendix. The percent total organic carbon (TOC) is also listed in Table A-l for each sediment sample where determined, and the percent lipid is also listed in Table A-2 for each mussel sample where determined. The sediment grain size distribution is listed in Table A-5 for each sediment sample where determined. Percent TOC, percent lipid, and sediment grain size are presented in these tables to facilitate comparison with future work. Following is a summary and statistical evaluation of the hydrocarbon results listed in these tables.

I. Alkanes

A. Sediments

Mean concentrations of individual alkane analytes were generally on the order of 1 to 10 ng/g dry sediment, ranging up to about 100 ng/g, at all sites except Constantine Harbor (Fig. 2). Mean alkane concentrations were consistently elevated by a factor of about 5 or more at Constantine Harbor compared with the other sites (Fig. 2). These mean concentrations are averages of sample duplicates and of all sampling periods.

Sediments at Constantine Harbor contained numerous unidentified alkane hydrocarbons compared with sediments at the

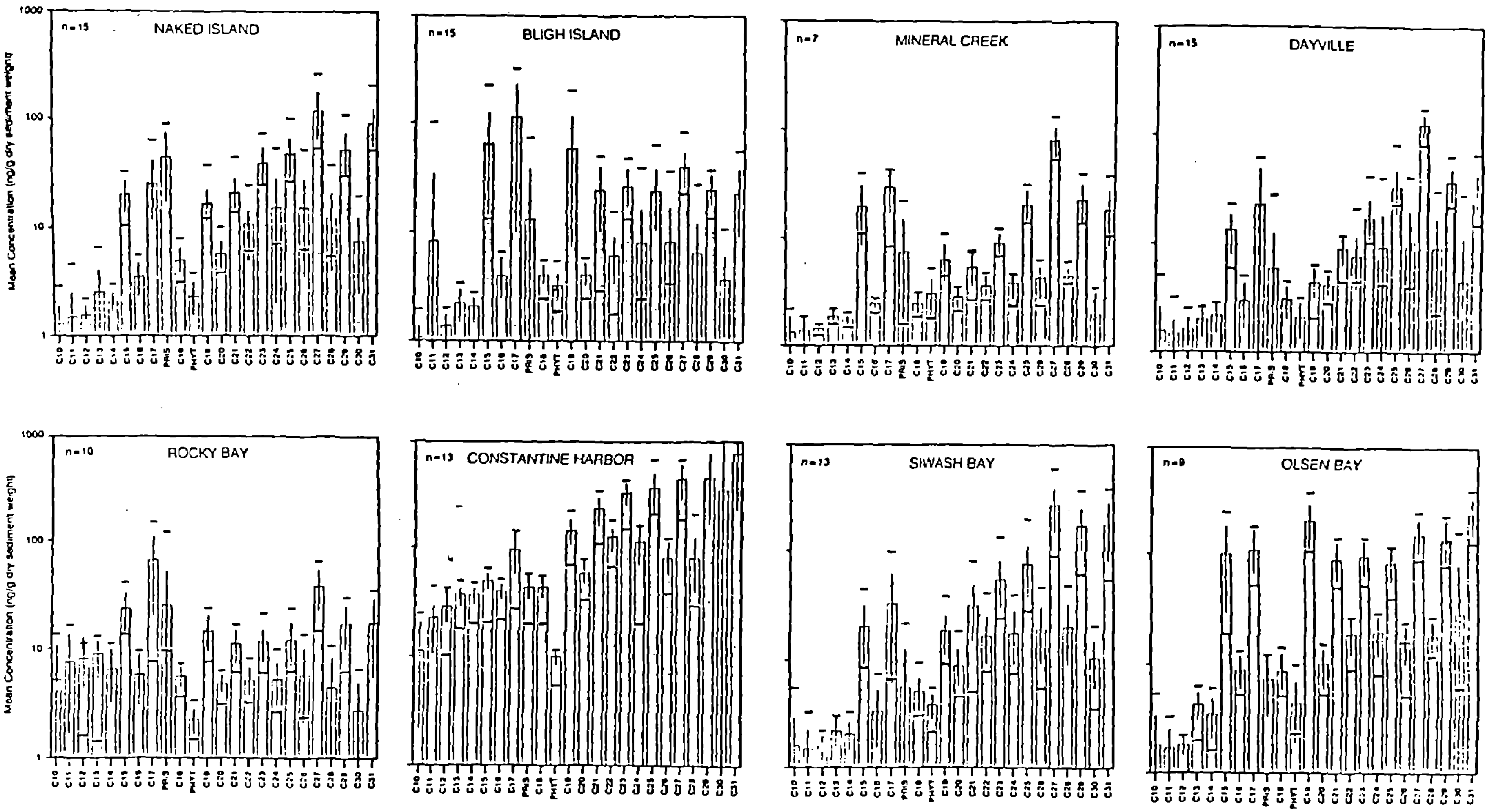

Figure 2.--Mean alkane analyte concentrations of sediment samples averaged over all replications of all sampling periods for each sampling station. The shaded bars indicate the mean alkane analyte concentration (ng/g dry sediment weight) on a logarithmic scale for each alkane analyte. The vertical lines associated with each shaded bar indicates +/- one standard deviation unit, and the horizontal bars indicate the range. The number of samples included in the means, n, is given in the upper left corner of each graph above. These graphs are derived from data in Table A-1.

other sampling stations. Representative chromatograms of alkanes in sediment samples at Constantine Harbor, Dayville Flats, and Olsen Bay in June 1978 are presented in Figure 3. Note the presence of numerous unidentified peaks in the Constantine Harbor chromatogram that are generally absent in the Dayville Flats and Olsen Bay chromatograms of Figure 3. Constantine Harbor is the only sampling station where these unidentified peaks are typically present.

Concentrations of normal alkanes having an odd number of carbon atoms generally predominate over adjacent even-numbered alkanes at all eight sites, with exceptions in the C-10 to C-14 range of the normal alkanes (Fig. 2). The sum of the mean concentrations of odd C-15 thru C-31 account for 71 - 89%, depending on the site, of the sum of the mean concentrations of all the alkanes, with maxima at C-15 to C-19 and at C-27 to C-31.

Pristane and phytane are relatively minor constituents of alkanes in sediments. Mean pristane concentrations were highest at Naked Island, Constantine Harbor, and Rocky Bay, with mean concentrations of 43.6 ng/g, 42.6 ng/g, and 24.4 ng/g, respectively. However, even at these three stations, the mean pristane concentration was less than 8% of the sum of the mean concentrations of all the alkanes at the respective stations. Phytane concentrations were consistently highest at Constantine Harbor at a mean concentration of 9.07 ng/g; mean phytane concentrations at the other stations range from 1.04 to 3.43 ng/g.

Intra-annual Variation - Sediments

In 1978, the sampling period was at least a highly significant factor ($P < 0.01$) for six alkane analytes, based on the intra-annual two-factor ANOVAs (Table 3). The ANOVA interaction term was not significant for two of these alkanes, pristane and C-20, indicating uniform changes of these two alkanes across the sampled stations. These two alkanes were consistently lower in August 1978 than in May 1978 at each sampled station (Table 4). The ANOVA interaction term was significant for the other four alkanes, C-13, C-14, C-16, and C-18, (Table 3), indicating station-specific significant changes of these alkanes. These four alkanes increased from May 1978 to August 1978 at Bligh Island and at Siwash Bay, but decreased during this same period at the other sampled stations (Table 4).

Sampling period is a significant factor ($P < 0.05$) for eight other alkane analytes at stations sampled in 1978, and the ANOVA interaction term is either not significant or is marginally significant (P -0.05) for these analytes (Table 3). These alkanes include phytane, C-19, C-21, C-22, C-24, C-27, C-29, and

Table 3.--Summary analysis of variance table for intra-annual variation of logarithmically transformed alkane concentrations in sediments during 1978 at seven sampling stations. The excluded station is Mineral Flats because it was not sampled in May 1978. The two-factor ANOVA includes 1978 sampling period and sampling stations as the two factore, and is performed for each alkane analyte listed below independently. Also listed for each alkane analyte below are the ANOVA F-ratios of the sampling period mean square (df = 2) and the error mean square (df = 21), the sampling station mean square (df = 6) and the error mean square, and the interaction mean square of sampling periods and sampling stations (df = 12) and the error mean square. The error mean square is itself listed for each alkane analyte to allow the reader to reconstruct the full ANOVA table for each alkane. These ANOVA's are fully balanced, with two observations for each combination of sampling period and sampling station. The symbols *, **, and *** associated with the F-ratios indicate significance ($P < 0.05$), high significance ($P < 0.01$), and very high significance ($P < 0.001$), respectively. Alkane concentrations of Table A-l were transformed as ln (c + 1), where c is the concentration listed in Table A-l, prior to the ANOVA calculation.

Alkane	Month $F_{2,21}$	Station[a] $F_{6\&21}$	Interaction $F_{12,21}$	MSe
C-12	0.616	366.690	1.393	0.02317
C-13	18.044***	365.154	3.950**	0.01739
C-14	14.799***	592.745	3.075*	0.01127
C-15	0.417	20.096	3.897**	0.11630
C-16	12.994***	187.574	7.061***	0.02663
C-17	2.784	8.646	1.479	0.38994
Pristane	19.628***	62.532	1.407	0.13396
C-18	9.186**	133.512	2.780*	0.03616
Phytane	3.532*	26.914	0.950	0.08818
C-19	3.509*	167.232	2.271*	0.06218
C-20	11.081***	199.373	1.822	0.02777
C-21	4.930*	166.873	1.785	0.04759
C-22	4.762*	143.210	1.192	0.05169
C-23	2.851	113.380	1.073	0.07033
C-24	3.704*	58.683	0.644	0.11632
C-25	2.319	23.230	0.675	0.32814
C-26	2.630	16.378	0.284	0.26987
C-27	4.848*	61.487	2.020	0.07321
C-28	1.098	14.344	0.338	0.32321
C-29	4.303*	75.760	1.698	0.11073
C-30	0.370	13.195	0.624	0.60154
C-31	4.708*	80.887	1.337	0.14173

[a]All numbers are very highly significant.

Table 4.--Proportional change from May 1978 to August 1978 of alkane analytes in sediments at seven sampling stations. The excluded station is Mineral Flats because it was not sampled in May 1978. Proportional change is calculated as (A - B)/B for each alkane analyte and for each included sampling station where A and B are mean alkane analyte concentrations of August 1978 and May 1978, respectively, using the data in Table A-l.

Alkane	Bligh Island	Const. Harbor	Dayville Flats	Naked Island	Olsen Bay	Rocky Bay	Siwash Bay
C-12	-0.063	-0.077	0.691	0.154	-0.180	-0.356	1.000
C-13	0.067	-0.064	-0.394	-0.738	-0.358	-0.491	0.154
C-14	0.055	-0.158	-0.435	-0.223	-0.500	-0.413	0.120
C-15	0.110	-0.010	-0.405	0.393	-0.721	-0.530	2.453
C-16	0.091	-0.051	-0.967	-0.293	-0.467	-0.385	0.583
C-17	-0.179	0.238	-0.646	-0.452	-0.519	-0.568	0.659
Pristane	-0.271	-0.211	-0.977	-0.556	-0.970	-0.364	-0.349
C-18	0.113	-0.047	-0.796	-0.343	-0.444	-0.431	0.123
Phytane	0.025	-0.162	-1.000	-0.423	-0.296	-0.707	-0.030
C-19	0.451	0.125	-0.610	-0.172	-0.452	-0.476	-0.103
C-20	-0.059	-0.009	-0.478	-0.222	-0.542	-0.500	-0.140
C-21	0.212	0.132	-0.461	-0.060	-0.505	-0.512	-0.194
C-22	-0.079	0.136	-0.356	-0.129	-0.615	-0.324	-0.219
C-23	0.056	0.200	-0.287	-0.098	-0.565	-0.488	-0.137
C-24	-0.257	0.202	-0.521	-0.127	-0.642	-0.355	-0.315
C-25	-0.405	0.259	-0.279	-0.137	-0.593	-0.506	-0.136
C-26	-0.387	0.158	-0.592	-0.118	-0.638	-0.475	-0.387
C-27	-0.068	0.661	-0.308	-0.344	-0.556	-0.631	-0.133
C-28	0.308	0.702	-0.597	-0.139	-0.477	-0.108	-0.209
C-29	-0.128	0.897	-0.554	-0.323	-0.573	-0.644	-0.200
C-30	0.139	0.938	-1.000	-0.152	-0.598	-0.141	-0.365
C-31	-0.279	0.774	-0.621	-0.340	-0.597	-0.643	-0.250

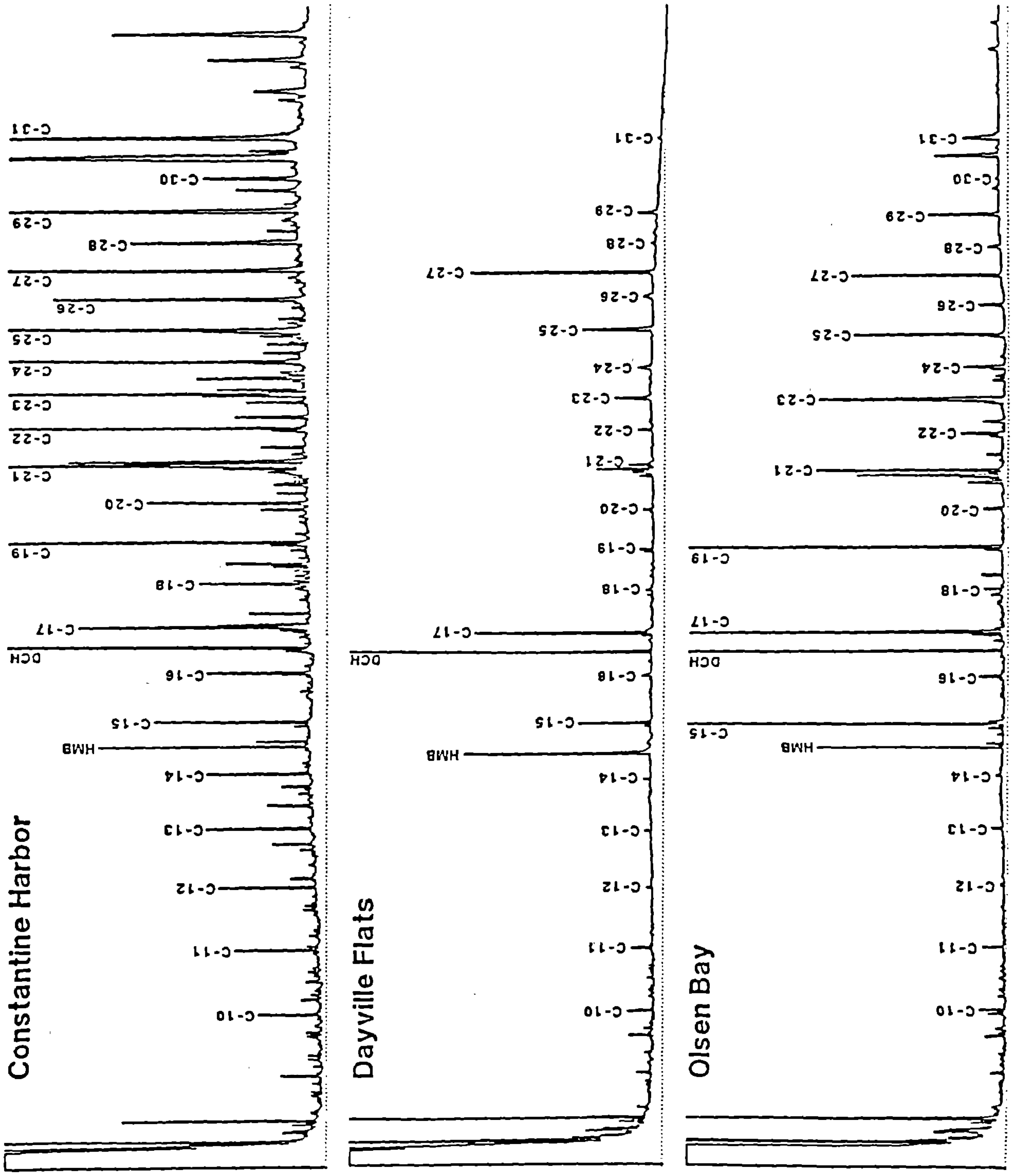

Figure 3.--Representative chromatograms of alkane hydrocarbons in sediments at Constantine Harbor, Dayville Flats, and Olsen Bay, June 1978.

C-31. These alkanes are consistently lower in August, 1978 than in May, 1978 at all the stations sampled except Bligh Island and Constantine Harbor, and they are frequently lower at Bligh Island.

Note that sampling station is consistently a very highly significant factor ($P < 0.001$) for each alkane listed in Tables 3 and 4.

Interannual Variation - Sediments

Very highly significant station-specific changes of C-17 and of pristane were observed when June 1977 and June 1978 concentrations were compared, based on the interannual two-factor ANOVAs (Table 5). Concentrations of C-17 were consistently higher at each station in June 1978 than in June 1977, by multiples ranging up to about 18 (Table 6). Concentrations of pristane were higher at most stations by factors ranging up to about 11; pristane concentrations were unchanged at Rocky Bay and decreased by 34.3% at Constantine Harbor (Table 6). Changes of the other alkane analytes listed in Tables 5 and 6 were either insignificant or were marginally significant (P -0.05).

Note that sampling station is consistently a very highly significant factor ($P < 0.001$) for each alkane listed in Tables 5 and 6.

B. Mussels

Mean concentrations of individual alkane analytes are generally on the order of 10 to 100 ng/g dry mussel tissue, although some alkanes are not detected at some stations, and others are detected at concentrations substantially higher than 100 ng/g (Fig. 4). In general, alkane analytes ranging from C-10 through pristane are the most abundant in mussels at all the sampling stations. Pristane, C-15, and C-17 together account for 62 - 87% of total alkanes, depending on the station. Phytane is detected sporadically at concentrations less than 100 ng/g except at Olsen Bay, where it is detected once only at 520 ng/g (May 1979, see Table A-2).

Intra-annual Variation - Mussels

In 1978 the sampling period is at least a highly significant factor ($P < 0.01$) for C-12, C-14, C-15, and pristane based on the intra-annual two-factor ANOVAs (Table 7). By far the most significant change was for pristane, which consistently declined at all stations from concentrations ranging up to several thousand ng/g in May 1978 to concentrations less than 100 ng/g in

Table 5.--Summary analysis of variance table for interannuel variation of logarithmically transformed alkane concentrations in sediments from June 1977 to June 1978 at six sampling stations. The excluded stations are Mineral Flats and Olsen Bay because these were not sampled in June 1977. The included stations were all sampled in June 1977 and in June 1978. The two-factor ANOVA includes the year of the June sampling period and sampling stations as the two factors, and is performed for each alkane analyte listed below independently. Also Listed for each alkane analyte below are the ANOVA F-ratios of the sampling period mean square (df = 1) and the error mean square (df = 121, the sampling station mean square (df = 5) and the error mean square, and the interaction mean square of sampling periods and sampling stations (df = 5) and the error mean square. The error mean square is itself listed for each alkane analyte to allow the reader to reconstruct the full ANOVA table for each alkane. These ANOVAs are fully balanced, with two observations of alkane concentration for each combination of sampling period and sampling station. The symbols *,**, and *** associated with the F-ratios indicate significance (P < 0.051, high significance (P < 0.011, and very high significance (P < 0.001), respectively. Alkane concentrations of Table A-l were transformed as ln (c + 1), where c is the concentration listed in Table A-l, prior to ANOVA calculation. The alkane analytes C-10 through C-14, and C-16, are not included in this table because the concentrations of these analytes are frequently below detection limits, and thus transform to zero, which compromises the homoscedastic assumptions of the ANOVA.

Alkane	Year $F_{1,12}$	Station[a] $F_{5,12}$	Interaction $F_{5,12}$	MSe
C-15	1.791	14.121	4.392*	0.12022
C-17	197.841***	29.786	9.351***	0.07742
Pristane	23.855***	138.899	7.454**	0.05576
C-18	0.037	197.561	1.802	0.01999
Phytane	0.717	54.526	0.526	0.02847
C-19	4.778*	204.542	2.723	0.02885
C-20	4.377	127.431	1.242	0.03465
C-21	5.225*	117.104	1.248	0.05038
C-22	2.805	142.414	1.127	0.04566
C-23	5.038*	116.427	1.350	0.05493
C-24	1.330	75.610	1.502	0.08182
C-25	3.992	74.375	1.623	0.08357
C-26	0.243	34.666	1.497	0.14291
C-27	5.126*	64.976	2.235	0.07251
C-28	0.073	27.603	3.351*	0.22507
C-29[b]	2.225	37.111	2.156	0.09069
C-30	0.255	39.342	3.860*	0.21178
C-31[b]	5.145*	60.822	16.888***	0.13069

[b]Only four sampling stations were included in this ANOVA; the additionally excluded station is Constantine Harbor, because the analytical results were not reported for this alkane analyte at this station in June 1977 results (see Table A-1, Constantine Harbor). The degrees of freedom for the sampling station mean square, the interaction mean square, and the error mean square are 4, 4, and 10, respectively, for this alkane in this table.

Table 6.--Proportional change from June 1977 to June 1978 of alkanes in sediments at six sampling stations. The excluded stations are Mineral Flats and Olsen Bay because they were not sampled in June 1977. Proportional change is calculated as (A - B)/B for each alkane analyte and for each included sampling station where A and B are mean alkane analyte concentrations of June 1977 and June 1978, respectively, using the data in Table A-l. The alkane analytes included in this table are those listed in Table 5.

Alkane	Bligh Island	Const. Harbor	Dayville Flats	Naked Island	Rocky Bay	Siwash Bay
C-15	1.031	-0.135	2.434	-0.333	0.054	-0.462
C-17	6.778	0.806	17.154	0.811	5.915	4.455
Pristane	10.385	-0.343	0.164	1.071	0	1.945
C-18	0.333	-0.221	0.182	0.156	0.060	-0.326
Phytane	0.278	-0.111	-0.230	-0.297	-0.021	-0.120
C-19	0.258	-0.308	0.333	-0.032	-0.346	-0.343
C-20	0.250	-0.209	0.014	-0.300	-0.013	-0.403
C-21	0.166	-0.328	0.175	-0.347	-0.339	-0.227
C-22	0.455	-0.242	-0.142	-0.327	0.182	-0.232
C-23	0.200	-0.214	0.074	-0.366	-0.021	-0.395
C-24	0.802	-0.219	0	-0.339	0.559	-0.388
C-25	0.548	-0.277	0.033	-0.420	0.090	-0.425
C-26	1.750	-0.330	0.136	-0.325	1.157	-0.400
C-27	0.455	-0.189	-0.129	-0.241	0.140	-0.506
C-28	3.061	0.023	-0.248	-0.450	N	-0.370
C-29	0.515	N	-0.171	-0.374	0.318	-0.498
C-30	-0.100	-0.013	N	-0.440	N	-0.688
C-31	1.231	N	-0.205	-0.315	N	-0.532

N = not available; June 1977 values below detection limits.

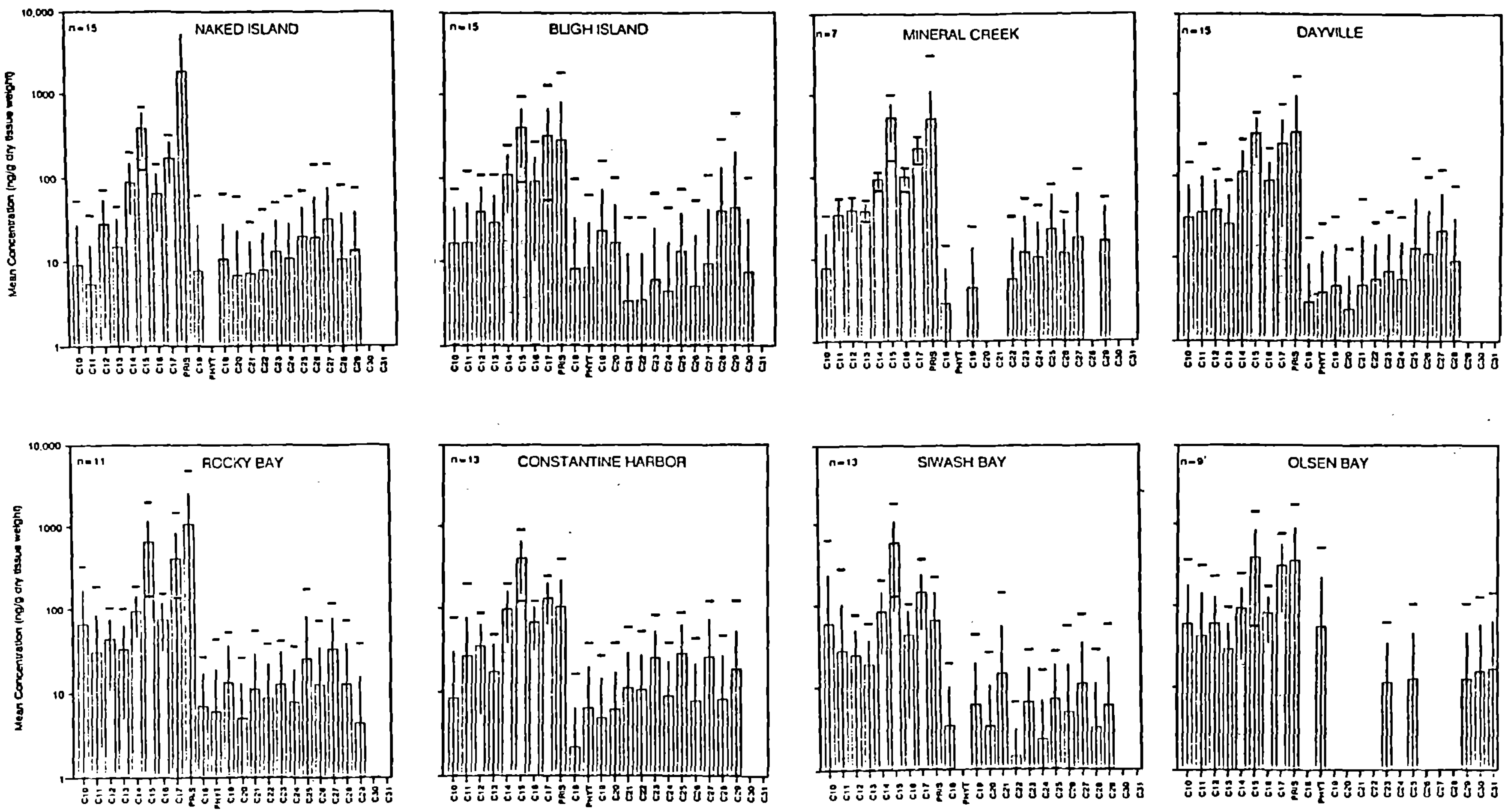

Figure 4.--Mean alkane analyte concentrations of mussel samples averaged over all replications of all sampling periods for each sampling station. The shaded bars indicate the mean alkane analyte concentration (ng/g dry tissue weight) on a logarithmic scale for each alkane analyte. The vertical lines associated with each shaded bar indicates +/- one standard deviation unit, and the horizontal bars indicate the range. The number of samples included in the means, n, is given in the upper left corner of each graph above. These graphs are derived from data in Table A-2.

August 1978 (Tables 8 and A-2). This seasonal decline of pristane concentrations were repeated in 1979 at all stations (Table A-2). The ANOVA interaction term was not significant for C-12 and for C-14 (Table 7)l indicating uniform declines of these two alkanes across the sampling stations (despite the slight rise of the mean concentration of C-13 at Siwash Bay; see Table 8). The ANOVA interaction term was significant for C-15 (Table 7) due to the decline of the C-15 mean concentration at Olsen Bay and the increase of the C-15 mean concentration at the other stations.

Note that sampling station is a significant factor only for pristane and C-15 in Table 7.

Interannual Variation - Mussels

Very highly significant changes of C-15 and pristane were observed when June 1977 and June 1978 concentrations were compared, based on the interannual two-factor ANOVAs (Table 9). Pristane consistently increased at each sampling station in June 1978 compared with June 1977 by multiples ranging up to ten-fold depending on sampling station (Table 10). C-15 consistently decreased at each sampling station by factors ranging up to 4 depending on sampling station (Table 10).

Note that sampling station is a significant factor only for pristane and C-17 in Table 9.

Correlation of Alkanes in Sediments and Mussels

Only pristane was significantly correlated in sediments and mussels, with a coefficient of correlation $r = 0.344$ ($n = 90$, $P < 0.001$). Correlation coefficients for C-15 and for C-17 were 0.028 ($n = 97$) and -0.053 ($n = 95$), respectively, and were clearly not significant ($P > 0.5$).

II. Aromatics

A. Sediments

At three of the sampling stations, a few aromatics were frequently present at concentrations well above detection limits. These stations included Constantine Harbor, Mineral Flats, and Rocky Bay (see Table A-3 for these stations). Perylene and phenanthrene were the most abundant aromatic analytes at these three stations, together accounting for 31 - 54% of total aromatic analytes (Fig. 5).

Sediments at Constantine Harbor contain numerous unidentified aromatic hydrocarbons compared with sediments at the other sampling stations. Representative chromatograms of aromatics in sediment samples at Constantine Harbor, Dayville Flats, and Olsen Bay in June 1978 are

Table 7. --Summary analysis of variance table for intra-annual variation of logarithmically transformed alkane concentrations in mussels during 1978 at seven stations. The excluded station is Mineral Flats because it was not sampled in May 1978. The two-factor ANOVA includes 1978 sampling period and sampling stations as the two factors, and is performed for each alkane analyte listed below independently. Also listed for each alkane analyte below are the ANOVA F-ratios of the sampling period mean square (df = 2) and the error mean square (df = 21), the sampling station mean square (df = 6) and the error mean square, and the interaction mean square of sampling periods and sampling stations (df = 12) and the error mean square. The error mean square is itself listed for each alkane analyte to allow the reader to reconstruct the full ANOVA table for each alkane. These ANOVAs are fully balanced, with two observations for each combination of sampling period and sampling' station. The symbols *, **, and *** associated with the F-ratios indicate significance ($P < 0.05$), high significance ($P < 0.01$), and very high significance ($P < 0.001$), respectively. Alkane concentrations of Table A-l were transformed as ln(c + 1), where c is the concentration listed in Table A-l, prior to the ANOVA calculation. The alkane analytes C-18 through C-31 and phytane are not included in this table because the concentrations of these analytes are frequently below detection limits, and thus transform to zero, which compromises the homoscedastic assumptions of the ANOVA.

Alkane	Month $F_{1,21}$	Station $F_{6,21}$	Interaction $F_{12,21}$	MSe
C-12	7.051**	0.492	0.829	1.55092
C-13	4.258*	0.860	3.651**	1.52679
C-14	7.394**	1.159	0.699	0.60150
C-15	9.992***	5.511**	3.799**	0.08158
C-16	2.178	1.174	0.495	1.94803
C-17	3.960*	1.233	1.749	1.38952
Pristane	204.238***	27.201***	4.702***	0.470161

Table 8.--Proportional change from May 1978 to August 1978 of alkanes in mussels at seven sampling stations. The excluded station is Mineral Flats, because it was not sampled in May 1978. Proportional change is calculated as (A - B)/B for each included alkane analyte, and for each included sampling station, where A and B are mean alkane analyte concentrations of August 1978 and May 1978, respectively, using the data in Table A-l. The alkane analytes included in this table are those listed in Table 7.

Alkane	Bligh Island	Const. Harbor	Dayville Flats	Naked Island	Olsen Bay	Rocky Bay	Siwash Bay
C-12	-0.608	-0.495	-0.848	-0.627	-0.790	-0.776	0.113
C-13	0.222	0	-1.000	(+)	-0.687	-0.663	(+)
C-14	-0.415	-0.360	-0.446	-0.421	-0.720	-0.452	-0.335
C-15	0.373	1.091	0.250	1.196	-0.502	2.150	2.000
C-16	-0.177	0.256	-0.223	0.725	-0.641	-0.500	-0.235
C-17	-0.464	-0.268	-0.895	0.952	-0.886	-0.871	-0.506
Pristane	-0.985	-0.737	-1.000	-0.989	-1.000	-0.984	-1.000

(+) : mean May 1978 = 0; mean August 1978 >0

Table 9.--Summary analysis of variance table for interannual variation of logarithmically transformed alkane concentrations in mussels from June 1977 to June 1978 at six sampling stations. The excluded stations are Mineral Flats and Olsen Bay because these were not sampled in May 1977. The included stations were all sampled in June 1977 and in June 1978. The two-factor ANOVA includes the year' of the June sampling period and sampling stations as the two factors, and is performed for each alkane analyte listed below independently. Also listed for each alkane analyte below are the ANOVA F-ratios of the sampling period mean square (df = 1) and the error mean square (df = 12), the sampling station mean square (df = 5) and the error mean square, and the interaction mean square of sampling periods and sampling stations (df = 5) and the error mean square. The error mean square is itself listed for each alkane analyte to allow the reader to reconstruct the full ANOVA table for each alkane. These ANOVAs are fully balanced, with two observations of alkane concentration for each combination of sampling period and sampling station. The symbols *, **, and *** associated with the F-ratios indicate significance ($P < 0.05$), high significance ($P < 0.01$), and very high significance ($P < 0.001$), respectively. Alkane concentrations of Table A-l were transformed as ln(c + 1), where c is the concentration listed in Table A-1, prior to ANOVA calculation. The alkane analytes C-18 through C-31, and phytane, are not included in this table because the concentrations of these analytes are frequently below detection limits, and thus transform to zero, which compromises the homoscedastic assumptions of the ANOVA.

Alkane	Year $F_{1,12}$	Station $F_{5,12}$	Interaction $F_{5,12}$	MSe
C-12	0.894	2.246	0.696	0.14602
C-13	0.111	1.265	1.499	0.70311
C-14	0.015	1.558	0.735	0.16911
C-15	28.798***	1.602	1.36	0.10715
C-16	0.193	2.811	1.853	0.72041
C-17	2.249	8.196**	1.166	0.13701
Pristane	35.711***	4.252*	3.076	1.67776

Table 10.--Proportional change from June 1977 to June 1978 of alkanes in mussels at six sampling stations. The excluded stations are Mineral Flats and Olsen Bay because they were not sampled in June 1977. Proportional change is calculated as (A - B)/B for each alkane analyte and for each included sampling station where A and B are mean alkane analyte concentrations of August 1978 and May 1978, respectively, using the data in Table A-l. The alkane analytes included in this table are those listed in Table 9.

Alkane	Bligh Island	Const. Harbor	Dayville Flats	Naked Island	Rocky Bay	Siwash Bay
C-12	-0.408	0.391	-0.174	0.068	-0.384	-0.333
C-13	-0.637	-0.309	-0.010	1.081	-0.605	-0.329
C-14	-0.400	0.542	0.303	0.033	-0.294	-0.253
C-15	-0.555	-0.563	-0.316	-0.136	-0.740	-0.618
C-16	-0.569	-0.117	0.325	-0.092	-0.427	2.200
C-17	-0.587	-0.300	0.032	0.019	0.214	-0.440
Pristane	3.478	0.329	(+)	9.144	(+)	0.914

(+): mean 1977 = 0; mean 1978 >0

presented in Figure 6. Note the presence of numerous unidentified peaks in the Constantine Harbor chromatogram that are generally absent in the Dayville Flats and Olsen Bay chromatograms of Figure 6. These unidentified peaks are most numerous and largest at Constantine Harbor, followed by Rocky Bay and Mineral Flats in decreasing order. Note also the prominence of identified aromatic analytes which lack alkyl substituents in the Constantine Harbor chromatogram of Figure-6.

The variety of identified aromatic analytes usually detected decreases as follows: Constantine Harbor > Rocky Bay > Mineral Flats. Most aromatic analytes are usually detected at elevated concentrations at Constantine Harbor and Rocky Bay, the exceptions being the mononuclear aromatics, benzothiophene, anthracene, and benzo[a]pyrene (and 2,3,5-trimethylnaphthalene at Rocky Bay), which are sporadically detected. Aromatic analytes usually detected at Mineral Flats include the naphthalenes (except 2,3,5-trimethylnaphthalene), fluorene, dibenzothiophene, phenanthrene, fluoranthene, and pyrene (Fig. 5).

At five of the sampling stations, all aromatic analytes except perylene were near or below detection limits (Table A-3). These stations included Bligh Island, Dayville Flats, Naked Island, Olsen Bay, and Siwash Bay. Aromatic analytes most frequently detected at these stations included phenanthrene, 2-methylnaphthalene, perylene, naphthalene, and 1-methylnaphthalene, in order of decreasing frequency of detection among these stations (Table A-3). Although not detected at Dayville Flats, perylene accounted for 43 - 79% of the aromatic analytes at the remaining four of these stations (Fig. 5) l In contrast, benzothiophene, benzanthracene, and benzo[e]pyrene were never detected at these five stations; 2,3,5-trimethylnaphthalene, dibenzothiophene, and chrysene were each detected once only at concentrations that were less than 0.7 ng/g.

The low and sporadic concentrations of aromatics preclude evaluation of intra- or interannual trends.

B. Mussels

Aromatic analytes were rarely detected in mussels. Aromatic analytes were detected only 18 times, which included only five analytes (Table A-4). Naphthalene was detected nine times-and 1-methylnaphthalene was detected six times. Iso-propylbenzene, n-propylbenzene, and benzothiophene were each detected once only. Naphthalene or 1-methylnaphthalene were detected most often at Dayville Flats (four times), Rocky Bay (four times), Bligh Island (three times), and Constantine Harbor (three times).

Aromatic analytes in mussels were detected most often in 1977, when detection limits are substantially lower than for succeeding years. Of the 18 instances of aromatic analyte detection in mussels,

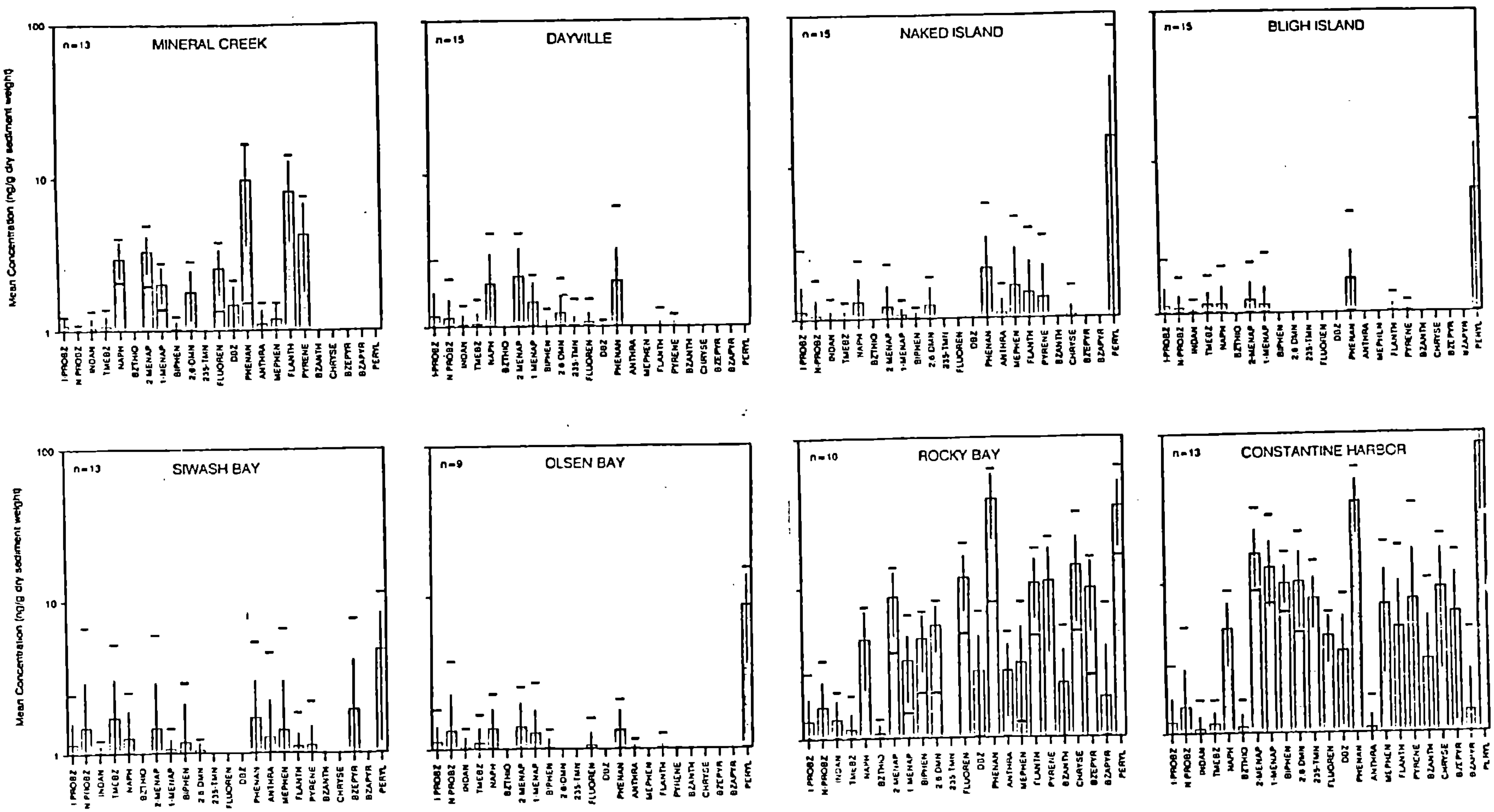

Figure 5.--Mean aromatic analyte concentrations of sediment samples averaged over all replications of all sampling periods for each sampling station. The shaded bars indicate the mean alkane analyte concentration (ng/g dry sediment weight) on a logarithmic scale for each alkane analyte. The vertical lines associated with each shaded bar indicates +/- one standard deviation unit, and the horizontal bars indicate the range. The number of samples included in the means, n, is given in the upper left corner of each graph above. These graphs are derived from data in Table A-3.

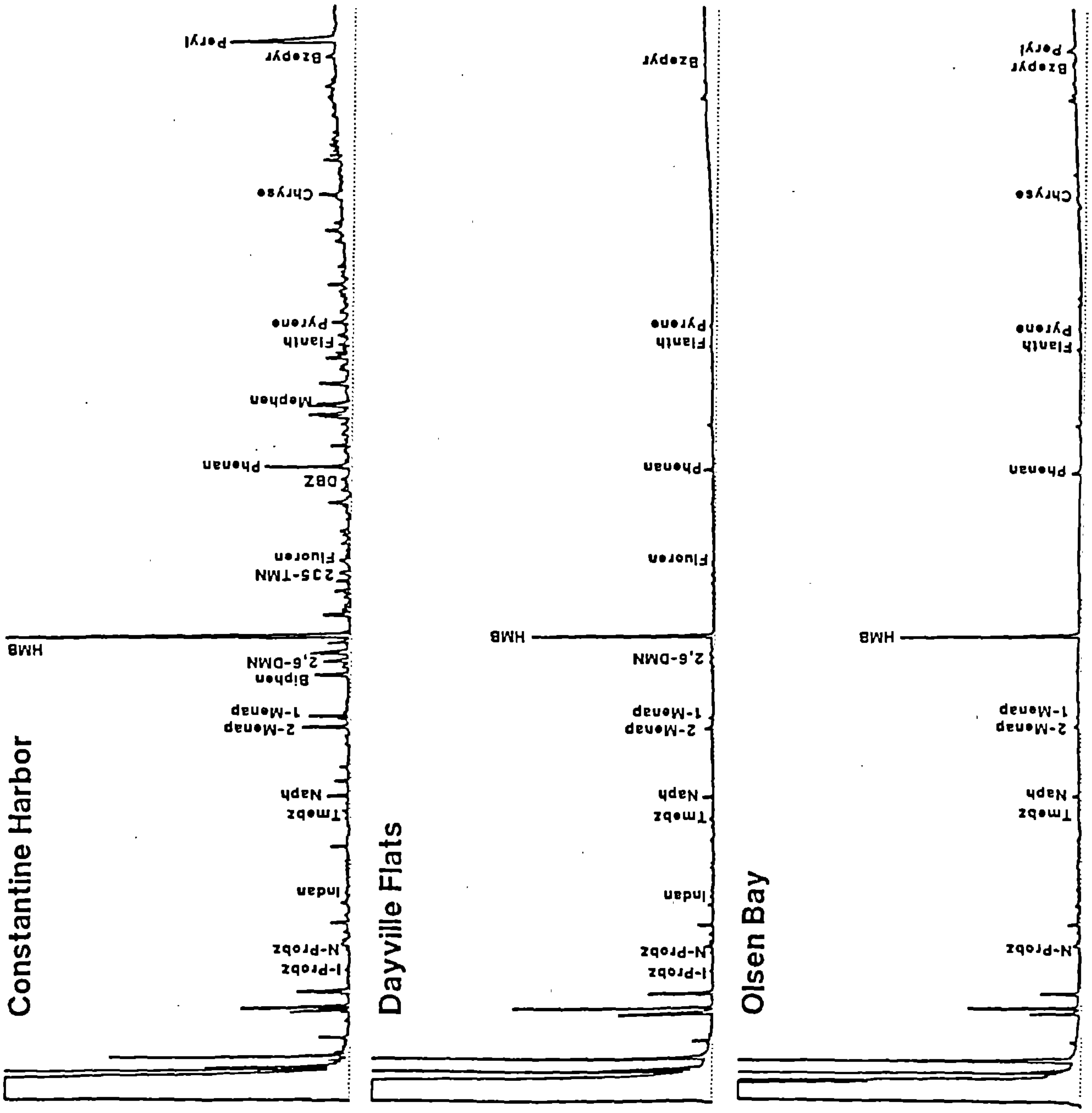

Figure 6.--Representative chromatograms of aromatic hydrocarbons in sediments at Constantine Harbor, Dayville Flats, and Olsen Bay, June 1978.

14 occur in 1977 (Table A-4). Detection limits of aromatic analytes for the 1977 samples were usually less than 3 ng/g, whereas these detection limits were usually greater than 4 rig/g for samples from succeeding years (Table A-4).

DISCUSSION

Trace level hydrocarbon contamination was evident at the Constantine Harbor, Mineral Flats, and Rocky Bay sampling stations. Contamination was indicated by the presence and diversity of aromatic hydrocarbons repeatedly found in sediments at these stations, which were generally absent at the other sampling stations.

Sediment contamination levels were highest at Constantine Harbor, and the contamination was probably the result of a combination of sources. The highest concentrations and greatest diversity of aromatic analytes and of other unidentified aromatic hydrocarbons was found in the sediments of this station. The presence of elevated concentrations of PAHs containing more than three rings and lacking alkyl substituents in these sediments (but not including perylene, see below), indicates a pyrolytic source for these PAHs. Lower concentrations of alkyl-substituted 3- and 4-ring PAHs compared with corresponding unsubstituted homologues may be inferred from the chromatograms of these samples (Fig. 6), which show the unsubstituted homologues as the most prominent peaks. Prominence of these higher molecular weight PAHs is indicative of a pyrolytic source and atmospheric transport to these sediments (Hites 1981, Lunde and Bjorseth 1977, Youngblood and Blumer 1975), and this source and transport mechanism was further supported by the general absence of PAHs in mussel tissues at the Constantine Harbor station.

Waterborne transport of petroleum-derived hydrocarbons to Constantine Harbor sediments was probably a second source of contaminant hydrocarbons. This source was indicated by the consistently elevated levels of lower molecular weight normal-alkanes, phytane, unidentified branched alkanes, and aromatics found in Constantine Harbor sediments. Phytane is associated with petroleum and with ancient sediments (Blumer and Snyder 1965, Oro et al. 1965) and is usually absent from modern unpolluted sediments, although it may be produced by biochemical processes or found in modern sediments in special situations (Ikan et al. 1975, Nissenbaum et al. 1972). Concentrations of lower molecular weight normal- and branched-alkanes and aromatics are enriched in refined petroleum products compared with crude oil. The general absence of these aromatic hydrocarbons in Constantine Harbor mussels suggests that the source is not petroleum hydrocarbon seepage from a terrestrial or sub-marine source because a nearly continuous seepage should result in a nearly constant influx of petroleum hydrocarbon contamination that would have been detected in these mussels.

The most likely source of all the contaminant hydrocarbons found in Constantine Harbor sediments is from sporadic fuel spills and fuel combustion, exhaust emissions of marine vessel traffic. Constantine Harbor is an excellent natural anchorage that is sometimes used as a harbor of refuge by vessels of all sizes, including commercial vessels, seeking protection from violent storms that frequently occur in the Gulf of Alaska. The larger vessels usually keep their engines running at idle while at anchor, and they may also discharge ballast water. The contaminant hydrocarbons found in Constantine Harbor probably arose from these emissions and discharges over the past several decades.

Contaminant hydrocarbons found at Rocky Bay and at Mineral Flats probably arose from sources similar to those at Constantine Harbor. Rocky Bay is the site of occasional commercial fishing, and Mineral Flats is adjacent to both the boat harbor at the city of Valdez and the oil tanker loading terminal in Port Valdez.

There was no evidence of detectable contaminant hydrocarbons at the other five sampling stations of this study. The perylene and phenanthrene detected at these stations probably arose from natural sources; both have been detected in unpolluted sediments worldwide and in sediment core samples that pre-date industrial activity (Venkatesan 1988, Hites et al. 1980, Farrington et al. 1977, Hites et al. 1977). Perylene has been reported as the predominant PAH in some Alaskan sediments, and has been significantly correlated with the sum of C-27 and C-29 in these sediments, which was taken as evidence of a terrigenous source (Venkatesan and Kaplan 1982). Our results are consistent with these observations; the highest concentrations of perylene, C-27, and C-29 occurred at Constantine Harbor. The other aromatic hydrocarbons found in sediments and in mussels at these stations were present only sporadically, and at concentrations near detection limits. Similarly, phytane and many of the normal alkanes having an even number of carbon atoms were found at these stations at concentrations near detection limits, further corroborating the general absence of petroleum hydrocarbon contamination.

Of the normal alkanes of molecular weight higher than C-19 in sediments, the high abundance of normal alkanes having an odd number of carbon atoms compared with those having an even number of carbon atoms at all the sampling stations of this study indicates terrestrial plants as primary sources of these alkanes (Kolattukudy 1976, Eglinton and Hamilton 1967, Eglinton et al. 1962). These alkanes may be transported by senescent leaves of beach grasses, upland shrubs, and trees such as alder (Alnus rubra), to intertidal sediments where they may be pulverized and incorporated into the organic carbon compartment of the surface sediments. These plants are common in Prince William Sound and may form dense stands adjacent to or in the upper intertidal zone. Primarily terrestrial sources of these hydrocarbons was further supported by the low and sporadic concentrations of these alkanes found in the mussels of these sampling stations.

The presence and abundance of normal alkanes of molecular weight lower than C-20 and pristane in sediments and in mussel tissues suggests sources of these hydrocarbons that are primarily marine. These normal alkanes are common constituents of marine bacteria (Oro et al. 1967), blue-green algae (Winters et al. 1969), planktonic and macrophytic algae (Clark and Blumer 1967, Blumer et al. 1971), and pristane is biochemically synthesized from phytol by several calanoid copepod species (Avigan and Blumer 1968, Blumer et al. 1964). Incorporation of these alkanes into intertidal sediments could arise from deposition of carcass fragments of these organisms after death, while incorporation into mussels could arise from ingestion of phytoplankton as food, and possibly from ingestion of detrital material derived from zooplankton.

The high concentrations, variability, and the different patterns of variability of pristane, C-15, and C-17 in sediments and in mussels indicates distinct biological sources of these alkanes. The very high May concentrations of pristane in mussels, followed by consistent and dramatically lower concentrations in June and still lower in August, suggests accumulation of pristane by ingestion of detrital material derived from carcasses of calanoid copepods. Blumer et al. (1964) found concentrations of pristane in *Calanus finmarchicus, C. glacialis,* and in *C. hyperboreus* approaching 1% dry weight in the northwestern Atlantic ocean, and in analogous Pacific ocean species such as C. *marshalae, Neocalanus plumchrus,* and *N. cristatus. Calanus marshalae* and *N. plumchrus* are abundant in Prince William Sound (Cooney 1987).

The very high May concentrations of pristane in mussels were highest at Rocky Bay and Naked Island, which are the two stations most exposed to the prevailing ocean current that enters the Sound at Hinchinbrook Entrance and exits through Montague Strait. This current carries inorganic nutrients from deep-water upwelling off the continental shelf into the Sound, which supports dense planktonic blooms in the spring, followed by blooms of zooplankton. It is remarkable, however, that pristane concentrations in mussels were quite low in 1977; this probably reflects the population dynamics of the calanoid copepods.

The significant correlation of pristane in mussels and in sediments among the sampling stations and periods further suggests calanoid copepods as the source of pristane in the sediments.

The high intra- and interannual variability of C-17 in sediments, but not in mussels, suggests multiple sources of this alkane in these matrixes. C-17 is the predominant normal alkane of many inter- and sub-tidal red algae *(Rhodophyceae)* (Clark and Blumer 1967), which on senescence may be incorporated into the organic compartment of intertidal sediments but would not be available to mussels. The relatively high concentrations of C-17 in mussels, together with less intra-annual variability may be due to the ubiquity of this alkane in phytoplankton ingested by mussels (Blumer et al. 1971).

The high intra- and inter-annual variability of C-15 in mussels, but not in sediments, suggests multiple sources of this alkane in these matrixes that are different than those of C-17. Although C-15 varied greatly from year to year, and generally increased from May to August in mussels, it was not clear why corresponding variation in sediments is not evident.

In conclusion, except in areas affected by localized vessel traffic, intertidal sediments and mussels in Prince William Sound were remarkably free of petroleum-contaminant hydrocarbons during the period of this study. The hydrocarbons found in sediments and mussels unaffected by vessel traffic can be adequately explained by known, natural sources. As a result, sediments and mussels contaminated by crude oil from the *Exxon Valdez* oil spill should be particularly apparent, due to the general absence of other confounding sources of petroleum hydrocarbons.

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APPENDIX

Table A-1.--Concentrations of alkane analytes found in sediment samples at each sampling period and sampling station of this study. Concentration units are ng alkane/g dry sediment weight. Concentrations less than detection Limits are indicated by the symbol <, followed by the detection limit estimate of that alkane analyte in that sample. Identities of abbreviated alkanes are given in Table 2 of the text. Also listed is total organic carbon (TOC) for each sample where determined, presented as g carbon/g dry sediment weight times 100%.

	MAY 1977	MAY 1977	JUNE 1977	JUNE 1977	OCT 1977	OCT 1977	MAY 1978	MAY 1978	JUNE 1978	JUNE 1978	AUG 1978	AUG 1978	MAY 1979	AUG 1979	AUG 1980	MEAN
									Bligh Island							
C10	<0.03	<0.03	N	N	N	N	<0.20	<0.13	<0.21	<0.12	<0.11	<0.16	0.20	1.0	N	0.10
C11	100	<0.03	N	N	N	N	3.5	<0.13	1.1	<0.12	<0.11	<0.15	1.1	0.85	N	10
C12	0.43	0.33	<0.04	<0.04	<0.04	<0.05	0.49	0.93	0.22	0.98	0.77	0.56	0.81	0.64	0.37	0.45
C13	0.9	1.1	<0.04	<0.04	<0.04	0.76	1.6	1.4	1.8	1.6	1.4	1.8	1.7	2.2	1.5	1.2
C14	1.5	1.2	<0.04	<0.04	0.82	0.76	1.3	0.88	1.4	1.3	1.0	1.3	1.6	1.7	1.0	1.1
C15	220	64	13	52	18	120	82	18	66	88	34	77	73	35	27	65
C16	5.3	2.6	<0.04	<0.04	1.6	3.9	3.6	1.9	3.6	3.5	2.5	3.5	4.2	3.8	3.3	2.9
C17	100	19	11	25	13	N	240	320	140	220	170	290	100	50	70	126
PRIS	4.1	4.1	1.3	<0.04	N	N	4.4	5.2	7.4	5.7	6.4	0.6	74	61	5.5	14
C18	3.1	1.9	2.6	2.8	1.5	3.1	3.2	2.1	3.6	3	2.5	3.4	4.4	3.9	2.9	3.0
PHYT	2.3	3.9	1.9	1.7	0.73	1.6	2.3	1.7	2.3	1.9	1.7	2.4	2.2	3.3	2.1	2.1
C19	73	16	51	38	27	N	36	15	56	41	25	49	190	150	85	61
C20	3.9	3.3	2.8	2.8	1.5	2.9	3.1	2.0	3.5	2.4	2.4	2.4	4.4	4.5	2.5	3.0
C21	23	16	21	15	1.9	39	17	9.4	21	16	14	18	52	52	30	23
C22	6.0	14	3.8	3.9	0.85	4.6	5.5	3.4	5.6	3.7	4.3	3.9	5.7	6.0	3.5	5.0
C23	23	37	21	19	16	34	23	13	24	18	17	21	40	43	24	25
C24	8.0	34	4.0	4.1	1.5	5.0	7.4	3.5	7.3	3.9	4.4	3.7	5.8	6.2	3.4	6.8
C25	27	62	16	15	28	22	24	13	24	15	<0.0	22	24	27	15	22
C26	6.8	33	3.2	3.2	6.9	4.0	9.3	3.1	8.8	3.3	5.2	2.4	5.2	5.0	2.6	6.8
C27	35	84	26	29	43	42	43	31	40	30	29	40	39	41	22	38
C28	4.7	26	1.2	2.1	2.8	<0.1	6.9	2.2	6.7	2.2	5.0	6.9	4.3	3.7	2.2	5.1
C29	23	36	16	17	29	37	27	20	25	18	18	23	24	25	12	23
C30	<0.04	9.6	3.0	5.0	1.1	<0.3	3.6	<0.68	3.6	<0.6	1.2	2.9	4.0	2.8	<0.09	2.5
C31	22	<0.06	12	14	56	<0.2	34	27	29	20	20	24	25	26	14	21
%TOC	0.46	0.46	0.36	0.36	0.40	0.55	0.76	0.54	0.54	1.13	0.49	0.0	1.21	0.0	N	

Table A-1.--Continued.

	MAY 1977	MAY 1977	JUNE 1977	JUNE 1977	MAY 1978	MAY 1978	JUNE 1978	JUNE 1978	AUG 1978	AUG 1978	MAY 1979	AUG 1979	AUG 1980	MEAN
							Constantine Harbor							
C10	<0.03	<0.03	N	N	14	16	17	12	20	13	24	16	N	13
C11	42	12	N	N	26	25	25	22	22	23	33	23	26	25
C12	34	15	9.2	21	35	30	30	29	29	31	39	27	29	28
C13	37	17	31	45	41	37	37	37	35	38	44	32	41	36
C14	41	20	34	47	41	35	34	35	30	34	44	33	39	36
C15	49	22	46	65	53	44	46	51	46	50	59	51	52	49
C16	44	22	36	50	39	39	37	41	35	39	47	37	39	39
C17	54	27	56	88	110	100	140	140	120	140	74	58	140	96
PRIS	50	18	49	59	46	44	44	48	27	44	43	37	45	43
C18	44	20	45	59	43	42	43	45	38	43	51	39	41	43
PHYT	7.7	4.9	8.8	11	11	10	9.9	11	7.6	10	11	8.1	6.9	9.1
C19	190	73	180	210	120	120	130	140	120	150	160	120	150	143
C20	75	31	61	78	54	57	55	60	53	57	68	52	60	59
C21	330	110	300	340	180	200	210	230	190	240	240	190	260	232
C22	150	70	150	180	110	110	110	130	110	140	140	110	140	127
C23	450	150	400	440	280	270	280	340	280	380	340	280	390	329
C24	170	69	150	170	110	98	100	120	100	150	130	100	20	114
C25	700	200	460	480	310	230	250	330	260	420	320	290	470	363
C26	99	36	110	120	81	52	58	85	44	110	80	71	100	81
C27	630	190	610	660	400	200	270	450	450	580	390	350	560	443
C28	100	40	82	91	75	29	43	78	80	97	65	51	200	79
C29	1000	280	N	N	490	190	360	700	580	710	460	480	680	539
C30	2400	760	76	81	60	20	50	100	69	86	20	800	<0.45	347
C31	1600	430	N	N	750	400	700	1900	940	1100	670	690	910	917
%TOC	0.44	2.7	1.9	2.1	1.3	1.9	2.4	2.3	0.47	2.7	2.1	0.44	2.7	

Table A-1.--Continued.

	MAY 1977	MAY 1977	JUNE 1977	JUNE 1977	OCT 1977	OCT 1977	MAY 1978	MAY 1978	JUNE 1978	JUNE 1978	AUG 1978	AUG 1978	MAY 1979	AUG 1979	AUG 1980	MEAN
								Dayville Flats								
C10	<0.03	<0.03	N	N	N	N	1.1	0.87	<0.23	<0.13	3.8	<0.16	1.2	1.1	N	0.81
C11	<0.03	<0.03	N	N	N	N	1.1	0.86	0.53	<0.13	2.0	<0.15	1.3	1.0	N	0.68
C12	0.28	<0.03	<0.04	<0.04	1.0	1.1	0.14	0.8	0.59	1.4	0.87	0.72	0.86	0.8	0.42	0.60
C13	0.66	0.53	<0.04	<0.04	0.14	1.4	1.6	1.6	1.6	1.5	1.1	0.84	1.5	1.2	0.84	0.97
C14	0.93	1.3	<0.04	<0.04	0.84	1.6	1.6	1.5	1.7	1.5	0.95	0.80	1.8	1.3	0.91	1.1
C15	7.3	8.2	5.1	4.8	8.5	9.6	22	20	17	17	15	10	14	11	13	12
C16	1.7	2.5	0.04	<0.04	1.8	3.8	3.2	2.3	3.0	2.4	0.18	<0.16	2.5	2.3	2.8	1.9
C17	1.7	3.3	3.7	2.8	3.0	3.8	56	57	62	56	40	<0.17	7.7	5.3	20	22
PRIS	4.0	2.8	3.2	2.3	N	N	6.2	4.1	3.4	3.0	0.24	<0.17	26	11	5.8	5.6
C18	1.1	1.7	2.3	2.1	1.5	2.0	3.3	2.1	3.1	2.1	1.1	<0.16	2.3	2.5	3.0	2.0
PHYT	1.2	2.0	1.3	1.4	1.1	1.8	1.2	0.7	1.2	0.88	<0.18	<0.16	<0.31	1.1	1.7	1.0
C19	1.1	3.5	3.5	3.1	2.1	3.4	4.4	3.8	4.9	3.9	1.7	1.5	4.0	4.0	4.9	3.3
C20	2.3	4.0	3.5	3.6	2.7	2.5	3.9	2.8	4.3	2.9	1.8	1.7	3.2	3.2	3.9	3.1
C21	5.3	11	11	5.6	7.0	6.4	11	9.4	11	8.5	5.8	5.2	7.8	3.5	11	7.8
C22	5.7	20	6.4	6.3	5.6	5.3	6.8	5.0	6.3	4.6	4.1	3.5	5.9	5.5	7.1	6.5
C23	13	38	13	14	15	15	17	13	16	13	12	9.4	16	14	18	15.8
C24	8.0	40	5.8	5.7	5.5	4.3	9.3	5.1	6.6	4.9	3.7	3.2	6.4	5.8	6.6	8.1
C25	30	81	32	29	28	24	37	24	32	31	23	21	31	26	30	32
C26	9.1	39	6.3	5.5	5.6	4.3	18	5.8	8.3	5.1	6.8	2.9	7.6	5.9	7.8	9.2
C27	82	130	160	150	160	100	140	110	140	130	89	84	120	100	140	122
C28	8.4	29	5.2	8.5	3.1	1.2	24	3.8	8.6	1.7	5.8	5.4	5.4	4.7	6.4	8.1
C29	26	44	42	40	50	29	63	29	46	22	21	20	37	30	41	36
C30	2.5	11	<0.05	<0.05	<0.2	<0.03	25	<0.73	2.1	<0.64	<0.26	<0.24	4.3	4.3	2.8	3.5
C31	20	34	36	37	14	20	66	21	44	14	16	17	34	22	37	29
% TOC	0.44	0.48	0.38	0.36	0.38	0.38	0.43	0.36	0.40	0.42	0.0	0.0	1.2	0.0	N	

Table A-l .--Continued.

	MAY 1978	MAY 1978	AUG 1978	AUG 1978	MAY 1979	AUG 1979	AUG 1980	MEAN
				Mineral Flats				
C10	<0.13	<0.16	<0.14	<0.11	1.1	1.2	N	0.38
C11	<0.13	0.90	<0.13	<0.1	0.77	0.90	N	0.43
C12	0.52	0.31	0.37	0.55	0.55	0.38	0.49	0.45
C13	0.85	1.1	0.64	0.63	1.2	0.75	0.84	0.86
C14	0.62	0.89	0.55	0.66	1.0	0.62	0.70	0.72
C15	14	20	42	9.9	15	19	10	19
C16	1.3	1.8	1.2	1.1	1.8	1.4	1.4	1.4
C17	40	44	37	24	7.2	15	32	29
PRIS	2.6	6.8	0.70	2.8	21	6.1	4.5	6.4
C18	1.2	2.0	0.84	1.0	1.8	1.3	1.9	1.4
PHYT	2.8	3.9	1.1	1.9	2.8	0.79	0.89	2.0
C19	3.6	5.9	4.1	3.4	5.2	10	4.4	5.2
C20	1.6	2.5	1.1	1.5	2.3	1.5	2.2	1.8
C21	3.4	6.6	2.7	3.8	5.7	1.6	6.7	4.4
C22	2.4	3.6	1.6	2.3	2.3	2.2	3.7	2.6
C23	7.4	9.4	5.9	5.8	9.4	6.8	11	8.0
C24	2.1	3.7	1.2	2.3	3.7	2.6	3.9	2.8
C25	16	21	13	12	19	28	25	19
C26	2.0	4.1	1.4	2.4	4.2	3.1	5.5	3.2
C27	74	92	60	55	90	56	130	80
C28	3.9	3.0	3.3	2.7	3.3	2.6	5.1	3.4
C29	19	20	14	16	27	17	39	22
C30	<0.19	<0.84	<0.21	2.5	1.7	0.43	2.2	0.98
C31	14	11	9.5	13	23	14	37	17
% TOC	0.59	0.70	0.0	0.62	1.1	0.0	N	

Table A-l .--Continued.

	MAY 1977	MAY 1977	JUNE 1977	JUNE 1977	OCT 1977	OCT 1977	MAY 1978	MAY 1978	JUNE 1978	JUNE 1978	AUG 1978	AUG 1978	MAY 1979	AUG 1979	AUG 1980	MEAN
Naked Island																
C10	<0.03	<0.03	N	N	N	N	0.46	<0.17	<0.14	0.70	<0.09	<0.1	1.9	1.3	N	0.44
C11	<0.03	<0.03	N	N	N	N	0.39	3.5	<0.14	0.63	<0.09	<0.1	1.6	1.2	N	0.69
C12	<0.03	0.33	<0.05	<0.04	0.70	0.77	0.59	0.58	0.98	0.59	0.75	0.6	1.2	0.63	0.5	0.55
C13	0.83	0.69	<0.05	<0.04	0.74	0.93	2.9	5.5	2.4	1.8	1.2	1.0	1.8	1.2	1.4	1.5
C14	1.2	1.1	<0.05	0.41	0.82	0.99	1.2	1.4	1.2	1.3	1.1	0.92	1.9	1.1	1.0	1.0
C15	20	13	33	27	10	12	13	15	15	25	20	19	26	22	18	19
C16	3.8	3.1	<0.05	<0.04	2.9	2.3	2.5	3.3	2.8	2.6	2.2	1.9	4.6	2.9	2.0	2.5
C17	16	N	18	19	12	13	32	61	27	40	26	25	38	17	20	26
PRIS	34	32	38	32	N	N	67	66	55	90	32	27	87	36	58	50
C18	3.0	2.1	3.9	3.8	2.7	2.6	4.8	5.7	4.5	4.4	3.9	3.0	6.9	3.9	3.5	3.9
PHYT	2.5	1.7	1.9	1.4	1.7	0.21	0.87	1.8	1.4	0.92	0.84	0.70	2.2	1.1	<0.09	1.3
C19	13	12	15	16	13	12	15	14	15	15	13	11	35	17	16	16
C20	5.5	3.3	6.4	5.6	3.5	3.5	4.3	4.7	4.1	4.3	3.7	3.3	9.1	5.6	3.0	4.7
C21	21	18	26	23	15	13	16	17	15	17	16	15	42	24	18	20
C22	24	15	9.9	9.7	5.5	5.1	6.8	7.9	6.0	7.2	6.5	6.3	19	11	6.5	9.8
C23	63	44	51	42	27	24	28	33	27	32	29	26	73	44	28	38
C24	54	32	13	10	6.8	6.0	7.4	9.9	7.0	8.2	7.4	7.7	22	13	7.8	14
C25	98	70	62	50	30	26	33	40	30	35	34	29	84	49	32	47
C26	49	31	14	10	5.7	5.5	8.4	12	7.5	8.7	8.4	9.6	23	13	8.4	14
C27	120	100	170	120	67	59	120	130	100	120	84	80	270	130	87	117
C28	34	24	12	8.9	4.1	4.2	7.7	11	5.3	6.2	7.8	8.3	18	10	6.9	11
C29	59	48	76	55	34	30	50	49	36	46	35	32	120	63	39	52
C30	18	11	9.1	5.0	<0.03	<0.03	3.6	6.3	3.1	4.8	3.8	4.6	14	8.1	4.8	6.4
C31	86	78	140	98	56	51	100	91	69	94	65	61	190	110	74	91
%TOC	0.94	0.61	0.65	0.60	0.73	0.82	0.78	0.73	0.85	0.75	0.67	0.79	2.2	0.0	N	

Table A-1 --Continued.

	MAY 1978	MAY 1978	JUNE 1978	JUNE 1978	AUG 1978	AUG 1978	MAY 1979	AUG 1979	AUG 1980	MEAN
					Olsen Bay					
C10	0.48	<2.8	<0.14	0.93	<0.17	<0.13	1.4	4.6	N	0.93
C11	0.69	1.5	<0.14	0.68	<0.17	<0.13	1.3	2.3	N	0.81
C12	0.83	0.84	1.3	0.78	0.71	0.66	1.1	1.3	<0.22	0.84
C13	4.0	4.1	2.8	5.3	2.8	2.4	3.1	4.2	0.93	3.3
C14	2.8	2.6	1.8	2.8	1.4	1.3	4.2	4.9	0.66	2.5
C15	110	130	140	66	45	22	250	130	18	101
C16	8.2	10	7.3	7.6	5.5	4.2	12	12	4.1	7.9
C17	110	150	120	110	74	51	160	170	57	111
PRIS	9.2	11	5.0	11	0.60	3.3	8.2	8.1	4.2	6.7
C18	7.0	9.2	5.8	7.9	4.9	4.1	11	14	5.3	7.7
PHYT	1.7	3.7	1.4	9.2	2.4	1.4	4.3	5.0	1.8	3.4
C19	160	260	130	210	120	110	330	390	170	209
C20	9.2	12	6.4	9.0	4.7	5.0	14	16	7.2	9.3
C21	84	120	60	93	50	51	130	140	82	90
C22	21	26	14	18	8.3	9.8	24	27	15	18
C23	99	140	71	95	51	53	130	140	87	96
C24	22	28	15	17	6.9	11	25	27	16	19
C25	94	120	66	77	39	48	110	120	75	83
C26	18	24	12	13	4.2	11	20	21	13	15
C27	170	240	120	140	96	86	190	210	140	155
C28	17	27	11	15	11	12	19	18	24	17
C29	140	230	100	110	82	76	200	190	120	139
C30	9.6	24	8.1	7.5	6.5	7.0	24	160	5.6	28
C31	260	410	200	200	140	130	330	280	220	241
%TOC	1.3	1.6	1.2	1.4	1.1	0.0	0.0	0.0	N	

Table A-l .--Continued.

	JUNE 1977	JUNE 1977	MAY 1978	MAY 1978	JUNE 1978	JUNE 1978	AUG 1978	AUG 1978	MAY 1979	AUG 1980	MEAN
						Rocky Bay					
C10	N	N	<0.13	13	9.4	8.3	<0.01	<0.11	12	N	6.1
C11	N	N	<0.13	16	10	10	4.1	3.0	11	13	13.7
C12	1.3	0.72	9.8	9.6	9.6	9.0	6.9	5.6	10	9.8	7.2
C13	4.3	3.1	11	11	10	9.9	6.3	4.9	8.0	13	8.2
C14	<0.05	0.53	6.8	9.2	7.9	8.3	5.3	4.1	6.5	7.7	5.6
C15	25	12	27	39	19	20	17	14	17	37	23
C16	<0.05	<0.05	6.9	7.4	6.9	5.1	5.1	3.7	6.1	8.3	5.0
C17	12	6.8	110	140	70	60	60	48	24	130	66
PRIS	15	16	15	18	18	13	12	9.0	90	38	24
C18	4.2	4.1	5.0	6.6	4.9	3.9	3.8	2.8	5.0	6.6	4.7
PHYT	1.1	1.3	1.6	2.6	0.95	1.4	0.78	0.45	1.5	1.3	1.3
C19	12	16	13	21	10	8.3	11	6.8	17	23	14
C20	3.9	3.7	4.2	5.4	3.7	3.8	2.7	2.1	4.1	5.0	3.9
C21	11	12	9.2	16	7.3	7.9	7.3	5.0	11	16	10
C22	3.5	3.1	3.9	7.2	3.2	4.6	5.1	2.4	4.2	5.1	4.2
C23	9.3	10	8.9	20	6.9	12	9.6	5.2	11	16	11
C24	2.9	3.0	3.4	9.0	2.5	6.7	6.3	1.7	3.7	4.1	4.3
C25	11	6.8	9.8	23	6.4	13	11	5.2	11	16	11
C26	2.6	2.5	3.2	13	2.1	8.9	7.1	1.4	3.7	3.5	4.8
C27	28	29	43	68	25	40	27	14	44	58	38
C28	<0.05	<0.05	2.3	9.7	1.8	7.2	9.3	1.4	3.0	<0.79	3.5
C29	12	10	24	28	11	18	13	5.5	16	25	16
C30	<0.06	<0.06	<0.71	5.6	2.4	3.2	3.9	0.91	1.9	<0.38	1.8
C31	<0.07	<0.07	25	35	14	19	14	7.4	23	29	17
%TOC	0.44	0.33	0.43	0.59	0.62	0.39	0.56	0.47	0.86	N	

Table A-l .--Continued.

	JUNE 1977	JUNE 1977	OCT 1977	OCT 1977	MAY 1978	MAY 1978	JUNE 1978	JUNE 1978	AUG 1978	AUG 1978	MAY 1979	AUG 1979	AUG 1980	WEAN
							Siwash Bay							
C10	N	N	N	N	0.39	<0.28	<0.10	0.34	<0.16	<0.14	0.99	1.7	4.7	0.90
C11	N	N	N	N	0.28	2.3	<0.10	0.26	<0.15	<0.14	0.84	1.1	1.6	0.71
C12	<0.06	<0.05	0.77	1.1	0.35	0.41	0.51	0.39	0.52	1.0	0.55	0.42	1.3	0.56
C13	<0.06	<0.05	1.9	1.7	1.2	1.4	1.1	1.5	1.5	1.5	0.72	1.1	2.0	1.2
C14	<0.06	<0.05	1.3	0.76	1.1	1.4	0.66	1.3	1.4	1.4	0.94	1.1	2.3	1.1
C15	16	18	13	17	9.3	13	7.3	11	44	33	11	23	31	19
C16	<0.06	<0.05	1.9	N	2.7	3.3	1.6	2.8	6.2	3.3	1.8	2.4	4.8	2.6
C17	5.1	5.9	7.3	18	35	47	21	39	94	42	13	15	71	32
PRIS	0.71	0.75	N	<1.0	2.6	3.1	1.6	2.7	0.71	3.0	20	16	8.5	5.0
C18	5.1	3.8	3.3	2.7	3.6	4.5	2.1	3.9	4.6	4.5	2.8	3.2	8.4	4.0
PHYT	2.2	2.8	3.3	1.4	2.7	4.0	1.2	3.2	3.3	3.2	1.7	2.8	4.4	2.8
C19	21	21	11	8.2	18	21	9.6	18	17	18	13	13	37	17
C20	11	7.6	5.8	6.3	6.5	8.5	3.4	7.7	5.6	7.3	6.0	7.4	17	7.7
C21	34	32	19	4.0	29	38	16	35	23	31	28	31	79	31
C22	17	14	12	8.6	14	18	6.8	17	11	14	14	17	39	16
C23	67	62	35	39	44	58	22	56	43	45	47	56	130	54
C24	21	19	9.3	12	14	19	6.5	18	9.6	13	15	18	41	17
C25	94	87	48	53	59	81	27	77	63	58	64	77	190	75
C26	24	21	4.1	14	15	23	7.0	20	8.3	15	17	20	46	18
C27	360	330	330	280	200	250	91	250	200	190	190	240	590	269
C28	24	22	11	<0.1	18	25	7.0	22	19	15	17	19	49	19
C29	220	200	150	240	140	160	61	150	120	120	140	150	370	171
C30	13	13	5.5	13	5.7	14	2.5	5.6	7.3	5.2	9.4	10	19	9.5
C31	230	210	92	300	140	180	56	150	110	130	140	140	390	174
%TOC	0.78	0.75	0.81	0.75	1.4	0.92	0.90	0.87	0.0	0.74	1.0	0.0	N	

Table A-2:-Concentrations of alkane analytes found in mussel tissue samples at each sampling period and sampling station of this study. Concentration units are ng alkane/g dry tissue weight. Concentrations Less than detection limits are indicated by the symbol <, followed by the detection Limit estimate of that alkane analyte in that sample. Identities of alkanes abbreviated below are given in Table 2 of the text. Also Listed is percent lipid content for each sample where determined, presented as g lipid/g dry tissue weight times 100%.

	MAY 1977	MAY 1977	JUNE 1977	JUNE 1977	OCT 1977	OCT 1977	MAY 1978	MAY 1978	JUNE 1978	JUNE 1978	AUG 1978	AUG 1978	MAY 1979	AUG 1979	AUG 1980	MEAN
								Bligh Island								
C10	<3.0	<3.0	66	52	<3.0	<3.0	45	71	<14	<21	<10	<12	<20	<20	N	17
C11	<3.0	<3.0	120	<4.0	<3.0	<3.0	42	56	22	<20	<10	<12	<20	<20	<12	16
C12	<3.0	<3.0	110	81	<3.0	<3.0	72	86	57	56	40	22	61	<18	<11	39
C13	<3.0	<3.0	110	80	<3.0	<3.0	<21	54	36	33	36	30	<20	<20	47	28
C14	110	99	250	250	<3.0	27	130	140	160	140	86	72	64	<18	130	111
C15	140	160	980	840	260	370	260	330	390	420	490	320	180	90	810	403
C16	<3.0	44	260	250	<3.0	<3.0	88	110	110	110	91	72	52	21	140	90
C17	53	120	1300	930	82	94	240	320	470	450	180	120	120	90	250	321
PRIS	<3.0	<3.0	67	<4.0	<4.0	43	1400	1800	140	160	49	<12	300	190	80	282
C18	<2.0	<2.0	95	<4.0	<3.0	<3.0	<22	13	<14	<21	<10	<12	<18	<17	<12	7.2
PHYT	<3.0	<3.0	62	<4.0	<3.0	<3.0	<22	53	<14	<21	<10	<12	<19	<17	<12	7.7
C19	<3.0	<3.0	140	160	<3.0	<3.0	<22	28	<14	<21	12	<12	<18	<17	<12	23
C20	<3.0	<3.0	90	96	<3.0	<3.0	<22	15	<14	<21	<10	<12	<17	<18	39	16
C21	<3.0	<3.0	N	N	<3.0	<3.0	<23	32	<14	<21	<10	<12	<18	<16	<12	2.5
C22	<3.0	<3.0	N	N	<3.0	<3.0	<25	33	<16	<23	<11	<12	<19	<16	<12	2.5
C23	<3.0	<3.0	N	N	<4.0	<3.0	<26	66	<17	<26	<12	<14	<19	<17	<13	5.1
C24	<3.0	<3.0	N	N	<3.0	<3.0	<24	46	<17	<26	<12	<13	<19	<16	<12	3.5
C25	<3.0	<3.0	N	N	<3.4	<3.0	<26	70	<19	<30	<13	<15	43	45	<13	12
C26	<3.0	<3.0	N	N	<3.0	<3.0	<27	54	<19	<35	<15	<17	<21	N	<13	4.5
C27	<3.0	<3.0	N	N	<4.0	<4.0	<33	110	<24	<48	<20	<23	<20	N	N	10
C28	<3.0	<3.0	N	N	<3.0	<4.0	<30	230	290	<51	<21	<24	<23	N	<14	43
C29	<3.0	<3.0	580	<4.0	<3.0	<3.0	<33	76	<25	<66	<27	<31	<24	<16	N	47
C30	<3.0	<3.0	98	<5.0	<4.0	<4.0	<40	<7.8	<30	<100	<39	<45	<28	<18	<16	6.5
C31	<3.0	<3.0	<2.0	<5.0	<4.0	<5.0	<58	<9.9	<44	<180	<66	<77	<37	<23	N	0.0
%LIPID	14	14	17	15	11	16	17	21	10	15	N	N	N	N	N	

Table A-2:-Continued.

	MAY 1977	MAY 1977	JUNE 1977	JUNE 1977	MAY 1978	MAY 1978	JUNE 1978	JUNE 1978	AUG 1978	AUG 1978	MAY 1979	AUG 1979	AUG 1980	MEAN
							Constantine Harbor							
C10	<3.0	<3.0	80	20	<32	<20	<15	<12	<8.6	<9.6	<16	<18	<12	7.7
C11	<3.0	<3.0	200	27	<31	<19	<14	55	22	<9.4	<16	25	20	27
C12	<3.0	<3.0	70	45	48	51	69	91	34	16	<15	33	<12	35
C13	<3.0	<3.0	50	31	<31	<20	16	40	41	<9.4	<16	37	<12	17
C14	<3.0	54	150	90	140	88	170	200	110	36	57	140	53	99
C15	120	160	970	610	200	240	290	400	570	350	160	730	550	412
C16	<3.0	<3.0	120	76	65	56	75	98	89	63	44	110	93	68
C17	<4.0	61	250	150	150	130	110	170	120	85	91	190	220	133
PRIS	<3.0	<3.0	100	73	230	150	120	110	59	41	400	85	<13	105
C18	<2.0	<2.0	<2.0	16	<33	<19	<15	<12	<8.4	<9.3	<15	<16	<12	1.2
PHYT	<3.0	<3.0	41	32	<33	<20	<15	<13	<8.6	<9.6	<15	<16	<12	5.6
C19	<3.0	<3.0	26	26	<33	<20	<15	<12	<8.4	<9.3	<14	<16	<12	4.0
C20	<3.0	<3.0	14	16	<33	<20	<15	<12	<8.3	<9.2	<14	39	<12	5.3
C21	<3.0	<3.0	29	26	<33	<21	<15	<13	<8.4	20	<14	61	<12	11
C22	<3.0	<3.0	26	27	<37	<22	<17	21	<9.0	<10	<15	53	<13	9.8
C23	<3.0	<3.0	67	54	<38	<24	<18	45	30	45	<16	83	N	27
C24	<3.0	<3.0	4.0	26	<36	<23	<18	39	<9.6	<11	<15	37	<13	8.2
C25	<3.0	<3.0	59	56	<39	<24	<20	55	<11	68	36	92	N	31
C26	<3.0	<3.0	25	43	<40	<25	<21	<17	<12	<13	<17	22	N	7.5
C27	<3.0	<3.0	120	110	<49	<31	<26	54	<16	50	<17	N	N	30
C28	<3.0	<3.0	49	46	<44	<27	<23	<19	<17	<19	<19	N	N	8.6
C29	<3.0	<3.0	60	63	<49	<30	<26	<22	<22	<25	<19	110	N	19
C30	<3.0	<3.0	<2.0	<2.0	<58	<35	<32	<26	<32	<36	<22	<18	<16	0.0
C31	<4.0	<4.0	<2.0	<2.0	<85	<50	<46	<39	<55	<61	<30	<23	N	0.0
%LIPID	9.4	10	18	11	16	15	N	N	N	N	N	N	N	

Table A-2. --Continued.

	MAY 1977	MAY 1977	JUNE 1977	JUNE 1977	OCT 1977	OCT 1977	MAY 1978	HAY 1978	JUNE 1978	JUNE 1978	AUG 1978	AUG 1978	MAY 1979	AUG 1979	AUG 1980	MEAN
								Dayville Flats								
C10	<3.0	<3.0	150	43	<3.0	<4.0	80	75	24	<14	96	<20	<24	<60	N	33
C11	<3.0	<3.0	240	40	<3.0	<4.0	100	89	38	34	<20	<20	<23	<60	32	38
C12	<3.0	<3.0	100	72	<3.0	<4.0	120	110	63	79	<20	35	<23	<60	54	42
C13	25	<3.0	55	41	<3.0	<4.0	85	88	32	63	<20	<20	<23	<60	24	28
C14	150	49	190	140	190	<4.0	160	120	140	290	59	96	36	110	93	122
C15	170	180	600	540	430	390	270	250	280	500	280	370	190	600	370	361
C16	64	98	140	100	37	<4.0	100	88	98	220	48	98	80	180	69	95
C17	73	67	390	230	200	160	740	730	220	420	120	34	140	280	180	266
PRIS	160	140	<2.0	<2.0	<4.0	<6.0	1400	1400	48	76	<20	<20	1600	220	170	348
C18	<3.0	<3.0	13	17	<4.0	<5.0	<16	<18	<9.4	<14	<20	<20	<22	<53	<5.9	2.0
PHYT	<3.0	<3.0	25	19	<3.0	<5.0	<16	<19	<9.6	<14	<20	<21	<22	<54	<6.1	2.9
C19	<3.0	<3.0	31	24	<3.0	<5.0	<16	<19	<9.4	<14	<20	<20	<21	<53	<6.0	3.7
C20	<3.0	<3.0	12	9.7	<3.0	<5.0	<16	<19	<9.4	<14	<19	<20	<21	<52	<5.9	1.5
C21	<3.0	<3.0	N	53	<3.0	<5.0	<16	<19	<9.6	<15	<20	<21	<21	<52	<6.1	3.8
C22	<3.0	<3.0	23	26	<4.0	<5.0	<18	<21	20	<16	<21	<23	<22	<54	<6.3	4.6
C23	<3.0	<3.0	38	21	<4.0	<6.0	<19	<22	32	<18	<24	<25	<23	<60	<6.6	6.1
C24	<3.0	<3.0	32	11	<4.0	<5.0	<18	<21	27	<18	<21	<25	<23	<52	<6.2	4.7
C25	<3.0	<3.0	160	<2.0	<4.0	<5.0	<20	<23	28	<21	<22	<30	<24	<53	N	13
C26	<3.0	<3.0	100	58	<4.0	<5.0	<21	<23	<13	<24	<23	<34	<25	<53	<6.3	11
C27	<3.0	<3.0	120	100	<4.0	<6.0	<27	<29	62	<33	35	<47	<26	N	N	24
C28	<3.0	<3.0	77	48	<3.0	<5.0	<25	<25	N	<35	<26	<50	<28	N	<6.4	9.6
C29	<3.0	<3.0	<2.0	<2.0	<4.0	<5.0	<28	<28	<16	<45	<30	<64	<29	<53	N	0.0
C30	<3.0	<3.0	<2.0	<2.0	<4.0	<6.0	<36	<33	<20	<69	<38	<98	<33	<60	<6.6	0.0
C31	<3.0	<3.0	<2.0	<2.0	<5.0	<7.0	<55	<47	<29	<120	<55	<180	<44	<80	N	0.0
%LIPID	15	15	18	17	14	12	11	18	7.5	14	N	N	N	N	N	

Table A-2. --Continued.

	JUNE 1978	JUNE 1978	AUG 1978	AUG 1978	MAY 1979	AUG 1979	AUG 1980	MEAN
				Mineral Flats				
C10	17	<17	<14	<14	30	<20	N	7.8
C11	33	46	51	48	21	<20	37	34
C12	43	48	40	40	41	<20	56	38
C13	28	38	38	31	44	30	51	37
C14	83	100	76	69	91	120	110	93
C15	380	600	1000	520	160	470	480	516
C16	64	99	120	93	100	130	84	99
C17	180	300	210	140	250	180	280	220
PRIS	56	110	120	<14	3100	90	140	517
C18	<8.8	<17	<14	<14	<10	<18	13	1.9
PHYT	<9.0	<18	<14	<14	<10	<18	<6.5	0.0
C19	<8.9	<17	24	<14	<10	<18	<6.3	3.4
C20	<9.0	<17	<14	<14	<10	<17	0.0	0.0
C21	<9.3	<18	<14	<14	<10	<17	<6.4	0.0
C22	<10	<19	<15	<15	<11	32	<6.6	4.6
C23	<11	<21	<16	<16	24	52	N	13
C24	<10	<21	<16	<16	22	43	N	11
C25	<11	<23	<18	<18	69	83	N	25
C26	<12	<24	<20	<20	36	37	N	12
C27	<15	<30	<28	<28	120	N	N	24
C28	<14	<27	<29	<29	<14	N	N	0.0
C29	<16	<31	<37	<37	56	52	N	18
C30	<20	<37	<55	<54	<17	<20	N	0.0
C31	<31	<54	<92	<92	<22	<26	N	0.0
%LIPID	N	N	N	N	N	N	N	

Table A-2. --Continued.

	MAY 1978	MAY 1978	JUNE 1978	JUNE 1978	AUG 1978	AUG 1978	MAY 1979	AUG 1979	AUG 1980	MEAN
					Olsen Bay					
C10	380	25	20	<18	<20	<12	130	<25	N	69
C11	<18	15	25	<17	<20	34	320	<24	7.9	44
C12	58	61	46	52	<19	25	250	33	42	63
C13	28	39	28	<18	<20	21	100	53	N	34
C14	120	130	95	93	<20	70	<27	250	110	96
C15	300	300	220	220	59	240	270	1500	550	407
C16	87	130	81	57	<20	78	62	180	85	84
C17	620	780	290	250	<21	160	230	440	190	329
PRIS	400	450	83	61	<21	<12	1900	470	<8.2	374
C18	<19	<13	<8.3	<18	<20	<12	<26	<23	<7.8	0.0
PHYT	<19	<13	<8.5	<18	<21	<12	520	<22	<8.0	58
C19	<19	<13	<8.3	<18	<20	<12	<26	<21	<7.9	0.0
C20	<19	<14	<8.3	<18	<20	<12	<25	<21	N	0.0
C21	<20	<15	<8.5	<18	<21	<12	<25	<20	<7.9	0.0
C22	<21	<17	<9.2	<20	<22	<13	<27	<21	<8.2	0.0
C23	<23	<18	<10	<22	<25	<14	36	64	N	13
C24	<22	<17	<9.9	<21	<23	<14	<27	<20	N	0.0
C25	<24	<18	<11	<24	<24	<16	<29	110	N	14
C26	<25	<19	<11	<25	<24	<17	<30	<20	N	0.0
C27	<32	<22	<14	<31	<29	<24	<31	N	N	0.0
C28	<29	<19	<13	<28	<24	<25	<34	N	N	0.0
C29	<34	<20	<15	<31	<25	<32	<35	110	N	14
C30	<42	<23	<18	<38	<29	<47	<40	<23	140	16
C31	<66	<30	<26	<56	<36	<79	<53	<30	150	17
%LIPID	15	16	9.5	10	N	N	N	N	N	

Table A-2.--Continued.

	JUNE 1977	JUNE 1977	MAY 1978	MAY 1978	JUNE 1978	JUNE 1978	AUG 1978	AUG 1978	MAY 1979	AUG 1979	AUG 1980	MEAN
						Rocky Bay						
C10	100	28	210	340	27	26	<14	<17	<31	<21	22	69
C11	190	39	34	29	<11	25	<14	<16	<31	<21	27	31
C12	110	67	64	61	59	50	<14	28	<30	<20	51	45
C13	100	52	40	46	31	29	29	<16	<31	<20	40	33
C14	190	120	120	130	120	99	73	64	<30	42	120	98
C15	2000	890	310	290	380	370	980	910	150	250	1100	694
C16	160	100	97	59	110	39	<15	78	53	45	110	77
C17	360	200	1600	890	400	280	140	180	200	140	370	433
PRIS	<2.0	<2.0	4700	2500	1400	940	46	68	2500	73	140	1124
C18	28	24	17	<10	<14	<7.8	<15	<16	<29	<19	<7.9	6.3
PHYT	45	<2.0	13	<11	<14	<8.0	<15	<17	<29	<20	<8.2	5.3
C19	52	48	40	<10	<15	<7.9	<15	<16	<28	<19	<8.0	13
C20	27	7.4	12	<10	<16	<8.0	<15	<16	<27	<18	<7.9	4.2
C21	55	39	24	<11	<17	<8.3	<15	<17	<28	<18	<8.1	11
C22	40	31	18	<12	<18	<8.9	<16	<18	<29	<18	<8.4	8.1
C23	43	42	31	<12	<20	20	<18	<21	<31	<19	N	14
C24	10	36	16	<12	<19	17	<16	<21	<30	<17	N	7.9
C25	39	180	34	<13	<20	29	<17	<24	<32	<18	N	28
C26	31	75	16	<13	<20	10	<17	<28	<33	<18	N	13
C27	120	100	99	<16	<24	56	<21	<39	<34	N	N	42
C28	<2.0	64	72	<14	<21	<12	<17	<41	<37	N	N	15
C29	<2.0	<2.0	39	<16	<22	<14	<18	<52	<38	<18	N	3.9
C30	<2.0	<2.0	<14	<18	<25	<18	<21	<81	<44	<20	N	0.0
C31	<2.0	<2.0	<21	<26	<33	<28	<26	<150	<58	<26	N	0.0
%LIPID	17	10	19	21	10	13	N	N	N	N	N	

Table A-2. --Continued.

	JUNE 1977	JUNE 1977	OCT 1977	OCT 1977	MAY 1978	MAY 1978	JUNE 1978	JUNE 1978	AUG 1978	AUG 1978	MAY 1979	AUG 1979	AUG 1980	MEAN
							Siwash Bay							
C10	120	<2.0	<3.0	<5.0	<28	<33	<14	660	24	<11	<18	<14	N	67
C11	290	<2.0	<3.0	<5.0	<28	<32	<14	33	25	<11	<18	<13	19	28
C12	82	17	<3.0	<5.0	62	<31	25	41	38	31	<17	22	<5.3	25
C13	64	18	<3.0	<5.0	<28	<32	26	29	43	29	<18	36	<5.4	19
C14	210	43	140	<5.0	140	57	79	110	74	57	<17	150	63	86
C15	1000	360	590	760	250	190	240	280	670	650	130	2100	650	605
C16	<2.0	45	<3.0	<5.0	98	<33	66	78	<13	75	36	110	71	45
C17	380	120	110	<5.0	180	140	130	150	48	110	91	290	220	151
PRIS	93	<2.0	<4.0	120	230	150	68	110	<14	<11	<17	<12	110	68
C18	19	<2.0	<3.0	<5.0	<29	<33	<14	<7.9	<13	<11	<17	<12	13	2.5
PHYT	<2.0	<2.0	<3.0	<5.0	<29	<34	<14	<8.1	<14	<11	<17	<12	<5.5	0.0
C19	46	23	<3.0	<5.0	<29	<34	<14	<8.0	<14	<11	<16	<12	<5.3	5.3
C20	26	5.5	<3.0	<5.0	<29	<34	<14	<8.1	<13	<11	<16	<12	N	2.6
C21	N	150	<3.0	<5.0	<30	<34	<15	<8.3	<14	<11	<16	<12	19	14
C22	N	5.5	<4.0	<5.0	<33	<38	<16	<9.0	<14	<12	<17	<12	5.6	0.46
C23	N	20	<4.0	<5.0	<34	<39	<17	21	<16	<13	<18	29	N	6.4
C24	N	<2.0	<3.0	<5.0	<32	<37	<17	16	<15	<13	<17	<12	N	1.5
C25	N	21	<4.0	<5.0	<34	<40	<19	27	<16	<14	<18	28	N	6.9
C26	N	49	<3.0	<5.0	<35	<41	<19	<11	<16	<16	<19	<12	N	4.5
C27	N	83	<4.0	<6.0	<44	<51	<25	40	<19	<22	<20	N	N	12
C28	N	28	<3.0	<6.0	<39	<45	<22	<14	<16	<23	<21	N	N	2.8
C29	N	<2.0	<3.0	<5.0	<44	<51	<25	<18	<17	<30	<22	62	N	5.6
C30	<2.0	<2.0	<4.0	<7.0	<52	<60	<30	<28	<19	<43	<25	<14	N	0.0
C31	<2.0	<2.0	<5.0	<7.0	<76	<87	<94	N	<24	<73	<33	<18	N	0.0
%LIPID	19	5.6	12	12	16	14	11	13	N	N	N	N	N	

Table A-3.--Concentrations of aromatic enalytes found in sediment samples at each sampling period and sampling station of this study. Concentration units are ng alkane/g dry sediment weight. Concentrations less than detection limits are indicated by the symbol <, followed by the detection limit estimate of that aromatic analyte in that sample. Identities of aromatics abbreviated below are given in Table 2 of the text.

	MAY 1977	MAY 1977	JUNE 1977	JUNE 1977	OCT 1977	OCT 1977	MAY 1978	MAY 1978	JUNE 1978	JUNE 1978	AUG 1978	AUG 1978	MAY 1979	AUG 1979	AUG 1980	MEAN
								Bligh Island								
I-PROBZ	<0.03	<0.03	N	N	N	N	0.02	1.3	0.06	<0.34	0.20	<0.10	0.33	<0.11	<0.09	0.14
N-PROBZ	<0.03	<0.03	N	N	N	N	0.01	0.71	<0.16	<0.14	0.15	<0.11	0.47	<0.13	<1.5	0.12
INDAN	<0.03	<0.03	N	N	N	N	0.25	<0.09	<0.14	<0.21	<0.19	<0.09	<0.11	<0.12	<0.10	0.02
TMEBZ	<0.03	<0.03	N	N	N	N	0.39	0.76	0.16	0.31	0.57	<0.09	<0.10	<0.12	N	0.22
NAPH	<0.03	<0.03	N	N	N	N	0.06	0.93	<0.12	<0.31	<0.01	<0.08	1.0	0.20	<0.12	0.20
BZTHIO	<0.03	<0.03	<0.06	<0.06	<0.05	<0.07	<0.18	<0.22	<0.15	<0.18	<0.21	<0.11	<0.13	<0.20	<0.09	0.0
2-MENAP	<0.03	<0.03	<0.05	<0.05	0.71	N	0.24	0.11	0.16	<0.11	0.24	<0.08	1.2	0.66	<0.09	0.24
1-MENAP	<0.03	<0.03	<0.04	<0.04	<0.04	<0.05	0.20	<0.07	0.20	<0.10	<0.13	<0.07	1.4	0.20	<0.09	0.13
BIPHEN	<0.03	<0.03	<0.04	<0.04	<0.04	<0.05	<0.13	<0.08	<0.11	<0.11	<0.15	<0.08	<0.10	<0.11	<0.09	0.0
2,6-DMN	<0.03	<0.03	<0.04	<0.04	<0.04	<0.05	<0.30	<0.08	<0.11	<0.10	<0.15	<0.08	<0.10	<0.11	<0.09	0.20
235-TMN	<0.03	<0.03	<0.04	<0.04	<0.04	<0.05	<0.13	<0.08	<0.12	<0.11	<0.15	<0.08	<0.11	<0.12	<0.09	0.0
FLUOREN	<0.03	<0.03	<0.04	<0.04	<0.04	<0.05	<0.13	<0.08	<0.11	<0.10	<0.15	<0.08	<0.10	<0.12	<0.09	0.0
DBZ	<0.03	<0.03	<0.05	<0.05	<0.08	<0.10	<0.24	<0.15	<0.21	<0.19	<0.28	<0.15	<0.12	<0.14	<0.09	0.0
PHENAN	0.78	0.87	<0.04	<0.04	0.92	<0.06	1.1	0.54	1.1	0.34	<0.15	<0.09	0.40	0.36	3.5	0.66
ANTHRA	<0.03	<0.03	<0.05	<0.05	<0.05	<0.06	<0.14	<0.09	<0.12	<0.11	<0.16	<0.09	<0.05	<0.06	<0.08	0.0
MEPHEN	<0.03	<0.03	<0.04	<0.04	<0.05	<0.06	<0.13	<0.08	<0.12	<0.10	<0.20	<0.09	<0.11	<0.13	N	0.0
FLANTH	<0.03	<0.03	<0.05	<0.05	N	N	<0.14	<0.08	0.33	<0.10	<0.17	<0.09	<0.11	<0.14	<0.09	0.03
PYRENE	<0.03	<0.03	<0.04	<0.04	<0.06	<0.08	<0.14	<0.08	0.20	<0.10	<0.17	<0.09	<0.11	<0.14	<0.09	0.01
BZANTH	<0.03	<0.03	<0.05	<0.05	<0.10	<0.20	<0.34	<0.19	<0.32	<0.24	<0.51	<0.19	<0.32	<0.50	<0.09	0.0
CHRYSE	<0.03	<0.03	<0.07	<0.07	<0.06	<0.08	<0.18	<0.10	<0.16	<0.13	<0.28	<0.10	<0.13	<0.20	<0.11	0.0
BZEPYR	<0.03	<0.03	<0.02	<0.02	<0.10	<0.10	<0.21	<0.11	<0.21	<0.14	<0.64	<0.11	<0.20	<0.30	<0.10	0.0
BZAPYR	<0.03	<0.03	<0.06	<0.06	<0.10	<0.20	<0.23	<0.11	<0.22	<0.13	<0.73	<0.10	<0.14	<0.22	<0.09	0.0
PERYL	<0.03	<0.03	<0.06	<0.06	<0.10	<0.10	9.4	12	12	8.7	<0.86	<0.13	9.7	17	12	5.4

Table A-3. --Continued.

	MAY 1977	MAY 1977	JUNE 1977	JUNE 1977	MAY 1978	MAY 1978	JUNE 1978	JUNE 1978	AUG 1978	AUG 1978	MAY 1979	AUG 1979	AUG 1980	MEAN
						Constantine Harbor								
I-PROBZ	<0.03	<0.03	N	N	<0.20	1.8	0.38	<0.18	<0.11	0.43	<0.12	<0.18	N	0.22
N-PROBZ	<0.03	<0.03	N	N	<0.21	0.98	0.77	<0.20	<0.11	0.47	0.44	4.0	<0.24	0.61
INDAN	<0.03	<0.03	N	N	<0.18	<0.11	0.66	<0.18	<0.11	<0.20	<0.13	0.37	<0.24	0.09
TMEBZ	<0.03	<0.03	N	N	0.22	0.19	0.38	0.18	<0.09	0.62	0.30	0.32	N	0.22
NAPH	7.8	6.3	N	N	3.9	4.2	4.5	3.6	4.0	2.9	4.7	6.1	3.4	4.7
BZTHIO	<0.03	<0.03	<0.06	<0.06	<0.19	0.62	0.43	<0.20	<0.12	0.41	<0.20	<0.24	<0.29	0.08
2-MENAP	11	12	30	25	13	7.8	13	12	8.4	13	15	15	14	15
1-MENAP	8.1	13	26	22	8.2	6.1	10	7.2	7.0	8.9	12	11	12	12
BIPHEN	5.2	5.6	15	12	9.6	6.9	8.5	8.1	6.5	8.0	9.4	11	9.2	8.5
2,6-DMN	3.8	7.5	20	19	7.4	3.7	8.8	8.1	4.7	9.0	12	5.2	10	9.2
235-TMN	6.8	5.8	13	10	5.7	5.7	7.0	5.9	<0.09	7.1	8.0	7.0	6.5	6.8
FLUOREN	1.8	1.4	5.2	4.3	3.5	3.3	4.0	3.6	<0.09	3.4	5.0	5.1	4.0	3.4
DBZ	0.66	3.0	<0.08	<0.07	3.5	0.92	4.4	3.5	<0.16	4.5	5.0	7.2	<0.26	2.5
PHENAN	34	31	56	48	43	22	31	27	<0.10	30	32	36	34	33
ANTHRA	<0.03	<0.03	<0.07	<0.04	<0.15	0.42	<0.17	<0.15	<0.10	<0.17	0.80	<0.08	<0.25	0.09
MEPHEN	<0.03	<0.03	3.5	7.0	7.1	5.5	8.1	7.3	3.9	10	10	17	N	6.6
FLANTH	<0.03	<0.03	16	14	2.0	4.0	1.7	1.5	3.7	1.7	4.8	3.0	<0.31	4.0
PYRENE	<0.03	<0.03	33	N	6.3	4.1	6.6	5.8	4.2	7.4	4.3	8.9	6.6	7.3
BZANTH	<0.03	<0.03	<0.09	<0.08	2.6	<0.22	3.4	2.8	5.0	3.1	<0.50	10	<0.31	2.1
CHRYSE	<0.03	<0.03	0.13	<0.11	9.7	11	12	9.7	6.7	17	7.9	19	13	8.2
BZEPYR	<0.03	<0.03	15	14	7.7	3.7	8.9	7.0	3.8	<0.66	4.8	<0.25	3.9	5.3
BZAPYR	<0.03	<0.03	<0.04	1.2	<0.25	<0.13	<0.30	<0.24	<0.11	<0.76	<0.31	4.0	<0.32	0.40
PERYL	<0.03	<0.03	190	160	86	58	110	90	74	50	92	67	69	81

Table A-3.--Continued.

	MAY 1977	MAY 1977	JUNE 1977	JUNE 1977	OCT 1977	OCT 1977	MAY 1978	MAY 1978	JUNE 1978	JUNE 1978	AUG 1978	AUG 1978	MAY 1979	AUG 1979	AUG 1980	MEAN
								Dayville Flats								
1-PROBZ	<0.03	<0.03	N	N	N	N	<0.12	1.7	0.02	0.05	<0.24	0.97	<0.12	<0.12	<0.10	0.25
N-PROBZ	<0.03	<0.03	N	N	N	N	<0.14	0.87	0.13	<0.18	<0.26	1.1	<0.14	0.20	<0.11	0.21
INDAN	<0.03	<0.03	N	N	N	N	<0.13	<0.09	0.39	<0.17	<0.22	<0.28	<0.13	<0.13	<0.11	0.05
TMEBZ	<0.03	<0.03	N	N	N	N	0.12	<0.09	0.54	<0.15	<0.19	0.22	<0.13	<0.12	N	0.09
NAPH	3.1	<0.03	N	N	N	N	<0.11	1.3	1.2	0.93	0.93	2.4	1.0	1.2	1.8	1.3
BZTHIO	<0.03	<0.03	<0.06	<0.07	<0.07	<0.07	<0.14	<0.23	<0.19	<0.23	<0.24	<0.06	<0.16	<0.20	<0.13	0.0
2-MENAP	2.3	<0.03	<0.05	<0.05	N	N	0.64	0.74	1.5	0.88	1.6	2.8	1.5	2.1	3.2	1.3
1-MENAP	<0.03	<0.03	<0.05	0.67	N	<0.05	0.42	<0.07	0.81	<0.12	0.65	1.2	0.98	1.0	1.1	0.49
BIPHEN	<0.03	<0.03	<0.04	<0.04	<0.06	<0.05	<0.10	<0.08	<0.14	<0.14	<0.17	0.3	<0.12	<0.11	<0.10	0.02
2,6-DMN	<0.03	<0.03	<0.04	<0.05	<0.06	<0.05	0.50	<0.08	0.89	<0.13	0.24	1.0	<0.12	<0.11	0.82	0.23
235-TMN	<0.03	<0.03	<0.04	<0.05	<0.06	<0.05	<0.10	<0.08	<0.14	<0.14	<0.18	0.48	<0.13	<0.12	<0.10	0.03
FLUOREN	<0.03	<0.03	<0.04	<0.05	<0.06	<0.05	<0.10	<0.09	0.23	<0.13	<0.17	0.38	<0.12	<0.12	0.47	0.07
DBZ	<0.03	<0.03	<0.05	<0.05	<0.06	N	<0.19	<0.15	<0.26	<0.24	<0.32	<0.08	<0.15	<0.14	0.10	0.01
PHENAN	1.4	1.3	<1.4	1.1	<0.10	<0.10	<0.10	0.93	1.7	0.85	<0.17	1.1	0.56	0.73	5.2	0.99
ANTHRA	<0.03	<0.03	<0.05	<0.06	<0.06	<0.06	<0.11	<0.09	<0.15	<0.14	<0.18	<0.05	<0.06	<0.05	<0.09	0.0
MEPHEN	<0.03	<0.03	<0.04	<0.04	<0.06	<0.06	<0.01	<0.08	<0.15	<0.13	<0.23	<0.06	<0.14	<0.13	N	0.0
FLANTH	<0.03	<0.03	<0.05	<0.05	<0.06	<0.06	<0.11	<0.08	0.30	<0.13	<0.19	<0.05	<0.14	<0.13	<0.10	0.02
PYRENE	<0.03	<0.03	<0.04	N	<0.09	<0.08	<0.11	<0.09	0.22	<0.14	<0.20	<0.05	<0.14	<0.13	<0.10	0.02
BZANTH	<0.03	<0.03	<0.05	<0.06	<0.20	<0.20	<0.26	<0.19	<0.39	<0.31	<0.59	<0.15	<0.40	<0.40	<0.10	0.0
CHRYSE	<0.03	<0.03	<0.08	<0.09	<0.08	<0.08	<0.14	<0.10	<0.20	<0.17	<0.31	<0.08	<0.17	<0.20	<0.12	0.0
BZEPYR	<0.03	<0.03	<0.06	<0.07	<0.10	<0.10	<0.16	<0.12	<0.31	<0.21	<0.73	<0.19	<0.22	<0.20	<0.12	0.0
BZAPYR	<0.03	<0.03	<0.02	<0.03	<0.20	<0.20	<0.17	<0.11	<0.25	<0.19	<0.84	<0.22	<0.18	<0.20	<0.11	0.0
PERYL	<0.03	<0.03	<0.06	<0.07	<0.10	<0.10	<0.20	<0.13	<0.27	<0.17	<1.0	<0.25	<0.22	<0.21	<0.11	0.0

Table A-3. --Continued.

	JUNE 1978	JUNE 1978	AUG 1978	AUG 1978	MAY 1979	AUG 1979	AUG 1980	MEAN
				Mineral Flats				
I-PROBZ	<0.16	0.09	<0.08	0.17	0.22	0.18	<0.08	0.09
N-PROBZ	<0.17	<0.22	<0.09	0.09	<0.10	<0.14	<0.09	0.01
INDAN	<0.15	<0.19	<0.08	<0.16	<0.10	0.33	<0.09	0.05
TMEBZ	0.15	0.37	<0.08	<0.13	<0.10	<0.13	N	0.09
NAPH	0.96	2.0	1.1	1.7	2.0	2.8	2.9	1.9
BZTHIO	<0.15	<0.20	<0.09	<0.17	<0.12	<0.17	<0.11	0.0
2-MENAP	1.5	2.4	0.99	2.2	2.5	2.4	3.7	2.2
1-MENAP	0.42	1.2	0.36	1.0	1.5	0.93	1.7	1.0
BIPHEN	0.22	<0.15	<0.07	<0.12	<0.10	<0.12	<0.08	0.03
2,6-DMN	0.82	1.0	<0.07	0.89	1.0	<0.61	1.8	0.79
235-TMN	<0.12	<0.15	<0.07	<0.12	<0.10	<0.13	<0.08	0.0
FLUOREN	1.6	0.6	0.31	1.6	2.0	1.9	2.7	1.5
DBZ	0.82	1.1	<0.13	0.72	<0.11	<0.15	0.69	0.48
PHENAN	0.76	12	0.46	8.5	14	8.3	15	8.4
ANTHRA	<0.12	<0.10	<0.08	<0.13	0.30	<0.06	0.43	0.10
MEPHEN	0.38	0.55	<0.07	0.40	<0.11	<0.13	N	0.79
FLANTH	5.6	7.7	<0.07	5.6	12	5.6	12	6.9
PYRENE	2.4	0.67	<0.07	4.1	5.8	3.0	6.4	3.2
BZANTH	<0.29	<0.50	<0.17	<0.41	<0.40	<0.32	<0.08	0.0
CHRYSE	<0.15	<0.27	<0.09	<0.22	<0.20	<0.14	<0.10	0.0
BZEPYR	<0.24	<0.84	<0.10	<0.51	<0.24	<0.18	<0.10	0.0
BZAPYR	<0.20	<0.62	<0.09	<0.59	<0.20	<0.16	<0.09	0.0
PERYL	<0.21	<0.72	<0.11	<0.70	<0.24	<0.19	<0.09	0.0

Table A-3.--Continued.

	MAY 1977	MAY 1977	JUNE 1977	JUNE 1977	AUG 1977	AUG 1977	MAY 1978	MAY 1978	JUNE 1978	JUNE 1978	AUG 1978	AUG 1978	HAY 1979	AUG 1979	AUG 1980	MEAN
								Naked Island								
I-PROBZ	<0.03	<0.03	N	N	N	N	<0.11	1.8	<0.20	<0.11	<0.13	<0.12	0.30	<0.13	<0.09	0.19
N-PROBZ	<0.03	<0.03	N	N	N	N	<0.13	1.0	<0.22	<0.13	<0.14	<0.13	<0.12	<0.15	<0.10	0.09
INDAN	<0.03	<0.03	N	N	N	N	N	<0.11	<0.19	<0.12	<0.12	<0.12	<0.12	0.35	<0.10	0.04
TMEBZ	<0.03	<0.03	N	N	N	N	0.17	<0.10	0.29	<0.10	<0.12	<0.11	<0.12	<0.14	N	0.05
NAPH	<0.03	<0.03	N	N	N	N	<0.10	1.1	0.13	0.64	<0.11	<0.11	1.3	1.4	N	0.46
BZTHIO	<0.03	<0.03	<0.07	<0.06	<0.05	<0.05	<0.13	<0.27	<0.21	<0.13	<0.14	<0.14	<0.12	<0.17	<0.11	0.0
2-MENAP	<0.03	<0.03	<0.05	<0.05	N	N	0.07	<0.10	0.25	0.60	<0.11	<0.11	1.3	0.87	<0.09	0.24
1-MENAP	<0.03	<0.03	<0.05	<0.04	<0.04	<0.04	<0.09	<0.09	0.16	0.10	<0.09	<0.09	0.37	0.32	<0.08	0.06
BIPHEN	<0.03	<0.03	<0.04	<0.04	<0.04	<0.04	0.09	<0.09	<0.15	0.12	<0.11	<0.10	<0.11	0.19	<0.08	0.03
2,6-DMN	<0.03	<0.03	<0.05	<0.04	N	N	0.54	<0.09	0.87	0.88	0.37	<0.10	<0.11	0.79	<0.09	0.27
235-TMN	<0.03	<0.03	<0.05	<0.04	<0.04	<0.04	<0.09	<0.10	<0.16	<0.10	<0.11	<0.11	<0.12	<0.13	<0.09	0.0
FLUOREN	<0.03	<0.03	<0.05	<0.04	<0.04	<0.04	<0.09	<0.10	<0.15	<0.09	<0.10	<0.10	<0.12	<0.13	<0.09	0.0
DBZ	<0.03	<0.03	<0.05	<0.05	<0.08	<0.08	<0.17	<0.18	<0.29	<0.17	<0.20	<0.20	<0.14	<0.15	<0.09	0.0
PHENAN	1.7	1.6	1.3	0.80	<0.04	N	<0.09	0.80	1.3	0.73	<0.12	<0.10	2.3	1.6	4.6	1.2
ANTHRA	<0.03	<0.03	<0.05	<0.05	<0.05	<0.05	<0.10	<0.11	<0.17	0.65	<0.12	<0.11	<0.05	<0.06	0.68	0.09
MEPHEN	1.9	3.6	1.0	2.4	<0.05	<0.05	<0.09	<0.10	<0.16	0.47	<0.11	<0.11	<0.13	0.14	N	0.68
FLANTH	<0.03	<0.03	<0.05	<0.04	N	N	0.49	<0.10	0.63	<0.24	<0.11	<0.11	2.8	0.85	2.5	0.56
PYRENE	<0.03	<0.03	N	N	<0.06	<0.06	0.22	<0.10	<0.17	N	<0.11	<0.11	2.2	0.88	2.4	0.48
BZANTH	<0.03	<0.03	<0.06	<0.05	<0.10	<0.10	<0.24	<0.22	<0.43	N	<0.25	<0.25	<0.50	<0.32	<0.09	0.0
CHRYSE	<0.03	<0.03	<0.09	<0.07	<0.06	<0.06	<0.13	<0.12	<0.22	<0.13	<0.13	<0.13	<0.20	0.61	<0.10	0.04
BZEPYR	<0.03	<0.03	<0.07	<0.06	<0.08	<0.08	<0.15	<0.14	<0.28	<0.15	<0.14	<0.15	<0.30	<0.18	<0.10	0.0
BZAPYR	<0.03	<0.03	<0.02	<0.02	<0.09	<0.09	<0.15	<0.13	<0.30	<0.16	<0.13	<0.14	<0.22	<0.16	<0.09	0.0
PERYL	<0.03	<0.03	<0.07	<0.06	<0.09	<0.09	13	17	22	21	<0.17	<0.16	82	34	24	14

Table A-).--Continued.

	MAY 1978	MAY 1978	JUNE 1978	JUNE 1978	AUG 1978	AUG 1978	MAY 1979	AUG 1979	AUG 1980	MEAN
					Olsen Bay					
I-PROBZ	<0.20	0.89	<0.20	<0.18	<0.30	<0.14	0.30	<0.21	N	0.15
N-PROBZ	<0.22	0.27	<0.21	<0.21	<0.32	<0.16	<0.17	2.7	<0.23	0.33
INDAN	<0.18	0.36	<0.19	<0.19	<0.27	<0.14	<0.16	<0.22	<0.22	0.04
TMEBZ	<0.15	<0.17	0.35	0.63	<0.23	<0.13	<0.16	<0.21	N	0.12
NAPH	<0.15	0.32	0.33	0.22	<0.22	<0.12	1.0	1.4	<0.21	0.36
BZTHIO	<0.19	<0.26	<0.20	<0.21	<0.29	<0.16	<0.20	<0.20	<0.27	0.0
2-MENAP	0.27	<0.16	0.39	0.50	<0.22	<0.13	1.5	0.92	<0.22	0.40
1-MENAP	0.02	<0.14	0.26	0.08	<0.19	<0.11	1.6	0.46	<0.18	0.27
BIPHEN	<0.14	<0.15	<0.15	<0.15	<0.21	<0.12	<0.15	0.29	<0.21	0.03
2,6-DMN	<0.14	<0.15	<0.15	<0.15	<0.21	<0.12	<0.15	<0.20	<0.21	0.0
235-TMN	<0.15	<0.16	<0.15	<0.15	<0.22	<0.12	<0.16	<0.21	<0.22	0.0
FLUOREN	<0.14	<0.15	<0.14	<0.14	<0.21	<0.12	0.58	<0.20	<0.22	0.06
DBZ	<0.26	<0.28	<0.27	<0.27	<0.39	<0.28	<0.19	<0.24	<0.24	0.0
PHENAN	<0.14	0.58	1.1	0.75	<0.02	<0.13	<0.16	0.62	<0.23	0.34
ANTHRA	<0.15	<0.16	<0.16	0.15	<0.23	<0.13	<0.07	<0.09	<0.23	0.02
MEPHEN	<0.15	<0.15	<0.15	<0.15	<0.28	<0.13	<0.17	<0.21	N	0.0
FLANTH	<0.15	<0.15	0.28	<0.16	<0.23	<0.13	<0.18	<0.22	<0.28	0.03
PYRENE	<0.15	<0.15	0.19	<0.16	<0.24	<0.13	<0.18	<0.22	<0.29	0.02
BZANTH	<0.37	<0.35	<0.38	<0.38	<0.72	<0.28	<0.49	<0.51	<0.29	0.0
CHRYSE	<0.19	<0.19	<0.20	<0.20	<0.39	<0.28	<0.20	<0.23	<0.34	0.0
BZEPYR	<0.25	<0.21	<0.24	<0.24	<0.89	<0.64	<0.26	<0.28	<0.35	0.0
BZAPYR	<0.26	<0.19	<0.26	<0.25	<1.0	<0.73	<0.22	<0.26	<0.30	0.0
PERYL	12	14	10	9.2	<1.2	<0.86	9.6	10	3.6	7.6

Table A-3. --Continued.

	JUNE 1977	JUNE 1977	AUG 1977	AUG 1977	JUNE 1978	JUNE 1978	AUG 1978	AUG 1978	MAY 1979	AUG 1980	MEAN
					Rocky Bay						
I-PROBZ	N	N	0.32	1.7	0.28	0.58	<0.14	<0.11	0.28	N	0.78
N-PROBZ	N	N	0.79	1.3	0.88	0.51	<0.15	<0.12	2.3	0.56	1.2
INDAN	N	N	1.1	0.29	0.87	<0.12	<0.14	<0.10	1.1	<0.20	0.42
TMEBZ	N	N	0.96	0.27	0.23	0.13	<0.13	<0.10	<0.14	N	0.23
NAPH	N	N	5.4	4.6	5.4	3.8	2.1	2.0	6.6	6.1	4.5
BZTHIO	<0.06	<0.06	0.27	<0.24	0.29	N	<0.16	<0.12	0.31	<0.24	0.10
2-MENAP	11	12	10	4.9	9.1	3.4	2.8	2.7	8.5	13	7.7
1-MENAP	2.8	2.6	3.2	0.42	3.1	2.2	0.54	0.64	1.9	5.5	2.3
BIPHEN	0.99	4.2	5.6	3.2	4.7	3.3	1.2	1.5	5.6	5.9	3.6
2,6-DMN	5.8	6.0	6.0	4.6	5.2	3.4	0.93	2.2	5.5	7.2	4.7
235-TMN	<0.04	<0.04	<0.10	<0.09	<0.12	<0.10	<0.13	<0.09	<0.14	<0.20	0.0
FLUOREN	11	12	14	8.2	12	9.0	4.2	3.8	14	19	11
DBZ	<0.05	<0.05	<0.18	2.6	6.0	1.4	1.9	1.7	4.2	<0.22	1.8
PHENAN	48	49	54	31	42	31	6.9	11	46	60	38
ANTHRA	0.79	0.86	3.5	2.3	3.0	1.7	<0.13	<0.10	1.7	4.1	1.8
MEPHEN	7.0	0.94	2.8	1.2	2.3	1.4	0.27	0.58	5.2	N	2.2
FLANTH	6.0	12	15	9.8	9.3	7.3	4.1	3.9	13	17	9.7
PYRENE	N	N	17	12	13	8.9	5.4	5.6	18	21	13
BZANTH	0.22	<0.05	4.6	0.62	2.6	1.5	<0.29	0.78	2.3	0.5	1.3
CHRYSE	18	31	15	7.8	12	7.9	4.2	4.4	11	19	13
BZEPYR	14	13	15	6.1	12	6.9	3.6	3.8	1.6	13	8.9
BZAPYR	<0.02	<0.02	0.85	<0.11	0.69	<0.12	<0.16	<0.11	7.0	<0.27	0.85
PERYL	19	30	61	31	44	24	16	16	36	56	33

Table A-3. --Continued.

	JUNE 1977	JUNE 1977	OCT 1977	OCT 1977	MAY 1978	MAY 1978	JUNE 1978	JUNE 1978	AUG 1978	AUG 1978	MAY 1979	AUG 1979	AUG 1980	MEAN
							Siwash Bay							
1-PROBZ	N	N	N	N	<0.22	1.4	0.06	<0.21	<0.27	<0.23	<0.07	0.61	<0.11	0.23
N-PROBZ	N	N	N	N	<0.24	0.8	0.12	<0.22	<0.30	<0.25	<0.07	5.4	<0.12	0.70
INDAN	N	N	N	N	<0.20	<0.10	0.24	<0.19	<0.25	<0.22	<0.07	0.2	<0.11	0.05
TMEBZ	N	N	N	N	<0.17	4.3	1.6	<0.16	2.1	1.1	0.29	<0.13	N	1.2
NAPH	N	N	N	N	<0.16	0.70	0.26	<0.15	<0.20	<0.18	0.98	1.5	N	0.43
BZTHIO	<0.06	<0.06	<0.07	<0.06	<0.21	<0.24	<0.20	<0.20	<0.27	<0.23	<0.09	<0.19	<0.14	0.0
2-MENAP	<0.07	<0.05	N	<0.05	<0.20	<0.09	0.25	0.14	<0.21	<0.18	5.0	0.65	N	0.55
1-MENAP	<0.07	<0.05	<0.05	<0.04	<0.14	<0.08	0.17	<0.13	<0.20	<0.15	0.45	0.34	<0.09	0.07
BIPHEN	<0.06	2.0	<0.05	<0.05	<0.16	<0.08	<0.15	0.15	<0.20	<0.17	<0.07	0.23	<0.10	0.18
2,6-DMN	<0.07	<0.05	N	<0.05	0.23	<0.08	<0.15	0.24	<0.19	<0.17	<0.07	0.21	<0.10	0.06
235-TMN	<0.06	<0.05	<0.06	<0.05	<0.16	<0.09	<0.15	<0.15	<0.20	<0.18	<0.07	<0.15	<0.11	0.0
FLUOREN	<0.06	<0.04	<0.06	<0.05	<0.15	<0.09	<0.15	<0.14	<0.19	<0.17	<0.07	<0.14	<0.10	0.0
DBZ	<0.07	<0.05	<0.10	<0.09	<0.15	<0.16	<0.28	<0.27	<0.04	<0.32	<0.08	<0.17	<0.10	0.0
PHENAN	<0.06	0.58	<0.06	<0.05	<0.15	1.3	0.63	<0.14	<0.20	0.62	<0.07	1.6	4.4	0.70
ANTHRA	<0.04	3.5	<0.06	<0.06	<0.17	<0.10	<0.16	<0.16	<0.21	<0.18	<0.03	<0.07	<0.10	0.27
MEPHEN	<0.05	<0.05	<0.06	<0.06	<0.16	<0.09	<0.16	<0.15	<0.26	<0.18	<0.08	5.4	N	0.45
FLANTH	<0.09	<0.07	N	N	0.65	<0.09	<0.16	<0.15	<0.20	<0.18	<0.08	0.84	<0.11	0.14
PYRENE	N	N	<0.08	<0.07	0.68	<0.09	<0.30	<0.16	<0.20	<0.19	<0.08	1.1	<0.11	0.16
BZANTH	<0.08	<0.06	<0.20	<0.10	<0.41	<0.20	<0.41	<0.38	<0.70	<0.45	<0.22	<0.35	<0.11	0.0
CHRYSE	<0.11	<0.09	<0.07	<0.07	<0.21	<0.11	<0.22	<0.20	<0.36	<0.23	<0.09	<0.16	<0.13	0.0
BZEPYR	6.4	5.4	<0.10	<0.10	<0.27	<0.12	<0.27	<0.25	<0.80	<0.28	<0.12	<0.20	<0.13	0.91
BZAPYR	<0.03	<0.03	<0.10	<0.10	<0.29	<0.11	<0.29	<0.27	<0.10	<0.30	<0.10	<0.18	<0.11	0.0
PERYL	<0.16	0.12	<0.10	<0.10	7.3	4.2	5.8	6.5	<1.1	4.4	2.6	<0.10	7.0	3.7

Table A-4.--Concentrations of aromatic analytes found in mussel samples at each sampling period and sampling station of this study. Concentration units are ng alkane/g dry mussel tissue weight. Concentrations less than detection limits are indicated by the symbol <, followed by the detection limit estimate of that alkane aromatic in that sample. Identities of aromatics abbreviated below are given in Table 2 of the text.

	MAY 1977	MAY 1977	JUNE 1977	JUNE 1977	OCT 1977	OCT 1977	MAY 1978	MAY 1978	JUNE 1978	JUNE 1978	AUG 1978	AUG 1978	MAY 1979	AUG 1979	AUG 1980	MEAN
								Bligh Island								
I-PROBZ	<2.0	<2.0	N	N	67	N	<5.2	<5.7	<5.9	<8.0	<16	<6.2	<3.8	<7.8	<8.2	5.6
N-PROBZ	<2.0	<2.0	N	N	<4.0	N	8.4	<6.2	<6.4	<8.6	<17	<6.8	<4.2	<8.5	<8.4	0.70
INDAN	<2.0	<2.0	N	N	<4.0	N	<5.0	<5.5	<5.6	<7.7	<15	<6.2	<4.1	<8.4	<8.7	0.0
TMEBZ	<2.0	<2.0	<2.0	<2.0	<4.0	<2.0	<4.7	<5.1	<5.3	<7.2	<14	<5.8	<4.0	<8.2	N	0.0
NAPH	<2.0	<2.0	13	<2.0	<3.0	<2.0	<4.4	9.6	<5.0	<6.8	<13	<5.4	<3.8	<7.7	<7.9	1.5
BZTHIO	<2.0	<2.0	<6.0	<2.0	<4.0	<3.0	<5.7	<6.2	<6.5	<8.9	<18	<7.2	<5.1	<10	<10	0.0
2-MENAP	<2.0	<2.0	<2.0	<2.0	<3.0	<2.0	<4.5	<5.0	<5.2	<7.0	<14	<5.6	<4.0	<8.0	<8.1	0.0
1-MENAP	<2.0	<2.0	34	<2.0	<3.0	<2.0	<3.8	<4.2	<4.3	<5.9	<12	<4.8	<3.3	<6.7	<6.9	2.3
BIPHEN	<2.0	<2.0	<2.0	<2.0	<3.0	<2.0	<4.3	<4.8	<4.9	<6.7	<13	<5.4	<3.8	<7.6	<7.8	0.0
2,6-DMN	<2.0	<2.0	<2.0	<2.0	<3.0	<2.0	<4.3	<4.7	<4.9	<6.6	<13	<5.3	<3.8	<7.6	<7.9	0.0
235-TMN	<2.0	<2.0	<2.0	<2.0	<3.0	<2.0	<4.5	<5.0	<5.1	<7.0	<14	<5.6	<4.1	<8.0	<8.2	0.0
FLUOREN	<2.0	<2.0	<2.0	<2.0	<3.0	<2.0	<4.2	<4.6	<4.8	<6.6	<13	<5.3	<4.0	<7.7	<7.7	0.0
DBZ	<2.0	<2.0	<2.0	<2.0	<6.0	<4.0	<8.0	<8.8	<9.2	<12	<25	<10	<4.8	<9.3	<7.9	0.0
PHENAN	<2.0	<2.0	<2.0	<2.0	<3.0	<2.0	<4.8	<5.3	<5.5	<8.3	<15	<5.2	<4.1	<8.1	<8.1	0.0
ANTHRA	<2.0	<2.0	<2.0	<2.0	<4.0	<2.0	<4.7	<5.2	<5.4	<7.3	<15	<6.0	<1.8	<3.5	<7.5	0.0
MENPHEN	<2.0	<2.0	<2.0	<2.0	<4.0	<2.0	<4.5	<5.0	<5.2	<7.0	<14	<5.7	<4.4	<8.7	N	0.0
FLANTH	<2.0	<2.0	<2.0	<2.0	<4.0	<2.0	<4.5	<5.0	<5.4	<7.1	<15	<5.7	<4.5	<8.9	<8.9	0.0
PYRENE	<2.0	<2.0	<2.0	<2.0	<5.0	<3.0	<4.6	<5.0	<5.5	<6.6	<15	<5.8	<4.5	<8.9	<9.0	0.0
BZANTH	<2.0	<2.0	<2.0	<2.0	<9.0	<5.0	<10	<11	<13	<17	<35	<13	<13	<22	<10	0.0
CHRYSE	<10	<10	<2.0	<2.0	<4.0	<3.0	<5.2	<5.7	<6.5	<8.4	<18	<6.6	<5.3	<9.8	<12	0.0
BZEPYR	<2.0	<2.0	<2.0	<2.0	<7.0	<6.0	<5.7	<6.3	<6.9	<8.9	<19	<7.1	<6.5	<12	<14	0.0
BZAPYR	<2.0	<2.0	<2.0	<2.0	<8.0	<5.0	<5.3	<5.9	<6.6	<9.2	<19	<7.1	<5.4	<11	<12	0.0
PERYL	<2.0	<2.0	<2.0	<2.0	<8.0	<5.0	<6.6	<7.2	<8.0	<11	<23	<8.5	<7.1	<13	<13	0.0

Table A-4.--Continued.

	MAY 1977	MAY 1977	JUNE 1977	JUNE 1977	MAY 1978	MAY 1978	JUNE 1978	JUNE 1978	AUG 1978	AUG 1978	MAY 1979	AUG 1979	AUG 1980	MEAN
							Constantine Harbor							
I-PROBZ	<2.0	<2.0	N	N	<5.7	<4.2	<5.0	<4.5	<8.0	<6.6	<6.0	<9.9	<12	0.0
N-PROBZ	<2.0	<2.0	N	N	<6.2	<4.5	<5.4	<4.9	<8.7	<7.2	<6.6	<11	<12	0.0
INDAN	<2.0	<2.0	N	N	<5.5	<4.1	<5.0	<4.3	<7.8	<6.5	<6.4	<11	<12	0.0
TMEBZ	<2.0	<2.0	<2.0	<2.0	<4.4	<3.9	<4.7	<4.1	<7.3	<6.2	<6.2	<10	N	0.0
NAPH	<2.0	<2.0	7.2	6.0	12	<3.6	<4.8	<3.8	<6.8	<5.7	<5.9	<9.7	<11	1.9
BZTHIO	<2.0	<2.0	<3.0	<2.0	<6.2	<4.8	<5.8	<4.9	<8.9	<7.6	<7.9	<12	<15	0.0
2-MENAP	<2.0	<2.0	<2.0	<2.0	<5.0	<3.7	<4.5	<3.9	<7.1	<5.9	<6.2	<10	<11	0.0
1-MENAP	<2.0	<2.0	<2.0	<2.0	<4.2	<3.2	<3.8	<3.3	<6.0	<5.0	<5.2	<8.4	<9.8	0.0
BIPHEN	<2.0	<2.0	<2.0	<2.0	<4.8	<3.6	<4.3	<3.8	<6.8	<5.7	<6.0	<9.5	<11	0.0
2,6-DMN	<2.0	<2.0	<2.0	<2.0	<4.7	<3.5	<4.3	<3.7	<6.7	<5.6	<5.9	<9.5	<11	0.0
235-TMN	<2.0	<2.0	<2.0	<2.0	<5.0	<3.7	<4.5	<3.9	<7.0	<5.9	<6.3	<9.9	<12	0.0
FLUOREN	<2.0	<2.0	<2.0	<2.0	<4.6	<3.5	<4.2	<3.6	<6.6	<5.5	<6.2	<9.5	<11	0.0
DBZ	<2.0	<2.0	<2.0	<2.0	<8.8	<6.6	<8.0	<7.0	<13	<11	<7.3	<11	<11	0.0
PHENAN	<2.0	<2.0	<2.0	<2.0	<5.3	<4.0	<3.8	<4.2	<7.6	<5.4	<6.4	<9.7	<11	0.0
ANTHRA	<2.0	<2.0	<2.0	<2.0	<5.2	<3.8	<4.6	<4.1	<7.4	<6.3	<2.8	<4.4	<11	0.0
MENPHEN	<2.0	<2.0	<2.0	<2.0	<5.0	<3.7	<4.5	<3.9	<7.2	<6.0	<6.8	<11	N	0.0
FLANTH	<2.0	<2.0	<2.0	<2.0	<5.0	<3.7	<19	<4.1	<7.4	<6.0	<7.0	<10	<13	0.0
PYRENE	<2.0	<2.0	<2.0	<2.0	<5.0	<3.5	<4.2	<4.2	<7.6	<6.0	<7.0	<10	<13	0.0
BZANTH	<2.0	<2.0	<2.0	<2.0	<11	<8.7	<10	<9.6	<18	<13	<20	<23	<15	0.0
CHRYSE	<2.0	<2.0	<2.0	<2.0	<5.7	<4.5	<5.5	<4.9	<9.2	<7.0	<8.2	<10	<17	0.0
BZEPYR	<2.0	<2.0	<2.0	<2.0	<6.3	<5.7	<6.8	<5.2	<9.8	<7.5	<10	<13	<17	0.0
BZAPYR	<2.0	<2.0	<2.0	<2.0	<5.9	<5.0	<6.0	<5.0	<9.6	<7.5	<8.4	<11	<17	0.0
PERYL	<2.0	<2.0	<2.0	<2.0	<7.2	<6.1	<7.3	<6.1	<11	<8.9	<11	<13	<18	0.0

Table A-4. --Continued.

	MAY 1977	MAY 1977	JUNE 1977	JUNE 1977	OCT 1977	OCT 1977	MAY 1978	MAY 1978	JUNE 1978	JUNE 1978	AUG 1978	AUG 1978	MAY 1979	AUG 1979	AUG 1980	MEAN
								Dayville Flats								
I-PROBZ	<2.0	<2.0	N	N	<3.0	<4.0	<16	<5.5	<10	<11	<19	<12	<10	<25	<7.4	0.0
N-PROBZ	<2.0	<2.0	N	N	<4.0	<5.0	<8.2	<6.0	<11	<12	<21	<13	<11	<27	<7.5	0.0
INDAN	<2.0	<2.0	N	N	<4.0	<5.0	<7.4	<5.3	<9.9	<11	<19	<11	<11	<26	<7.8	0.0
TMEBZ	<2.0	<2.0	<2.0	<2.0	<3.0	<5.0	<7.0	<5.0	<9.4	<9.6	<17	<11	<11	<26	N	0.0
NAPH	<2.0	<2.0	42	15	<3.0	<4.0	<6.6	<4.6	<8.8	<9.1	<16	<10	<10	<24	<7.1	3.8
BZTHIO	<2.0	<2.0	<2.0	<2.0	<4.0	<6.0	<8.6	<6.0	<1.4	<12	<22	<13	<14	<32	<9.4	0.0
2-MENAP	<2.0	<2.0	<2.0	<2.0	<3.0	<4.0	<6.8	<4.8	<9.0	<9.3	<17	<10	<11	<25	<7.3	0.0
1-MENAP	<2.0	<2.0	11	14	<3.0	<4.0	<5.7	<4.1	<7.6	<7.9	<14	<8.8	<9.0	<21	<6.3	1.7
BIPHEN	<2.0	<2.0	<2.0	<2.0	<3.0	<4.0	<6.5	<4.6	<8.6	<8.7	<16	<10	<10	<24	<7.1	0.0
2,6-DMN	<2.0	<2.0	<2.0	<2.0	<3.0	<4.0	<6.4	<4.5	<8.6	<8.6	<16	<9.9	<10	<24	<7.2	0.0
235-TMN	<2.0	<2.0	<2.0	<2.0	<3.0	<4.0	<6.8	<4.8	<9.0	<8.8	<17	<10	<11	<25	<7.4	0.0
FLUOREN	<2.0	<2.0	<2.0	<2.0	<3.0	<4.0	<6.3	<4.5	<8.4	<8.4	<160	<9.7	<12	<24	<7.0	0.0
DBZ	<2.0	<2.0	<2.0	<2.0	<6.0	<8.0	<12	<8.5	<6.0	<16	<30	<19	<13	<28	<7.1	0.0
PHENAN	<2.0	<2.0	<2.0	<2.0	<3.0	<4.0	<7.8	<5.1	<9.6	<8.2	<16	<11	<11	<24	<7.2	0.0
ANTHRA	<2.0	<2.0	<2.0	<2.0	<4.0	<5.0	<7.3	<5.0	<9.6	<9.0	<18	<11	<4.9	<11	<6.7	0.0
MENPHEN	<2.0	<2.0	<2.0	<2.0	<4.0	<5.0	<6.9	<4.8	<9.1	<8.8	<17	<11	<12	<27	N	0.0
FLANTH	<2.0	<2.0	<2.0	<2.0	<3.0	<5.0	<7.1	<4.8	<9.4	<9.0	<17	<11	<12	<26	<7.6	0.0
PYRENE	<2.0	<2.0	<2.0	<2.0	<5.0	<6.0	<7.3	<4.8	<9.6	<9.2	<18	<11	<12	<26	<7.8	0.0
BZANTH	<2.0	<2.0	<2.0	<2.0	<9.0	<11	<17	<11	<22	<22	<42	<26	<35	<57	<8.2	0.0
CHRYSE	<12	<14	<2.0	<2.0	<4.0	<6.0	<8.7	<5.5	<11	<12	<21	<14	<15	<26	<9.3	0.0
BZEPYR	<2.0	<2.0	<2.0	<2.0	<7.0	<9.0	<9.2	<6.0	<12	<14	<22	<14	<21	<31	<11	0.0
BZAPYR	<2.0	<2.0	<2.0	<2.0	<8.0	<10	<8.8	<5.7	<11	<14	<24	<14	<17	<28	<10	0.0
PERYL	<2.0	<2.0	<2.0	<2.0	<8.0	<10	<11	<7.0	<14	<17	<33	<17	<21	<32	<11	0.0

Table A-4.--Continued.

	JUNE 1978	JUNE 1978	AUG 1978	AUG 1978	MAY 1979	AUG 1979	AUG 1980	MEAN
				Mineral Flats				
1-PROBZ	<7.6	<6.4	<14	<17	<9.6	<6.8	<6.8	0.0
N-PROBZ	<8.2	<6.9	<16	<19	<11	<7.5	<6.9	0.0
INDAN	<7.4	<6.2	<14	<17	<10	<7.3	<7.1	0.0
TMEBZ	<7.0	<5.9	<13	<16	<10	<7.1	N	0.0
NAPH	<6.6	<5.5	<13	<15	<9.6	<6.7	<6.5	0.0
BZTHIO	<8.6	<7.2	<17	<19	<13	<8.8	<8.6	0.0
2-MENAP	<6.8	<5.7	<13	<15	<10	<6.9	<6.7	0.0
1-MENAP	<5.7	<4.8	<11	<13	<8.4	<5.8	<5.7	0.0
BIPHEN	<6.5	<5.5	<12	<15	<9.8	<6.5	<6.5	0.0
2,6-DMN	<6.4	<5.4	<12	<14	<9.6	<6.5	<6.6	0.0
235-TMN	<6.8	<5.7	<13	<15	<10	<6.9	<6.8	0.0
FLUOREN	<6.4	<5.4	<12	<14	<9.7	<6.5	<6.4	0.0
DBZ	<12	<10	<23	<27	<19	<7.8	<6.5	0.0
PHENAN	<7.8	<6.6	<12	<16	<10	<6.7	<6.6	0.0
ANTHRA	<7.3	<6.1	<14	<16	<9.7	<3.0	<6.2	0.0
MENPHEN	<6.9	<5.8	<13	<16	<11	<7.4	N	0.0
FLANTH	<7.2	<6.0	<13	<16	<11	<7.2	<6.9	0.0
PYRENE	<7.3	<6.2	<13	<16	<11	<7.1	<7.1	0.0
BZANTH	<17	<14	<29	<38	<26	<16	<7.5	0.0
CHRYSE	<8.8	<7.4	<15	<20	<14	<7.1	<8.9	0.0
BZEPYR	<9.2	<7.8	<16	<21	<15	<8.6	<10	0.0
BZAPYR	<8.8	<7.4	<16	<21	<15	<7.8	<9.3	0.0
PERYL	<11	<9.1	<20	<25	<18	<8.9	<10	0.0

Table A-4. --Continued.

	MAY 1977	MAY 1977	JUNE 1977	JUNE 1977	OCT 1977	OCT 1977	MAY 1978	MAY 1978	JUNE 1978	JUNE 1978	AUG 1978	AUG 1978	MAY 1979	AUG 1979	AUG 1980	MEAN
								Naked Island								
I-PROBZ	<1.0	<2.0	N	N	<3.0	N	<3.6	<4.7	<5.5	<7.8	<7.1	<13	<6.9	<7.5	<6.3	0.0
N-PROBZ	<1.0	<2.0	N	N	<3.0	N	<3.9	<5.1	<6.0	<8.4	<7.6	<14	<7.6	<8.3	<6.5	0.0
INDAN	<1.0	<2.0	N	N	<3.0	N	<3.4	<4.5	<5.2	<7.5	<6.8	<12	<7.4	<8.1	<6.6	0.0
TMEBZ	<1.0	<2.0	<2.0	<2.0	<3.0	<2.0	<3.2	<4.2	<5.0	<7.1	<6.4	<11	<7.1	<7.9	N	0.0
NAPH	<1.0	<2.0	<2.0	<2.0	<3.0	<2.0	<3.6	<4.0	<4.6	<6.6	<6.0	<11	<6.8	<7.4	<6.0	0.0
BZTHIO	<1.0	<2.0	<3.0	<2.0	<3.0	<3.0	<3.9	<5.2	<8.7	<6.0	<7.9	<14	<9.2	<9.8	<7.9	0.0
2-MENAP	<2.0	<2.0	<2.0	<2.0	<3.0	<2.0	<3.1	<4.1	<4.8	<6.9	<6.2	<11	<7.2	<7.7	<6.2	0.0
1-MENAP	<1.0	<2.0	3.6	<2.0	<2.0	<2.0	<2.7	<3.5	<4.0	<5.8	<5.2	<9.4	<6.0	<6.4	<5.3	0.24
BIPHEN	<1.0	<2.0	<2.0	<2.0	<3.0	<2.0	<3.0	<3.9	<4.6	<6.6	<5.9	<11	<6.9	<7.2	<6.0	0.0
2,6-DMN	<1.0	<2.0	<2.0	<2.0	<3.0	<2.0	<3.0	<3.9	<4.5	<6.5	<5.8	<10	<6.9	<7.2	<6.1	0.0
235-TMN	<1.0	<2.0	<2.0	<2.0	<3.0	<2.0	<3.1	<4.1	<4.8	<6.8	<6.1	<11	<7.3	<7.6	<6.2	0.0
FLUOREN	<1.0	<2.0	<2.0	<2.0	<3.0	<2.0	<2.9	<3.8	<4.5	<6.4	<5.8	<10	<7.2	<7.2	<5.9	0.0
DBZ	<2.0	<2.0	<2.0	<2.0	<5.0	<4.0	<5.6	<7.3	<8.5	<12	<11	<20	<8.5	<8.6	<6.0	0.0
PHENAN	<1.0	<2.0	<2.0	<2.0	<3.0	<2.0	<3.3	<4.4	<5.1	<8.1	<5.8	<13	<7.4	<7.4	<6.2	0.0
ANTHRA	<1.0	<2.0	<2.0	<2.0	<3.0	<2.0	<3.3	<4.3	<5.1	<7.2	<6.6	<12	<3.3	<3.3	<5.8	0.0
MENPHEN	<1.0	<2.0	<2.0	<2.0	<3.0	<2.0	<3.1	<4.1	<4.8	<6.9	<6.2	<11	<7.8	<8.1	N	0.0
FLANTH	<1.0	<2.0	<2.0	<2.0	<3.0	<2.0	<3.2	<4.1	<5.0	<6.9	<6.3	<11	<8.1	<8.0	<6.8	0.0
PYRENE	<1.0	<2.0	<2.0	<2.0	<4.0	<3.0	<3.2	<4.1	<5.1	<6.5	<6.5	<10	<8.1	<7.9	<6.9	0.0
BZANTH	<1.0	<2.0	<2.0	<2.0	<7.0	<5.0	<7.0	<9.1	<12	<16	<15	<27	<23	<18	<7.9	0.0
CHRYSE	<12	<10	<2.0	<2.0	<3.0	<2.0	<3.6	<4.7	<6.0	<8.2	<7.8	<13	<9.5	<7.9	<7.4	0.0
BZEPYR	<2.0	<2.0	<2.0	<2.0	<6.0	<5.0	<4.0	<5.2	<6.4	<8.7	<8.2	<14	<12	<9.5	<10	0.0
BZAPYR	<2.0	<2.0	<2.0	<2.0	<6.0	<5.0	<3.7	<4.9	<6.1	<9.0	<8.9	<15	<9.8	<8.6	<9.2	0.0
PERYL	<1.0	<2.0	<2.0	<2.0	<6.0	<5.0	<4.6	<6.0	<7.4	<11	<6.4	<17	<13	<9.8	<9.7	0.0

Table A-4. --Continued.

	MAY 1978	MAY 1978	JUNE 1978	JUNE 1978	AUG 1978	AUG 1978	MAY 1979	AUG 1979	AUG 1980	MEAN
					Olsen Bay					
I-PROBZ	<10	<15	<7.9	<6.9	<9.4	N	<21	<11	<11	0.0
N-PROBZ	<11	<17	<8.5	<7.4	<10	N	<23	<13	<11	0.0
INDAN	<10	<16	<7.5	<6.8	<9.1	N	<23	<12	<12	0.0
TMEBZ	<9.5	<16	<7.1	<6.4	<8.5	N	<22	<12	N	0.0
NAPH	<8.9	<15	<6.6	<6.0	<8.0	N	<21	<11	<10	0.0
BZTHIO	<21	<12	<8.6	<7.9	<10	N	<28	<15	<14	0.0
2-MENAP	<9.2	<17	<6.8	<6.2	<8.2	N	<22	<12	<11	0.0
1-MENAP	<7.8	<14	<5.8	<5.3	<6.9	N	<18	<9.8	<9.3	0.0
BIPHEN	<8.8	<17	<6.5	<6.0	<7.9	N	<21	<11	<10	0.0
2,6-DMN	<8.7	<17	<6.5	<5.9	<7.8	<13	<21	<11	<11	0.0
235-TMN	<9.2	<19	<6.8	<6.2	<8.2	<13	<22	<12	<11	0.0
FLUOREN	<8.6	<18	<6.4	<5.8	<7.7	<13	<22	<11	<10	0.0
DBZ	<16	<37	<12	<11	<15	<24	<26	<14	<11	0.0
PHENAN	<11	<21	<7.3	<7.2	<7.7	<14	<23	<12	<11	0.0
ANTHRA	<9.8	<18	<7.2	<6.7	<8.8	<14	<10	<5.1	<10	0.0
MENPHEN	<9.4	<23	<6.9	<6.3	<8.3	<14	<24	<13	N	0.0
FLANTH	<9.7	<24	<7.1	<6.6	<8.4	<14	<25	<13	<12	0.0
PYRENE	<9.9	<25	<7.3	<6.7	<8.6	<14	<25	<13	<12	0.0
BZANTH	<23	<64	<17	<15	<20	<33	<70	<32	<14	0.0
CHRYSE	<12	<32	<8.6	<8.0	<10	<17	<29	<14	<16	0.0
BZEPYR	<12	<37	<9.1	<8.4	<11	<19	<36	<17	<18	0.0
BZAPYR	<12	<33	<8.7	<8.0	<12	<18	<30	<16	<16	0.0
PERYL	<15	<43	<11	<9.9	<16	<22	<39	<19	<17	0.0

Table A-4.--Continued.

	JUNE 1977	JUNE 1977	MAY 1978	MAY 1978	JUNE 1978	JUNE 1978	AUG 1978	AUG 1978	MAY 1979	AUG 1979	AUG 1980	MEAN
						Rocky Bay						
I-PROBZ	N	N	<7.9	<5.3	<11	<4.7	<11	<12	<9.5	<6.4	<3.6	0.0
N-PROBZ	N	N	<8.8	<5.8	<13	<5.2	<12	<13	<10	<7.0	<3.7	0.0
INDAN	N	N	<8.0	<5.2	<12	<4.6	<11	<12	<10	<6.8	<3.8	0.0
TMEBZ	<2.0	<2.0	<7.5	<4.9	<12	<4.4	<10	<11	<9.8	<6.7	N	0.0
NAPH	9.1	<2.0	<7.0	<4.6	<12	<4.1	<9.6	<11	<9.4	<6.3	<3.4	0.83
BZTHIO	<2.0	26	<9.2	<6.0	<16	<5.4	<13	<14	<13	<8.5	<4.5	2.4
2-MENAP	<2.0	<2.0	<7.3	<4.8	<13	<4.3	<9.9	<11	<9.9	<6.6	<3.5	0.0
1-MENAP	6.1	5.6	<6.1	<4.0	<11	<3.6	<8.3	<9.3	<8.2	<5.5	<3.0	1.1
BIPHEN	<2.0	<2.0	<6.9	<4.6	<13	<4.1	<9.4	<10	<9.4	<6.2	<3.4	0.0
2,6-DMN	<2.0	<2.0	<6.8	<4.5	<13	<4.0	<9.4	<10	<9.4	<6.2	<3.5	0.0
235-TMN	<2.0	<2.0	<7.2	<4.7	<14	<4.3	<9.8	<11	<10	<6.6	<3.6	0.0
FLUOREN	<2.0	<2.0	<6.8	<4.4	<14	<4.0	<9.3	<10	<9.9	<6.3	<3.4	0.0
DBZ	<2.0	<2.0	<13	<8.4	<28	<7.6	N	<20	<12	<7.6	<3.4	0.0
PHENAN	<2.0	<2.0	<6.5	<5.1	<16	<4.9	<9.3	<10	<10	<6.6	<3.5	0.0
ANTHRA	<2.0	<2.0	<7.5	<5.2	<14	<4.6	<11	<12	<4.5	<2.9	<3.3	0.0
MENPHEN	<2.0	<2.0	<7.3	<4.8	<17	<4.3	<9.9	<11	<11	<7.2	N	0.0
FLANTH	<2.0	<2.0	<7.3	<5.0	<18	<4.5	<10	<11	<11	<7.3	<3.9	0.0
PYRENE	<2.0	<2.0	<7.4	<5.1	<19	<4.6	<10	<11	<11	<7.3	<3.9	0.0
BZANTH	<2.0	<2.0	<17	<12	<48	<11	<24	<25	<31	<18	<4.5	0.0
CHRYSE	<2.0	<2.0	<8.8	<6.1	<24	<5.6	<13	<13	<13	<8.0	<5.4	0.0
BZEPYR	<2.0	<2.0	<9.8	<6.5	<28	<5.8	<13	<14	<16	<9.6	<6.0	0.0
BZAPYR	<2.0	<2.0	<11	<6.1	<25	<5.5	<14	<14	<13	<8.7	<5.3	0.0
PERYL	<2.0	<2.0	<7.2	<7.4	<32	<6.8	<19	<16	<17	<11	<5.6	0.0

Table A-4. --Continued.

	JUNE 1977	JUNE 1977	OCT 1977	OCT 1977	MAY 1978	MAY 1978	JUNE 1978	JUNE 1978	AUG 1978	AUG 1978	MAY 1979	AUG 1979	AUG 1980	MEAN
							Siwash Bay							
I-PROBZ	N	N	<3.0	N	<7.3	<7.6	<5.2	<7.9	<9.4	<13	<13	<5.5	<3.8	0.0
N-PROBZ	N	N	<4.0	N	<7.9	<8.2	<5.7	<8.6	<10	<14	<14	<6.1	<3.9	0.0
INDAN	N	N	<4.0	N	<6.9	<7.2	<5.1	<7.7	<9.1	<13	<14	<5.9	<4.0	0.0
TMEBZ	<2.0	<2.0	<4.0	N	<6.5	<6.8	<4.8	<7.4	<8.5	<12	<14	<5.8	N	0.0
NAPH	23	<2.0	<3.0	<4.0	<9.8	<6.4	<4.5	<6.9	<8.0	<11	<13	<5.4	<3.7	1.8
BZTHIO	<2.0	<2.0	<4.0	<5.0	<7.9	<8.3	<5.9	<9.0	<10	<15	<17	<7.2	<4.9	0.0
2-MENAP	<2.0	<2.0	<3.0	<4.0	<6.3	<6.6	<4.7	<7.1	<8.3	<12	<14	<5.6	<3.8	0.0
1-MENAP	<2.0	<2.0	<3.0	<3.0	<5.3	<5.6	<4.0	<6.0	<6.9	<10	<11	<4.7	<3.2	0.0
BIPHEN	<2.0	<2.0	<3.0	<4.0	<6.0	<6.3	<4.5	<6.8	<7.9	<11	<13	<5.3	<3.7	0.0
2,6-DMN	<2.0	<2.0	<3.0	<4.0	<6.0	<6.2	<4.4	<6.7	<7.8	<11	<13	<5.3	<3.7	0.0
235-TMN	<2.0	<2.0	<3.0	<4.0	<6.3	<6.6	<4.7	<7.1	<8.2	<12	<14	<5.6	<3.8	0.0
FLUOREN	<2.0	<2.0	<3.0	<4.0	<5.9	<6.2	<4.4	<6.6	<7.7	<11	<14	<5.3	<3.6	0.0
DBZ	<2.0	<2.0	<6.0	<7.0	<11	<12	<8.3	<13	<15	<21	<16	<6.3	<3.7	0.0
PHENAN	<2.0	<2.0	<3.0	<4.0	<6.7	<7.0	<5.4	<8.2	<7.8	<13	<14	<5.4	<3.8	0.0
ANTHRA	<2.0	<2.0	<4.0	<4.0	<6.6	<6.9	<5.0	<7.6	<8.8	<12	<6.2	<2.5	<3.5	0.0
MENPHEN	<2.0	<2.0	<4.0	<4.0	<6.3	<6.6	<4.8	<7.2	<8.3	<12	<15	<6.0	N	0.0
FLANTH	<2.0	<2.0	<4.0	<3.0	<6.3	<6.6	<4.9	<7.5	<8.5	<12	<15	<5.9	<4.2	0.0
PYRENE	<2.0	<2.0	<5.0	<5.0	<6.4	<6.7	<5.0	<7.6	<8.6	<13	<15	<5.8	<4.2	0.0
BZANTH	<2.0	<2.0	<10	<9.0	<14	<15	<12	<18	<20	<30	<43	<13	<4.8	0.0
CHRYSE	<2.0	<2.0	<4.0	<4.0	<7.3	<7.6	<6.0	<9.2	<10	<15	<18	<5.8	<5.7	0.0
BZEPYR	<2.0	<2.0	<7.0	<9.0	<8.0	<8.3	<6.4	<9.6	<11	<16	<22	<7.0	<6.4	0.0
BZAPYR	<2.0	<2.0	<8.0	<9.0	<7.5	<7.8	<6.0	<9.2	<12	<16	<18	<6.3	<5.6	0.0
PERYL	<2.0	<2.0	<8.0	<9.0	<9.2	<9.6	<7.4	<11	<16	<19	<24	<7.2	<6.0	0.0

Table A-5. Table of sediment grain-size distribution for sediment samples.

Sampling period	(PHI) Sediment grain size as fraction percent							
	<-2	-2 to +0	+0 to +2	+2 to +4	+4 to +8	>+8	Mean	Sand/Mud
				Bligh Island				
May 1977	12 3.4	2.4 1.5	6.7 6.9	73 82	4.7 4.8	1.5 1.6	2.5 3.0	15 15
Jun 1977	0.0 2.7	0.89 0.93	3.8 5.5	87 86	5.9 3.5	1.7 1.4	3.1 3.1	12 19
Oct 1977	5.6 0.35	2.2 1.8	4.0 4.5	81 86	5.8 5.5	1.9 1.8	3.0 3.1	12 13
May 1978	10 20	2.0 1.3	1.8 1.7	80 72	4.8 3.9	1.5 1.9	3.0 1.2	15 16
Jun 1978	0.79 1.7	2.5 1.1	5.9 3.7	87 85	2.4 6.7	1.7 1.6	3.0 3.0	23 11
				Constantine Harbor				
May 1977	13 0.0	1.3 0.34	3.5 5.2	54 66	21 21	7.6 7.7	3.2 3.5	2.5 2.5
Jun 1977	1.9 2.3	0.82 0.71	2.6 3.1	64 55	21 29	9.8 10	3.7 3.9	2.3 1.6
May 1978	N N	0.55 0.95	2.0 2.4	67 65	22 22	8.4 9.8	3.6 3.6	2.3 2.2
Jun 1978	2.7 0.77	0.81 0.76	2.4 2.1	63 60	21 26	9.9 11	3.6 3.9	2.2 1.7
				Dayville Flats				
May 1977	0.0 0.64	0.46 2.3	3.5 7.3	24 33	56 40	17 17	5.5 5.1	0.38 0.77
Jun 1977	0.32 0.0	0.21 1.0	1.6 2.9	13 28	67 52	18 17	6.0 5.4	0.18 0.47
Oct 1977	0.0 2.0	0.78 0.47	2.4 1.8	16 19	61 60	19 17	6.0 5.7	0.24 0.30
May 1978	N N	0.38 0.63	3.9 3.0	23 23	58 57	15 16	5.5 5.5	0.37 0.37
Jun 1978	N N	0.46 0.27	2.4 2.0	24 22	59 60	14 16	5.4 5.5	0.36 0.33

Table A-5 .--Continued.

Sampling period	(PHI) Sediment grain size as fraction percent							
	<-2	-2 to +0	+0 to +2	+2 to +4	+4 to +8	>+8	Mean	Sand/Mud
Mineral Flats								
Jun 1978	12	10	25	27	23	4.2	2.0	2.2
	0.44	11	25	33	25	6.3	2.8	2.7
Naked Island								
May 1977	2.8	10	15	62	7.8	2.4	2.2	8.8
	3.9	16	16	54	8.2	2.6	1.9	8.3
Jun 1977	10	18	15	46	8.2	2.3	1.6	8.5
	17	16	12	47	6.5	2.2	1.0	10
Oct 1977	26	15	16	36	5.1	2.6	0.40	12
	21	20	15	37	6.0	1.0	0.61	13
May 1978	7.0	18	24	43	6.0	1.8	1.5	12
	7.4	18	25	40	7.1	2.1	1.5	10
Jun 1978	6.0	17	22	44	8.5	2.0	1.6	8.5
	12	14	22	46	4.8	2.2	1.4	13
Olsen Bay								
May 1978	N	1.7	14	50	27	7.6	3.5	1.9
	N	1.6	17	50	24	7.2	3.3	2.2
Jun 1978	N	1.6	12	51	27	8.2	3.5	1.9
	N	2.5	15	52	25	6.1	3.3	2.3

Table A-5 .--Continued.

Sampling period	(PHI) Sediment grain size as fraction percent							
	<-2	-2 to +0	+0 to +2	+2 to +4	+4 to +8	>+8	Mean	Sand/Mud
				Rocky Bay				
Jun 1977	0.0	0.01	3.2	94	1.6	1.5	2.8	31
	0.0	0.0	4.5	93	1.0	1.4	2.7	41
May 1978	N	0.09	6.1	90	3.0	0.76	2.8	26
	N	0.40	4.2	91	3.9	0.97	3.0	20
Jun 1978	0.29	0.18	4.2	92	1.8	1.2	2.9	33
	N	0.27	4.6	92	2.1	1.2	2.8	30
				Siwash Bay				
Jun 1977	0.0	0.60	1.8	9.8	80	7.7	5.2	0.14
	1.7	0.19	1.6	6.8	80	10	5.2	0.12
Oct 1977	0.57	0.59	6.0	31	55	6.7	4.2	0.61
	0.96	3.3	5.2	30	54	6.0	4.1	0.66
May 1978	N	0.42	1.8	27	65	6.3	4.5	0.41
	N	0.90	1.8	20	69	8.4	4.7	0.30
Jun 1978	N	0.68	1.4	19	70	8.5	4.9	0.27
	N	0.13	1.1	20	69	9.3	4.9	0.27

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