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Survey of Subsistence Fish and Shellfish for Exposure to Oil Spilled from the *Exxon Valdez*

First Year: 1989

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U.S. DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
National Marine Fisheries Service

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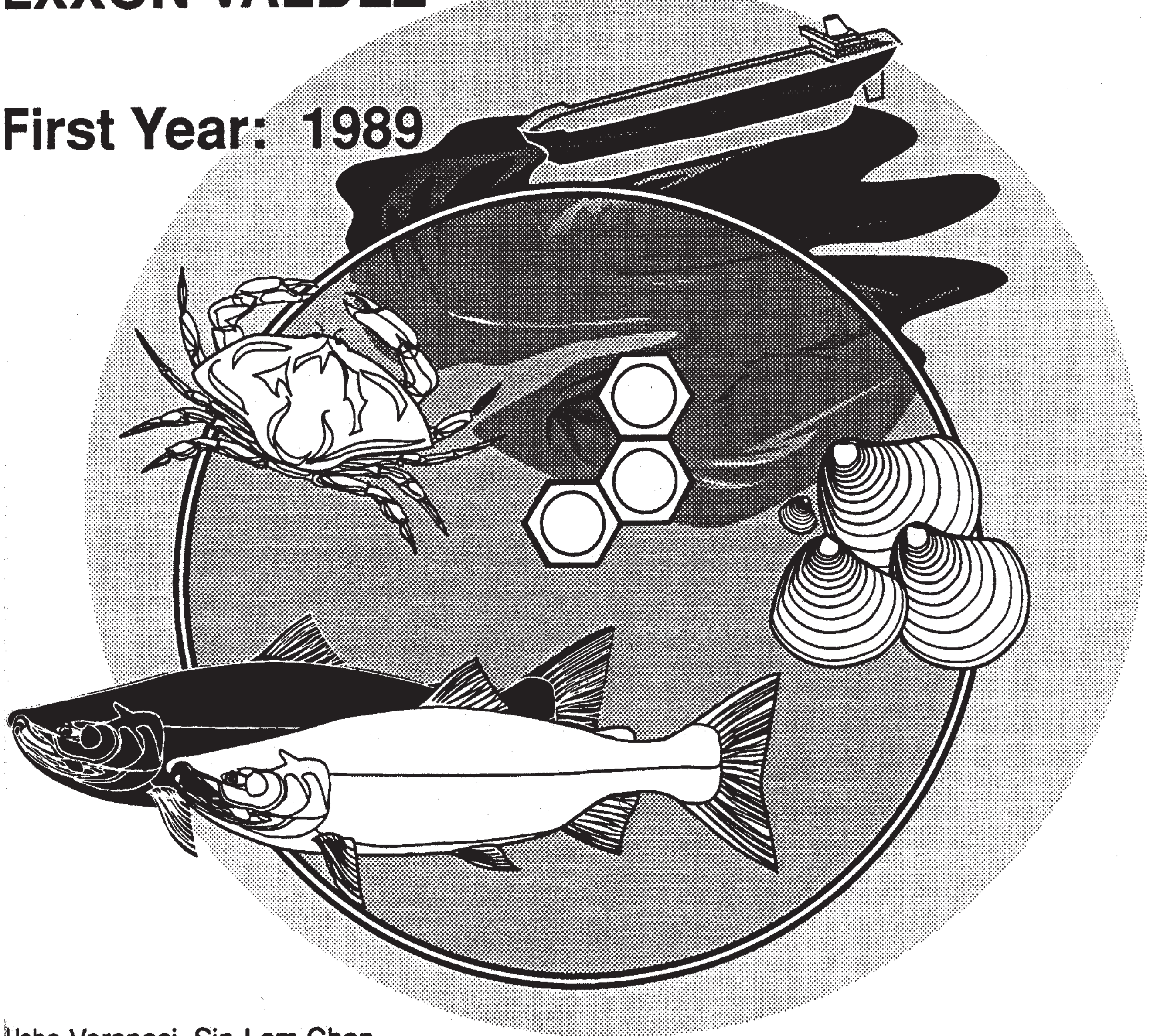

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ABSTRACT

More than 500 fish and shellfish samples collected from native Alaskan fishing grounds were analyzed for aromatic contaminants (ACs) from petroleum (alkylated and unsubstituted aromatic hydrocarbons with 2-7 benzenoid rings and dibenzothiophenes). Intertidal molluscs (mussels, clams, chitons, and snails) from Windy Bay, Kodiak (City), Chenega Bay, and Old Harbor consistently had more than 100 parts-per-billion (ppb) ACs, with levels in mussels from Windy Bay and Kodiak as high as 12,000 to 18,000 ppb. Levels of ACs in molluscs, crabs, and sea urchins from other villages were less than 10 ppb, a level comparable to that measured in shellfish from the designated reference area in Southeast Alaska near Angoon. Nonparametric statistics on 147 samples of molluscs showed that levels of ACs in molluscs from Windy Bay, Kodiak, and Chenega Bay were significantly higher ($p \le 0.05$) than those in the Angoon molluscs sampled.

Of the 210 samples of edible flesh of fish analyzed in 1989, only two samples of pink salmon *(Onchorhynchus gorbuscha)* from Kodiak had AC levels that neared or exceeded 100 ppb. Another 11 samples of pink and coho salmon (*O. kisutch)* from Kodiak, Chenega Bay, Tatitlek, and Larsen Bay exceeded 10 ppb of total, ACs. The levels in the edible flesh of salmon from other subsistence fishing areas and in bottomfish from all areas were generally comparable (less than 10 ppb) to the levels detected in the same or related species from the reference site, near Angoon. Two samples of smoked salmon, one from Old Harbor and one from Tatitlek, contained 8,200 and 22,000 ppb of ACs, respectively.

In an unofficial advisory opinion, the Food and Drug Administration has indicated that little risk is involved in the consumption of the non-smoked subsistence foods studied. The results to date provide important information on the level of contamination of subsistence fish and shellfish from fishing areas of native Alaskan villages in and near Prince William Sound and a reference database against which future temporal changes of petroleum derived ACs in the edible flesh of fish and shellfish can be evaluated.

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PREFACE

The Environmental Conservation (EC) Division of the Northwest Fisheries Center conducts investigations on the fate and effects of organic contaminants in the marine environment. Because we usually are dealing with trace levels of toxic chemicals, and because the chemical makeup of marine environments can be extremely complex, we need sensitive, reliable analytical methods to produce data with an appropriate level of confidence. Our analytical chemistry facility for trace organics was originally established in the mid-1970s to provide NOAA with advanced analytical capabilities that were not otherwise readily available. This resulted in the development of state-of-the-art analytical techniques to measure trace organics and their metabolites. Much of the analytical methodology needed for NOAA's environmental projects was developed over the past decade by the Division's researchers, with funding support coming from not only the National Marine Fisheries Service but also other NOAA elements such as the Outer Continental Shelf Environmental Assessment Program and the Marine Ecosystems Analysis Program.

During the last decade, the EC Division conducted thousands of sophisticated analyses of marine samples for trace levels of petroleum hydrocarbons and other organic chemical contaminants. Early success in studies conducted in Puget Sound and in the New York Bight laid the foundations for the Division's present prominent role in NOAA's longterm National Status and Trends Program in analyzing sediments and benthic fish from U.S. coastal waters for organic contaminants. At the same time, we have conducted interlaboratory comparisons for analyses of marine samples. Until 1980, comparisons of analytical results among experienced laboratories differed by as much as tenfold. We were asked to investigate ways to improve the intercomparability among such laboratories. Over the years, precision among experienced laboratories improved substantially to a range of 14-81% relative standard deviation. Moreover, in response to the need to analyze large numbers of environmental samples with greater speed, we replaced two lengthy manual cleanup procedures with a single high performance liquid chromatography, cutting cleanup time by 75% and solvent consumption by 50%. Division scientists also developed a method to test for petroleum exposure by rapidly screening fish bile for metabolites of aromatic compounds. These coordinated efforts have placed the EC Division in an excellent position to provide timely and quality analyses on subsistence samples related to the oil spilled from the *Exxon Valdez* in Prince William Sound.

INTRODUCTION

The spreading of oil spilled from the *Exxon Valdez* on 24 March 1989 raised concerns among native Alaskans that their subsistence seafood could have been contaminated by petroleum hydrocarbons. In response, NOAA entered into memorandum of understanding (MOU) with Exxon to analyze subsistence fish and shellfish from native Alaskan villages for aromatic contaminants (ACs) found spilled in oil. The ACs consist of the aromatic hydrocarbons and dibenzo-iophenes listed in Table 1. This report discusses the levels of these chemicals found in fish and shellfish collected in July, August, and September 1989 (Cycles II, and 1111, respectively). Statistical interpretations are included. The subsistence fishing grounds sampled in this study appear in Figure 1.

Previous laboratory studies have shown that fish efficiently biotransform aromatic hydrocarbons to derivatives (metabolites) that are concentrated in bile for excretion (Statham et al. 1976, Varanasi and Gmur 1981, Stein et al. 1984, Varanasi et al. 1989a). This means that aromatic hydrocarbons may not readily cumulate in the edible flesh of fish. Thus, to monitor the exposure of fish to ACs, we developed a rapid, sensitive method to screen fish bile for presence of metabolites characteristic of petroleum ACs. This procedure utilizes high performance liquid chromatography (HPLQ with fluorescence detection (Krahn et al. 1984, 1986a). It has been employed previously in an oil spill on the Columbia River (Krahn et al. 1986b) to determine exposure of fish to ACs from petroleum.

The more specific analyses for individual ACs in tissues, which involve combined gas chromatography/mass spectrometry (GC/MS), are more costly than the screening of bile for ACs and their metabolites. Nevertheless, recent important improvements and automation of the extract cleanup procedure enable us now to provide high quality analytical data for AC levels in the edible flesh of fish and shellfish more quickly than before and with less labor (Krahn et al. 1988). These methods can also be used to detect sulfur-containing ACs, such as the dibenzothiophenes.

Statistical differences of AC levels in edible flesh or bile among sites were assessed using both parametric and nonparametric tests.

Table 1. Aromatic contaminants (ACs: aromatic hydrocarbons and dibenzothiophenes) determined in edible tissue in the Exxon/NOAA Subsistence Fish and Shellfish Study. Lower molecular weight ACs = LACs; higher molecular weight ACs = HACs.

2- to 3-Ring Aromatic Compounds (LACs)	4- to 7-Ring Aromatic Compounds (HACs)
naphthalene (NPH)	fluoranthene
C1-naphthalenes	pyrene
C2-naphthalenes	C1-fluoranthenes/pyrenes
C3-naphthalenes	benz[a]anthracene
C4-naphthalenes	chrysene
acenaphthylene	C1-chrysenes/benz[a]anthracenes
acenaphthene	C2-chrysenes/benz[a]anthracenes
fluorene	C3-chrysenes/benz[a]anthracenes
C1-fluorenes	C4-chrysenes/benz[a]anthracenes
C2-fluorenes	benzo[b]fluoranthene
C3-fluorenes	benzo[k]fluoranthene
phenanthrene (PHN)	benzo[a]pyrene
C1-phenanthrenes/anthracenes	indeno[1,2,3-cd]pyrene
C2-phenanthrenes/anthracenes	dibenz[a,h]anthracene
C3-phenanthrenes/anthracenes	benzo[ghi]perylene
C4-phenanthrenes/anthracenes	
dibenzothiophene	
C1-dibenzothiophenes	
C2-dibenzothiophenes	
C3-dibenzothiophenes	

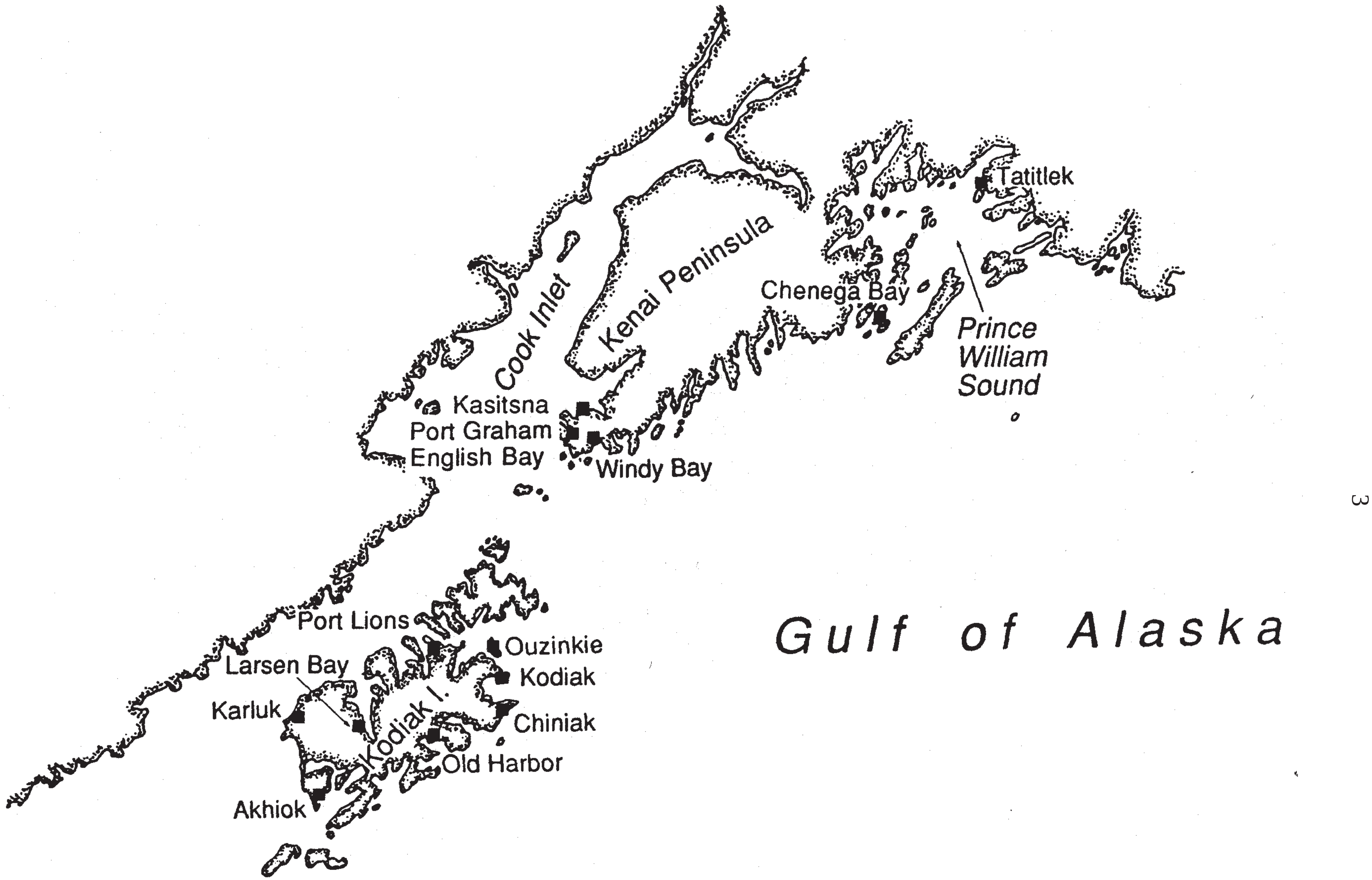

Figure 1. Native Alaskan fishing sites.

EXPERIMENTAL METHODS

Details of protocols for the field sampling, chemical analyses, and statistical evaluation are outlined below. These protocols have also been briefly described in the periodic reports (Varanasi et al. 1989b-e) issued throughout the study.

Field Sample Collection

Under contract with Exxon, Dames and Moore biologists collected samples of fish (Table 2) and shellfish (Table 3) from subsistence fishing areas near native Alaskan villages (Fig. 1). Generally, at least two sites were sampled per village with assistance of NOAA or State of Alaska field biologists. Bile samples from these fish were usually screened for metabolites of ACs (see below) to indicate the priority by which samples of edible fish flesh should be subjected to a more detailed analysis; however, Cycle I sampling was completed before this- protocol could be fully implemented. Otherwise, samples of bile and flesh were chilled in the field, frozen before shipment, and stored frozen in the laboratory until analyzed. Shellfish samples were composites of whole individual animals, while fish were sampled as individuals for shipment.

Bile Analyses

Fish bile samples were analyzed for fluorescent ACs (FACs) by the metho of Krahn et al. (1986a) outlined below. Bile collected from the fish was stored at, the laboratory at -80°C until analyzed.

Fluorescent Aromatic Contaminant Determinations

The FACs in bile were analyzed on a Waters[1] high performance liquid chromatograph equipped with a Perkin-Elmer HC-ODS/ PAH column (0.26 X 25 cm.), an automatic injector, and Perkin-Elmer model 40 fluorescence detecto connected in series.

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[1] Reference to trade name does not imply endorsement by the National Marine Fisheries Service NOAA.

Table 2. Fish: Species sampling log for subsistence studies, cycles I - III, 1989.

		Species											
Village, Sampling site	Code	Pink salmon	Coho salmon	Sockeye salmon	Chum salmon	Chinook salmon	Dolly Varden	Smoked salmon	Halibut	Yellowfin sole	Pacific cod	Rockfish	Irish lord
Windy Bay 1	WNB 1												
Windy Bay 2	WNB 2												
Kodiak (city) 1	KOD 1											2	
Kodiak (city) 2	KOD 2								2				
Kodiak (city) 3	KOD 3												
Kodiak (city) 4	KOD 4												
Kodiak (city) 5	KOD 5	16		1			2						
Kodiak (city) 6	KOD 6								3				
Chenega Bay 1	CHE 1												
Chenega Bay 2	CHE 2								9		6	4	
Chenega Bay 3	CHE 3	8											
Chenega Bay 4	CHE 4	18											
Old Harbor 1	OHA 1								5		2		
Old Harbor 2	OHA 2	25					1				1		
Old Harbor 3	OHA 3												
Old Harbor 4	OHA 4												
Old Harbor (smo. salm.)	OHASS							1					
Tatitlek 1	TAT 1												
Tatitlek 2	TAT 2	3											
Tatitlek 3	TAT 3	6										1	
Tatitlek 4	TAT 4								2		2	1	
Tatitlek 5	TAT 5												
Tatitlek 6	TAT 6								2				
Tatitlek 7	TAT 7		18										
Tatitlek (smo. salm.)	TATSS							1					
Larsen Bay 1	LAB 1												
Larsen Bay 2	LAB 2												
Larsen Bay 3	LAB 3												
Larsen Bay 4	LAB 4												
Larsen Bay 5	LAB 5								1				
Larsen Bay 6	LAB 6	3		14	1				4		3		
Larsen Bay 7	LAB 7	2											
Larsen Bay 8	LAB 8	15							4				

Table 2 (continued). Fish: Species sampling log for subsistence studies, cycles I - III, 1989.

		Species											
Village, Sampling site	Code	Pink salmon	Coho salmon	Sockeye salmon	Chum salmon	Chinook salmon	Dolly Varden	Smoked salmon	Halibut	Yellowfin sole	Pacific cod	Rockfish	Irish lord
Ouzinkie 1	OUZ 1	2							2				
Ouzinkie 2	OUZ 2												
Ouzinkie 3	OUZ 3								8				
Ouzinkie 4	OUZ 4												
Ouzinkie 5	OUZ 5	20											
Ouzinkie 6	OUZ 6		16										
Chiniak 1	CHI 1												
Chiniak 2	CHI 2												
Chiniak 3	CHI 3												
Chiniak 4	CHI 4											2	
Chiniak 5	CHI 5	12		1	6								
Chiniak 6	CHI 6								3				
Chiniak 7	CHI 7	12			2								
Akhiok 1	AKH 1			2									
Akhiok 2	AKH 2												
Akhiok 3	AKH 3												
Akhiok 4	AKH 4	4	3										
Port Lions 1	PTL 1												
Port Lions 2	PTL 2												
Port Lions 3	PTL 3	3	13						3				
Port Lions 4	PTL 4												
Port Lions 5	PTL 5												
Port Lions 6	PTL 6								2	1			
Port Lions 7	PTL 7	18											
Port Lions 8	PTL 8								4				
Port Gra./Eng. Bay 1	PTG 1												
Port Gra./Eng. Bay 2	PTG 2								1				2
Port Gra./Eng. Bay 3	PTG 3	13	4										
Port Gra./Eng. Bay 4	PTG 4												
Port Gra./Eng. Bay 5	PTG 5								1				
Karluk 1	KAR I	2	5	4			2						
Karluk 2	KAR 2												
Kasitsna 1	KAS 1												
Angoon 1	AGN 1												
Angoon 2	AGN 2												
Angoon 3	AGN 3	6	8			3			3		2		

Table 3. Shellfish: Species sampling log for subsistence studies, cycles I - III, 1989.

Village Sampling site	Code	Species: Mussels	Butter clams	Horse clams	Littleneck clams	Cockles	Chitons	Snails	Limpets	Urchins	Dungeness crab	Tanner crab	King crab
Windy Bay 1	WNB 1	3					2	1					
Windy Bay 2	WNB 2				1								
Kodiak City 1	KOD 1												
Kodiak City 2	KOD 2												
Kodiak City 3	KOD 3	1	1		2		2						
Kodiak City 4	KOD 4										1		
Kodiak City 5	KOD 5										1		
Kodiak City 6	KOD 6												
Chenega Bay 1	CHE 1	6	2										
Chenega Bay 2	CHE 2												
Chenega Bay 3	CHE 3												
Chenega Bay 4	CHE 4												
Old Harbor 1	OHA 1												
Old Harbor 2	OHA 2											2	
Old Harbor 3	OHA 3	1	5		1		3			1			
Old Harbor 4	OHA 4		5		1								
Tatitlek 1	TAT 1	3											
Tatitlek 2	TAT 2												
Tatitlek 3	TAT 3												
Tatitlek 4	TAT 4												
Tatitlek 5	TAT 5	6					2						
Tatitlek 6	TAT 6												
Tatitlek 7	TAT 7												
Larsen Bay 1	LAB 1	1	3				2		1				
Larsen Bay 2	LAB 2		4				1						
Larsen Bay 3	LAB 3									1			
Larsen Bay 4	LAB 4							1			1	2	1
Larsen Bay 5	LAB 5												
Larsen Bay 6	LAB 6												
Larsen Bay 7	LAB 7												
Larsen Bay 8	LAB 8												

Table 3 (continued). Shellfish: Species sampling log for subsistence studies, cycles I - III, 1989.

Village Sampling site	Code	*Species*											
		Mussels	Butter clams	Horse clams	Littleneck clams	Cockles	Chitons	Snails	Limpets	Urchins	Dungeness crab	Tanner crab	King crab
Ouzinkie 1	OUZ 1												
Ouzinkie 2	OUZ 2	1	2		2		2						
Ouzinkie 3	OUZ 3		1										
Ouzinkie 4	OUZ 4		1										
Ouzinkie 5	OUZ 5												
Ouzinkie 6	OUZ 6												
Chiniak 1	CHI 1	1	3		2								
Chiniak 2	CHI 2	1	4		1	2	5	1					
Chiniak 3	CHI 3										1		
Chiniak 4	CHI 4												
Chiniak 5	CHI 5												
Chiniak 6	CHI 6												
Chiniak 7	CHI 7												
Akhiok 1	AKH 1												
Akhiok 2	AKH 2	1	3				1						
Akhiok 3	AKH 3	1			1								
Akhiok 4	AKH 4												
Port Lions 1	PTL 1		5		2		3	1					
Port Lions 2	PTL 2		2				2	1					
Port Lions 3	PTL 3												
Port Lions 4	PTL 4											3	1
Port Lions 5	PTL 5										1		
Port Lions 6	PTL 6												
Port Lions 7	PTL 7												
Port Lions 8	PTL 8												
Port Gra./Eng. Bay 1	PTG 1	7			1	1	3						
Port Gra./Eng. Bay 2	PTG 2												
Port Gra./Eng. Bay 3	PTG 3												
Port Gra./Eng. Bay 4	PTG 4	4						1					
Port Gra./Eng. Bay 5	PTG 5												
Karluk 1	KAR I	1					1						
Karluk 2	KAR 2	3	1				1						
Kasitsna 1	KAS 1	2	1				1						
Angoon 1	AGN 1	2					2						
Angoon 2	AGN 2		1	1									
Angoon 3	AGN 3												

Thawed bile was injected directly into the HPLC and eluted through the column using a linear gradient from 100% solvent A (water containing 5 ppm acetic acid) to 100% solvent B (pure methanol) during 15 minutes. The flow rate was 1.0 mL/min and the column temperature was 50°C. All solvents were degassed with helium.

The fluorescence responses were recorded at the wavelength pairs for NPH and PHN, prominent aromatic constituents of Prudhoe Bay crude oil (see Table 1). Fluorescence of NPH metabolites was monitored using excitation and emission wavelength pairs of 290 and 335 mn, respectively. Fluorescence of PHN metabolites was monitored using excitation and emission wavelength pairs of 260 and 380 nm, respectively.

The total integrated area from each detector was then converted to corresponding units of either NPH or PHN that would give the same integrated response. Results for FACs in bile are reported on the basis of bile volume and biliary protein (Fig. 2). The levels of protein in bile (Table 4) were determined by the method of Lowry et al. (1951) that measures the complex formed with phenol at 660 nm.

Quality Assurance

Quality assurance procedures included use of NPH and PHN calibration standards, a "bile pool" reference material, blank analyses, and replicate analyses to evaluate HPLC/UV fluorescence performance.

Edible Flesh Analyses

Our laboratory procedures for the analysis of toxic organic contaminants (Krahn et al. 1988a, MacLeod et al. 1985) follow protocols established by the EC Division. A total of 365 analyses of edible flesh of fish and shellfish were performed for the ACs listed in Table 1. Summaries of the analytical protocols are giv en below (for further details, please consult the original publications). These protocols consist of four ma or steps: a) extraction; b) cleanup (by HPLC); c) analyte determination (by GC/MS); and d) quality assurance.

The results of the bile analyses were used to prioritize and composite fish samples whose edible flesh was to be analyzed by the more quantitative and costly GC/MS technique. Edible flesh samples from the same fish species were analyzed as individual samples or as composites according to the levels of FACs in bile. Thus, for a given species at a given site, flesh from fish showing relatively high levels of bile FACs was analyzed either from individuals or composites of individuals with similarly high FACs levels. Samples of flesh from fish with relatively low levels of bile FACs were generally analyzed as composites.

Extraction of Aromatic Contaminants

Samples of edible flesh of fish or shellfish were extracted for ACs according to the procedures of Krahn et al. (1988a). A 3-g sample of flesh is added to a centrifuge tube containing sodium sulfate and methylene chloride. The method internal standards (surrogates) for the ACs are added, and the mixture is macerated with a Tekmar Tissurnizer. The extract is filtered through a column of silica and alumina, and the extract concentrated to 1 mL for cleanup by HPLC.

Cleanup of Aromatic Contaminants

The ACs were isolated on a high performance liquid chromatograph. A Spectra-Physics (Mountain View, CA) model 8800 HPLC was employed, equipped with an ultraviolet detector (254 nm) and an automatic injector. Two 22.5 x 250-mm stainless-steel (preparatory size) columns containing Phenogel 100-A size-exclusion packing (Phenomenex, Rancho Palos Verdes, CA) were used in series with a 2-µM Rheodyne model 7302 filter and a 7.8 x 50-mm. guard column containing the same Phenogel packing. The HPLC precolumn and column were connected to a six-port valve that allows the guard column to be backflushed to remove extraneous materials after cleanup of a set of samples

(n ~ 10).

Methylene chloride was used as the solvent and was pumped at a flow rate of 7 mL/min for 20 minutes at ambient temperature. The HPLC solvent was degassed by bubbling helium through the solvent. The helium was delivered via a regulator equipped with a stainless-steel diaphragm and passed through an in-line charcoal filter (200-cc hydrocarbon trap, Alltech Assoc., Deerfield, IL) to eliminate inadvertent contaminants which could be transferred to the HPLC solvent by the helium.

A 250-µL portion of a 1-mL extract was injected onto the HPLC column and the fraction containing the ACs was collected according to Krahn et al. (1988a). The solvent in the HPLC fraction was exchanged into hexane as the volume was reduced by evaporation to approximately 1 mL. Standards were then added for analysis by capillary column gas chromatography with mass spectrometric quantitation.

Aromatic Contaminant Determinations by GC/MS

The ACs were determined according to MacLeod et al. (1985) by GC/MS quantitation as outlined by Burrows et al. (1990). A 30-m x 0.25-mm DB-5 capilliary column (J & W Scientific) was used in a Hewlett-Packard model 5880 or 5890 gas chromatograph. The GC sample (3 µL) was injected splitless, and the split valve was opened after 18 seconds (split ratio of 20:1). The oven temperature of 50°C was held for 1 minute and then programmed to increase at 4°C/min to 170°C, then at 1°C/min to 210°C, and finally at 4°C/min. to 300°C, where the temperature was held for 10 minutes.

Quality Assurance

Quality assurance measures included analyses of method blanks, spiked blanks, and matrix spikes. Analyte recoveries were normalized through the use of internal standards. The recoveries of the following surrogates are reported as QA information: Naphthalene-d8, acenaphthene-d10, and benzo[*a*]pyrene-dl2. Analyte concentrations are reported on the basis of the internal standards (“surrogates”) added at the beginning of the sample extraction. The HPLC internal standard (used to determine the fraction of total sample extract that was used in the analysis for aromatic hydrocarbons) was phenanthrene-dl0. Hexamethylbenzene was used as the GC internal standard to calculate the recoveries of the surrogates. The recovery for each surrogate standard was greater than 50%, but less than 130%, and the relative standard deviations (RSDs) for surrogate recoveries in a set of samples was less than 25%. When the recovery of any surrogate was outside these guidelines, corrective action was taken, including instrument repair, inlet cleaning, column replacement, and/or reanalysis.

The GC calibration standards generally included all surrogates and analytes of interest, except for some classes of alkylated aromatic hydrocarbons and dibenzothiophenes the corresponding unsubstituted compound was used to calculate the response factor. Graduated concentrations of GC-calibration-check standards were used for multilevel response-factor determinations. A GC calibration standard was analyzed after every six samples to demonstrate the stability of the calibration. The GC/MS was considered “under control” when the response for each analyte or surrogate in a GC calibration standard was reproducible within ± 10% from analysis to analysis.

The detection limits generally were less than 1 ng/g (wet weight basis). A hyphen (-) is used in the data tables to indicate that the analyte was not detected. The range of detection limits is included in the explanatory notes for each appendix.

One method blank was analyzed with each sample set of approximately 10 samples. The aromatic hydrocarbons (except naphthalene) and dibenzothiophenes in the blanks should not be present above the limit of detection. A matrix spike (containing 50-80 ng/g of each analyte) or a spiked blank (containing 40-70 ng/g of each analyte) was analyzed with each set of approximately 10 samples. The recoveries of analytes should be no less than 50%.

Statistical Methods

The Kruskal-Wallis test nonparametric analysis of variance (Sokal and Rohlf 1981, Zar 1984) was used to test for differences among villages (sites). If the null hypothesis of no difference among villages (sites) was rejected at a = 0.05, other nonparametric methods were used, specifically, to a) compare control results to other groups and b) ascertain differences among groups by multiple comparisons (Dunn 1964, Hollander and Wolfe 1973, and Zar 1984). The significance level was set at a = 0.05.

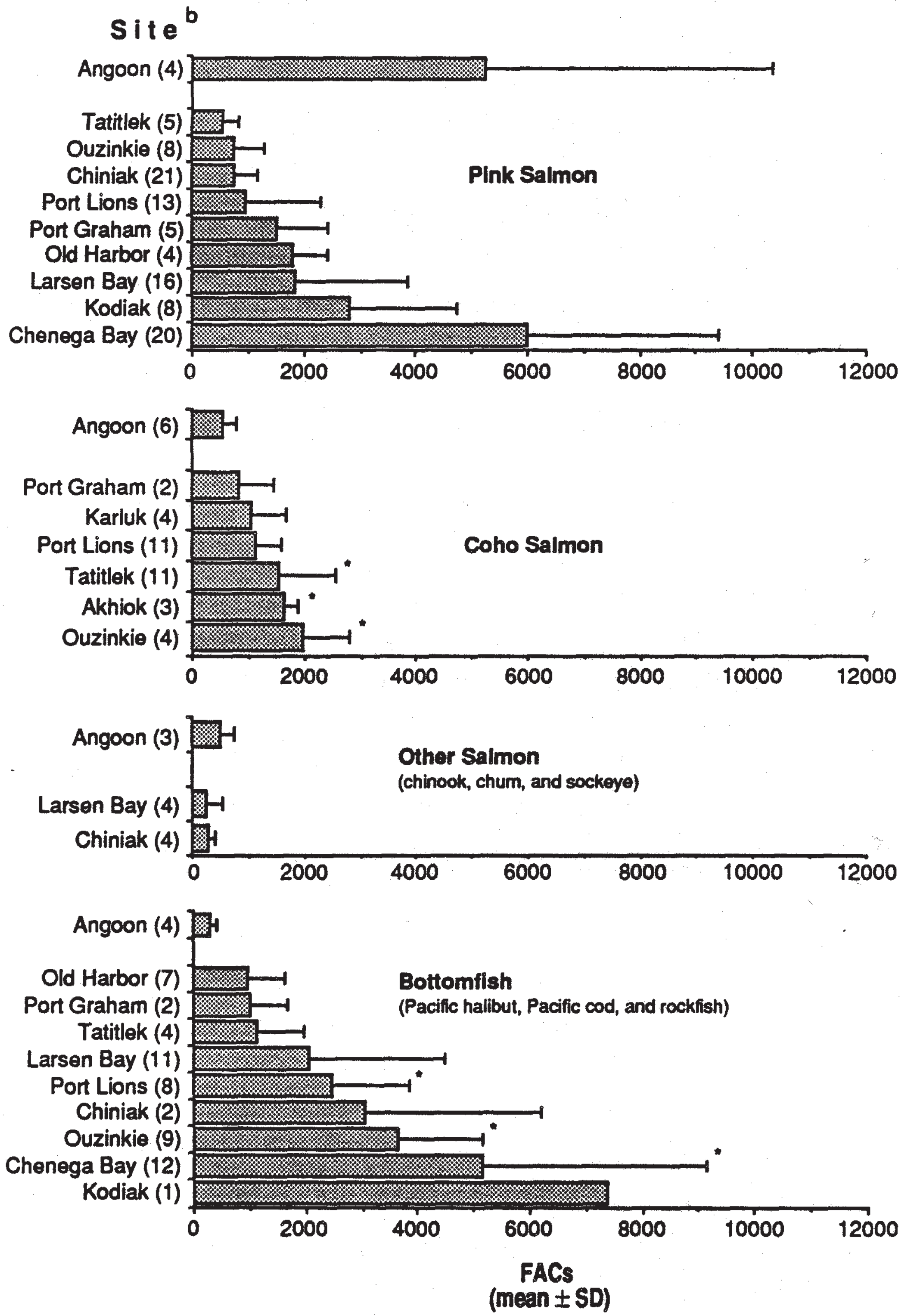
Because in many cases the sample sizes for individual species were too small (especially at Angoon) to permit strong statistical conclusions to be drawn, samples were grouped by taxonomic affiliation and habitat (viz., beach, midwater, or benthic) for purposes of statistical analyses. For example, it was necessary to combine data for all intertidal molluscs at each village to obtain a sample size suitable for statistical analyses. Combining species or taxa with similar biology and habitat also permitted inclusion of villages that would otherwise have been omitted from the comparisons because only one sample was available for a particular species or group.

RESULTS AND DISCUSSION

Fluorescent Aromatic Contaminants in Bile of Fish

Our laboratory studies (Varanasi and Gmur 1981, Stein et al. 1984, Varanasi et al. 1989a) with benthic fish exposed to naphthalene and benzo[*a*]pyrene (BaP) have shown that levels of metabolites of these ACs in bile can be substantially greater than those in edible flesh. Thus, even though the values for FACs in bile of field sampled fish may indicate exposure of fish to petroleum, the levels of aromatic hydrocarbons from petroleum in edible flesh of fish, if detectable, could remain low. The utility of the bile method is in quickly identifying those fish that are relatively unexposed to ACs and therefore of less immediate interest.

The results of the HPLC fluorescence analyses for FACs in bile, at the PHN wavelengths, are summarized in Figure 2 and Table 4. Presentation of results at NPH wavelengths is not necessary because of the strong statistical correlation between $FACs_{PHN}$ and $FACs_{NPH}$ ($r = 0.93$, P: ≤ 0.0001). In Figure 2 the concentrations of $FACs_{PHN}$ are reported on the basis of bile protein. Previous laboratory studies (Collier and Varanasi 1987) have shown marked increases in concentrations of protein in bile of nonfeeding fish compared to feeding fish. It was shown that the variation between levels of FACs in feeding and nonfeeding fish were greatly reduced when the differences in bile protein were taken into account. Hence, the reporting of $FACs_{PHN}$ levels on the basis of bile protein is appropriate in this study, because the salmon sampled were sexually mature and may not have been feeding.



[a] Fluorescent aromatic compounds (FACs) are reported in units of ng phenanthrene (PHN) equivalents per mg bile protein.
[b] Values in ( ) indicate number of samples analyzed.
* Significantly different from Angoon, the reference site, by nonparametric test ($P \leq 0.05$).

Figure 2. Results of HPLC analyses of bile of salmon and bottomfish for $FACs_{PHN}$.[a]

Table 4. Mean levels ± SD of fluorescent aromatic compounds (FACs) and protein in bile of salmon and bottomfish. The levels of FACs are reported as ng phenanthrene equivalents per gram bile.[a]

Site	FACs (ng PHN eq./g bile)	Biliary protein (mg protein/g bile)
Pink Salmon		
Angoon (4)[b]	4,400 ± 4,900	2 ± 1
Tatitlek (5)	44,000 ± 40,000	64 ± 50
Ouzinkie (6)	7,800 ± 4,200	13 ± 7
Chiniak (21)	35,000 ± 28,000	42 ± 26
Port Lions (16)	23,000 ± 6,600	37 ± 15
Port Graham (5)	27,000 ± 19,000	21 ± 17
Old Harbor (16)	64,000 ± 25,000	40 ± 16
Larsen Bay (16)	56,000 ± 39,000	35 ± 17
Kodiak (10)	100,000 ± 8,000	30 ± 29
Chenega Bay (22)	180,000 ± 170,000	30 ± 17
Coho Salmon		
Angoon (6)	1,700 ± 700	4 ± 2
Port Graham (2)	3,900 ± 3,300	4 ± 1
Karluk (4)	3,200 ± 2,300	4 ± 3
Port Lions (11)	5,900 ± 2,900	6 ± 4
Tatitlek (11)	19,000 ± 11,000	14 ± 6
Akhiok (3)	11,000 ± 8,000	7 ± 4
Ouzinkie (4)	22,000 ± 12,000	12 ± 6
Other Salmon		
Angoon (3)	1,400 ± 400	3 ± 2
Larsen Bay (7)	2,400 ± 1,300	14 ± 7
Chiniak (4)	6,300 ± 5,200	23 ± 24
Bottomfish		
Angoon (4)	1,000 ± 600	3 ± 1
Old Harbor (7)	4,800 ± 6,100	4 ± 4
Port Graham (2)	2,800 ± 2,400	4 ± 5
Tatitlek (4)	4,400 ± 1,100	5 ± 2
Larsen Bay (11)	3,500 ± 2,400	3 ± 2
Port Lions (8)	3,300 ± 1,700	2 ± 2
Chiniak (2)	4,300 ± 2,700	2 ± 1
Ouzinkie (9)	4,900 ± 2,300	2 ± 2
Chenega Bay (12)	19,000 ± 21,000	4 ± 4
Kodiak (1)	6,000	1

[a] Fluorescence response of bile is converted to an equivalent response of a phenanthrene standard.

[b] Number in ( ) indicate total samples analyzed.

The results from the present study showed that reporting the concentration of FACs on the basis of bile protein appeared to account for large species differences in FACSPHNIevels for fish from a village. For example, calculation of the FACspHN levels for pink salmon *(Oncorhynchus gorbuscha)* and bottomfish from Port Graham and English Bay on the basis of bile protein rather than on the basis of bile volume reduced the difference between the levels from about tenfold to about 80 % (Table 4). This does not imply that the exposure to oil is similar for the two species, just that the level of FACs in bile appear similar. Numerous factors can affect tissue and fluid levels of contaminants; hence, dose-response studies with each species are required to validate comparisons between species.

As summarized in Figure 2, the levels of FAC_{PHN} in bottomfish from Chenega Bay, Ouzinkie, and Port Lions were significantly different (higher) from the levels in bile of bottomfish from Angoon, the reference site. The levels of FACsPHNin coho salmon *(O. kisutch)* from Ouzinkie, Akhiok, and Tatitlek were significantly higher than those in coho salmon from Angoon. For pink salmon, however, no significant differences were observed when compared to Angoon. The lack of statistically significant differences with respect to Angoon was due to a single pink salmon having a bile level of $FACs_{PHN}$ that was four- to twentyfold greater than the bile levels in the other three pink salmon from Angoon. What the finding of a high level of $FACs_{PHN}$ in the one pink salmon from Angoon Figure 2 means is not known. A larger sample size from the designated reference site or samples from another reference site win be needed for proper statistical evaluation of salmon exposure to ACs.

The results with bile suggest that a number of fish species from some sites were exposed to ACs. However, in subsequent analyses of the edible flesh, levels of total ACs in bottomfish never exceeded 1 ppb and were comparable to those from Angoon (Fig. 3), while in bile, mean levels of $FACs_{PHN}$ were up to 25 times greater than those from Angoon (Fig. 2). The results for pink and coho salmon (Fig. 3) also show low levels of total ACs in muscle (generally less than 7 ppb), while the level of $FACs_{PHN}$ (Fig. 2) ranged widely, from 80 to 17,000 ng PHN equivalents/mg bile protein. These results are consistent with the interpretation, based on laboratory studies, that efficient metabolizing of petroleum-derived ACs by the liver of fish greatly limits the accumulation of ACs in other tissues such as muscle (Varanasi et al., 1989a).

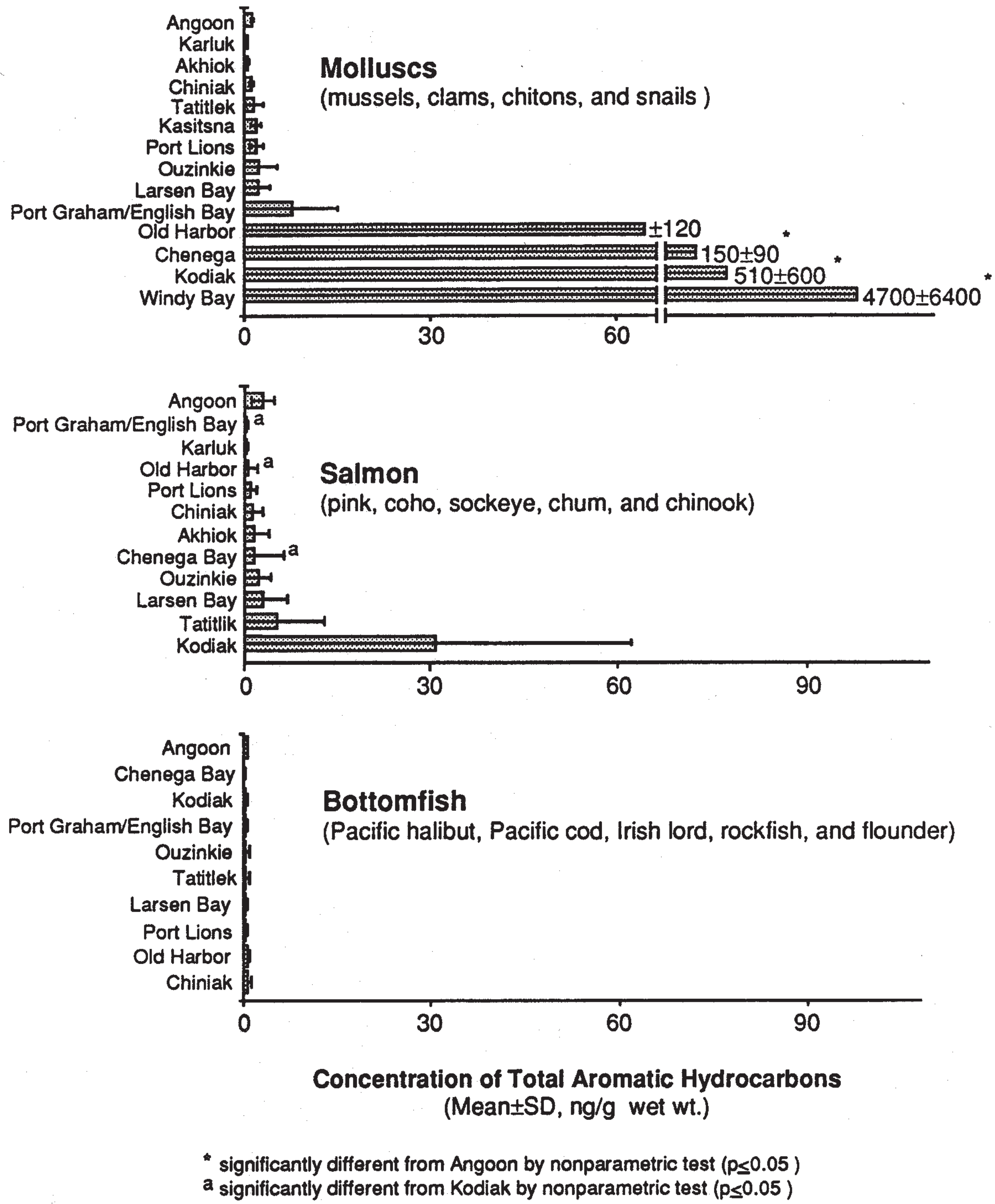


Figure 3. Results of GC/MS analyses of organic-solvent extracts of edible flesh of molluscs, salmon, and bottomfish for total aromatic hydrocarbons.

It should also be noted that when the levels of $FACs_{PHN}$ in bile of individual salmon were less than 1,000 ng PHN equivalents/ing bile protein, no pink or ccohoo salmon showed levels of total ACs exceeding 5 ppb. A few pink and coho salmon had AC levels greater than 7 ppb; however, in these fish,the levels of ACs in muscle were not directly related to levels of $FACs_{PHN}$ in bile, suggesting that a factor other than exposure was also affecting the tissue distribution of ACs in these few fish. Most of the salmon sampled in this study were near spawning. Previous studies (Varanasi et al. 1982; Reichert and Varanasi 1982) have shown that in marine bottomfish near spawning, aromatic hydrocarbons are not as effectively metabolized by the liver and that this can lead to some retention of unaltered aromatic hydrocarbons by tissues such as muscle.

Aromatic Contaminants in Edible Flesh of Fish and Shellfish

All 548 samples of edible flesh from fish and shellfish received in 1989 are included in the 365 analyses for the ACs reported herein. Summary results are presented for fish in Table 5 and for shellfish in Table 6. Included are results from comparison samples collected at Angoon, a designated reference site in Southeast Alaska. Results are also presented for a sample of smoked salmon each from Tatitlek and Old Harbor.

The data in Tables 5 and 6 have been summarized according to the low-molecular-weight ACs (LACs) and the high-molecular-weight ACs (HACs) listed in Table 1, following a practice we have established (Varanasi et al. 1988, 1989f) in the Benthic Surveillance Project of NOAA’s National Status and Trends Program. This has the convenience of dividing the ACs approximately into (a) the more water-soluble and acutely toxic compounds, LACs, and (b) the less water-soluble and more chronically toxic compounds, HACs. The LACs are more prone to dissolution, evaporation, and bacterial degradation and, hence, their levels in the environment generally would decline as the spilled oil weathers. Moreover, LACs are more rapidly excreted from the body than are HACs, and LACs are known for their acute toxicity in experimental animals. The HACs, on the other hand, are more resistant to dissolution, evaporation and bacterial degradation and, hence, tend to persist in the environment. Carcinogens generally appear atnong the HACs.

Table 5. Fish: Sums of LACs / HACs (listed in Table 1) in edible flesh in ng/g (ppb) wet weight by GC/MS of extract; nd = not detected. Brackets indicate analyses of split samples. Reference values are listed under Angoon.

Village:	Windy Bay	Kodiak Village	Chenega Bay	Old Harbor	Tatitlek	Larsen Bay	Ouzinkie	Chiniak	Akhiok	Port Lions	Port Graham/ English Bay	Karluk	Kasitsna	Angoon
Salmon: pink		[110 / 12, 72 / 8]	0.9 / nd	nd	0.05 / nd	2 / nd	nd	[2 / nd, 0.4 / nd]	4 / 0.4	nd	nd	nd		2 / nd
		54 / 5	20 / nd	1 / nd	[nd, nd]	[13 / 0.7, 12 / 0.2]	1 / nd	3 / 0.2	1 / 0.1	3 / 0.2	1 / nd			2 / nd
		22 / 2	nd	2 / 0.1	nd	1 / nd	3 / nd	1 / nd		0.4 / nd	nd			
		6 / 0.2	0.3 / nd	1 / nd	nd	0.3 / nd	5 / 0.5	2 / nd		0.5 / nd	nd			
		[84 / 10, 22 / 3]	[2 / nd, 2 / nd]	1 / nd	nd	0.8 / nd	1 / nd	4 / 0.2		nd	nd			
		4 / 0.2	1 / nd	4 / 0.3		0.8 / nd	1 / nd	4 / 0.2		1 / nd	nd			
		32 / 5	0.2 / nd	nd		0.5 / nd	1 / nd	0.3 / nd		0.3 / nd	nd			
		[0.7 / nd, 0.5 / nd]	nd	nd		nd	1 / nd	0.3 / nd		0.2 / nd				
		[1 / nd, 1 / nd]	0.4 / nd	nd		0.2 / nd	0.9 / nd	0.3 / nd		0.9 / nd				
		[0.9 / nd, 3 / nd]	nd	nd		0.3 / nd	1 / nd	0.3 / nd		0.8 / nd				
			nd	nd		1 / 0.1		nd						
			nd	nd		0.2 / nd		0.3 / nd						
			nd	nd		0.7 / nd								
			0.6 / nd	nd		0.7 / nd								
			nd	nd										
			3 / nd	nd										
			1 / nd	0.2 / nd										
			0.3 / nd	0.2 / nd										
			0.8 / nd											
			0.7 / nd											

Table 5 (continued). Fish: sums of LACs / HACs (listed in Table 1) in edible flesh in ng/g (ppb) wet weight by GC/MS of extract; nd = not detected. Brackets indicate analyses of split samples. Reference values are listed under Angoon.

Village:	Windy Bay	Kodiak Village	Chenega Bay	Old Harbor	Tatitlek	Larsen Bay	Ouzinkie	Chiniak	Akhiok	Port Lions	Port Graham/ English Bay	Karluk	Kasitsna	Angoon
Salmon:														
coho					14 / 1		6 / 0.6		nd	2 / nd	1 / nd	0.5 / nd		2 / nd
					15 / 1		0.8 / nd			0.6 / nd	nd	0.5 / nd		4 / nd
					19 / 2		2 / nd			0.2 / nd				2 / nd
					3 / 0.1		0.6 / nd			0.3 / nd				
					5 / 0.2		0.6 / nd			3 / 0.1				
					3 / nd		4 / 0.2			2 / nd				
					3 / nd		2 / nd							
							5 / 0.4							
sockeye		11 / 0.5				6 / 0.2		1 / nd	nd			0.2 / nd		
						3 / nd						0.7 / nd		
						2 / nd								
						6 / 0.1								
						3 / nd								
chum						1 / nd		5 / 0.2						
								0.8 / nd						
								0.4 / nd						
chinook														5 / 0.1
smoked salmon				[7100 / 650 7800 / 700]	[20000 / 3000 21000 / 1800]									

Table 5 (continued). Fish: Sums of LACs / HACs (listed in Table 1) in edible flesh in ng/g (ppb) wet weight by GC/MS of extract; nd = not detected. Reference values are listed under Angoon.

Village:	Windy Bay	Kodiak Village	Chenega Bay	Old Harbor	Tatitlek	Larsen Bay	Ouzinkie	Chiniak	Akhiok	Port Lions	Port Graham/ English Bay	Karluk	Kasitsna	Angoon
Dolly Varden		1 / nd		1 / nd								0.6 / nd		
Halibut		nd	nd	nd	nd	nd	nd	0.8 / nd		0.3 / nd	nd			0.4 / nd
		0.3 / nd	nd	1 / nd	nd	0.3 / nd	0.2 / nd	1 / nd		nd	0.2 / nd			
		0.9 / nd	nd	0.8 / nd		0.7 / nd	1 / 0.1			0.4 / nd				
			0.5 / nd			0.5 / nd	nd			0.6 / nd				
						0.6 / nd	0.3 / nd							
Yellowfin Sole										0.8 / nd				
Pacific Cod			nd	nd	nd	0.5 / nd								0.6 / nd
			nd	0.7 / nd		0.3 / nd								
			nd											
			0.3 / nd											
Rockfish		nd	nd		1 / nd			nd						
			nd		0.6 / nd									
			nd											
Irish Lord											0.6 / nd			
											0.4 / nd			

The tables in the Appendices contain more detailed information. Appendix A tabulates the summary results (LACs/HACs) according to village, sites, and species, including our laboratory sample numbers and composite sample information. Appendix B presents the complete set of analytical data for ACs from the edible flesh of all samples of fish (including the data for smoked salmon and the field collector's sample numbers). Appendix C contains analogous information for shellfish.

Fish

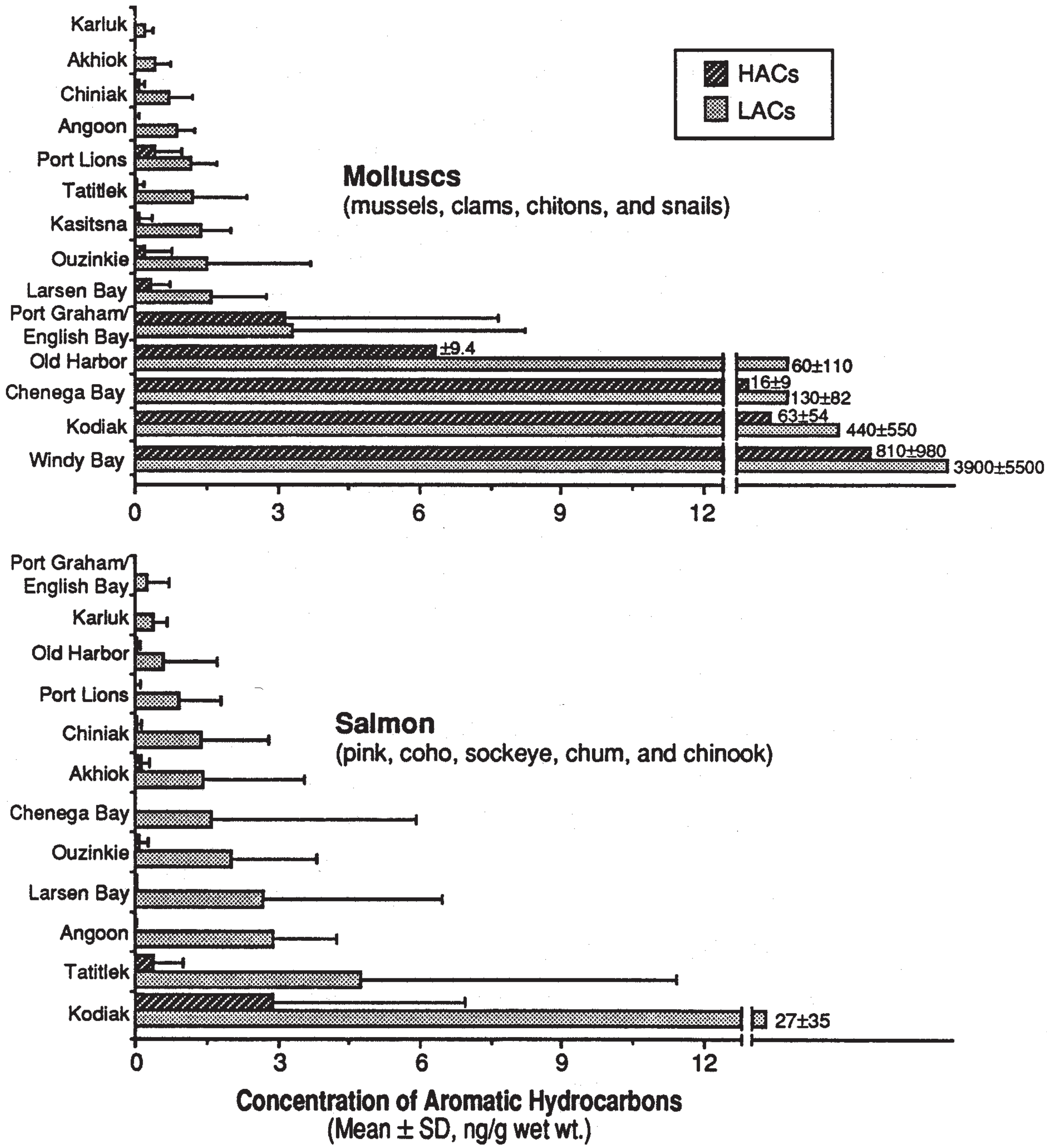
As there are significant differences in the rates of uptake, metabolism, excretion, and types of toxic effects exerted by various ACs, the fish data are also presented in Figure 4 to show the levels of LACs and HACs separately. The HACs are metabolized by fish to a greater extent than are the LACs and some HACs exert chronic toxic effects (e.g., carcinogenicity, tetratogenicity, and reproductive dysfunction) in experimental animals. To our knowledge, there are presently no established guidelines for acceptable levels of LACs or HACs in food products.

Of the 208 samples of edible flesh of unsmoked fish analyzed in this first year, only two samples of pink salmon from the village of Kodiak had levels of ACs nearing or slightly exceeding 100 ppb. Eleven samples of pink, coho, and sockeye salmon (0. *nerka)* from Kodiak, Chenega Bay, Tatitlek, and Larsen Bay exceeded 10 ppb of ACs. The levels of ACs in the edible flesh of salmon from other subsistence fishing areas and bottomfish from an fishing areas were generally comparable (less than 10 ppb) to the levels detected in the same or related species from the reference site, Angoon.

Two samples of smoked salmon from Old Harbor and Tatitlek were analyzed in this study; they contained 7,500 and 20,000 ppb of LACs and 670 to 2,400 ppb HACs, respectively. The concentrations of benzo[alpyrene, a carcinogenic HAC, in these samples were 6 ppb (Old Harbor) and 20 ppb (Tatitlek). More samples of smoked fish must be analyzed before proper comparisons can be drawn.

Molluscs

Analyses of molluscs (mussels, clams, chitons, and snails) from Windy Bay, Kodiak (village), Chenega Bay, and Old Harbor showed consistent



* A chart for bottomfish is not presented because HACs in flesh of these species were not detected.

Figure 4. Results of GC/MS analyses of organic-solvent extracts of edible flesh of molluscs and salmon for HACs and LACs.*

evidence of exposures to ACs (tissue levels above 100 ppb). Mussels from Windy Bay and Kodiak had AC levels as high as 12,000 to 18,000 ppb (Table 6). Otherwise, levels of ACs in molluscs, crabs, and urchins from the other collection sites were less than 10 ppb, a level comparable to that measured in shellfish collected near the village of Angoon, a designated reference area in southeast Alaska.

Benzo[a]pyrene was detected in molluscs from Windy Bay and Chenega Bay at levels of 0.1 to 7 ppb, but was not detected in fish.

Statistical Results

In addition to these qualitative interpretations of the AC data, statistical analyses of the AC data were also conducted. The results of these analyses revealed, however, that the sample sizes for individual species were generally too small to draw strong statistical conclusions. This was especially evident for the reference site, near Angoon, where the sample size was only 1 to 3 for any single species.

To increase our ability to draw statistical inferences from the data, samples were grouped according to type (e.g.,. salmonids or bottornfish) or habitat (e.g., intertidal or benthic) as shown in Table 7. For example, combining data for all intertidal molluscs increased the sample size (n = 147) to a reasonable value and allowed inclusion of most villages in the statistical analyses. While grouping of different species and samples from different sampling stations is not ideal, such an approach did enable certain general conclusions to be drawn, as is discussed below.

Of the taxonomic groupings of species, the sample size was largest for Pacific salmon, n = 164; this includes 6 samples from Angoon and 11 villages with 2 or more samples. Next in sampling size were the intertidal molluscs, n = 147, which includes 7 samples from Angoon and 13 villages with 2 or more samples. The statistical results have the greatest validity for these two groups.

Although it is often convenient to consider the LACs and the HACs separately, in this study the statistical conclusions for each of these categories were not different from those for all the ACs together. Hence, the conclusions

Table 6. Shellfish: sums of LACs / HACs (listed in Table 1) in edible flesh in ng/g (ppb) wet weight by GC/MS of extract; nd = not detected. Brackets indicate duplicate samples. Reference values are listed under Angoon.

Village:	Windy Bay	Kodiak Village	Chenega Bay	Old Harbor	Tatitlek	Larsen Bay	Ouzinkie	Chiniak	Akhiok	Port Lions	Port Graham/ English Bay	Karluk	Kasitsna	Angoon
Molluscs: mussels	3300 / 440	1500 / 160	220 / 20	nd	[nd nd]	1 / 0.3	0.9 / nd	nd	0.3 / nd		nd	nd	1 / nd	0.6 / nd
	16000 / 2500		160 / 22		3 / 0.2			nd	0.4 / nd		4 / 0.4	0.4 / nd	0.7 / nd	1 / 0.1
	2400 / 550		200 / 22		3 / 0.1						1 / nd	0.3 / nd		
			190 / 26		3 / 0.3						1 / nd	0.3 / nd		
			96 / 15		0.8 / nd						2 / nd			
					1 / nd						1 / nd			
					0.9 / nd						2 / 0.2			
											5 / 12			
											4 / 9			
											2 / 3			
clams butter		410 / 50	37 / 5	2 / 0.6		3 / 1	nd	1 / 0.1	nd	0.9 / 0.4		0.3 / nd	2 / 0.4	0.5 / nd
			15 / 3	2 / 0.8		0.5 / nd	0.9 / nd	0.2 / nd	0.4 / nd	1 / 0.2				
				0.7 / 0.3		1 / nd	7 / 2	0.6 / 0.3	0.3 / nd	1 / 1				
				1 / 1		2 / 0.1	3 / 0.5	0.3 / nd		1 / 1				
				0.3 / nd		4 / 0.8		0.5 / nd		1 / 1				
				6 / 5		1 / 0.2		0.3 / nd		2 / 0.1				
				4 / 7		4 / 0.8		0.9 / nd		2 / 1				
				4 / 3										
				[230 / 21 330 / 29]										
				210 / 20										
horse														[0.5 / nd 0.8 / nd]

Table 6 (continued). Shellfish: Sums of LACs / HACs (listed in Table 1) in edible flesh in ng/g (ppb) wet weight by GC/MS of extract; nd = not detected. Brackets indicate duplicate samples. Reference values are listed under Angoon.

Village:	Windy Bay	Kodiak Village	Chenega Bay	Old Harbor	Tatitlek	Larsen Bay	Ouzinkie	Chiniak	Akhiok	Port Lions	Port Graham/ English Bay	Karluk	Kasitsna	Angoon
Molluscs:														
clams														
littleneck	830 / 130	270 / 87		2 / 0.7			1 / nd	0.6 / 0.3	[0.3 / nd 0.7 / nd]	2 / 1	20 / 9			
,		120 / 24		200 / 19			0.6 / nd	2 / 0.4		1 / 1				
								1 / 0.1						
cockles								0.8 / 0.1			3 / 10			
								[0.7 / nd 0.5 / nd]						
chitons	13 / 3	230 / 27		2 / 0.1	nd	0.6 / 0.06	0.1 / nd	1 / 0.1	1 / nd	0.6 / nd	0.7 / nd	0.2 / nd	2 / nd	1 / nd
	4000 / 1800	90 / 30		0.9 / nd	1 / nd	0.9 / 0.6	0.5 / nd	1 / 0.1		2 / nd	0.2 / nd	nd		1 / nd
				0.5 / nd		0.4 / nd		1 / 0.1		1 / nd	0.7 / nd			
								0.5 / nd		[0.3 / nd 0.4 / nd]				
								0.1 / nd		1 / nd				
snails	620 / 160					1 / nd		1 / nd		0.8 / nd	3 / 0.9			
										0.9 / nd				
limpets						2 / 0.1								
Urchins				5 / 2		2 / 1								
Crabs														
dungeness		0.2 / nd				0.1 / nd		0.1 / nd		0.1 / nd				
		0.6 / nd												
tanner				0.1 / nd		0.2 / nd				0.1 / nd				
										0.7 / nd				
king						2 / nd				3 / nd				

Table 7. Taxonomic/habitat groupings of samples for statistical analyses.

Bottomfish (benthic) --51 samples (2 from Angoon);
villages with 2 or more samples

Pacific cod
Pacific halibut
Irish lord
rockfish
sole

Salmon (midwater) --164 samples (6 from Angoon);
villages with 2 or more samples

Chinook salmon
Chum salmon
Coho salmon
Pink salmon
Sockeye salmon

Intertidal molluscs (beach)--147 samples (7 from Angoon);
villages with 2 or more samples

Clams
Mussel
Limpets
Chiton
Snails

are presented for total ACs. Thus, Figure 3 shows that the highest mean level of ACs in molluscs (4,700 ppb) was substantially greater than the highest mean level in salmon (30 ppb) and bottomfish (0.7 ppb).

Fish. The levels of total ACs in edible flesh of salmon and bottomfish and results of statistical analyses are shown in Figure 3. In salmon and bottomfish, the levels of ACs in this study were not significantly different from the levels in fish from Angoon. However, the levels of ACs in salmon from the village of Kodiak were significantly different (higher) from those in salmon from Chenega Bay, Old Harbor, and Port Graham and English Bay. The very low levels of ACs in the edible flesh of bottomfish did not warrant further statistical investigation. To date, only two samples of smoked salmon from Old Harbor and Tatitlek were analyzed in this study (see above). More samples of smoked fish must be analyzed before proper statistical comparisons can be drawn.

Molluscs. The levels of total ACs in edible flesh of intertidal molluscs and results of statistical analyses are also shown in Figure 3. The AC levels in molluscs from Windy Bay, Kodiak, and Chenega Bay were significantly higher than in those from Angoon. No other villages had significantly higher levels than Angoon, not even Old Harbor, despite the three samples which had greater than 200 ppb of total ACs.

Analytical Chemical Results According to Fishing Village (Site)

Summary results for each subsistence fishing area are discussed with the sums of the LACs preceding those of the HACs.

Windy Bay --

Fish. None were collected at Windy Bay.

Mussels. In Cycles I and 111, three samples from this area at the tip of the Kenai Peninsula showed the highest levels of ACs of any mussels evaluated in this study. The 2,400-16,000 ppb of LACS and 440-2,500 ppb of HACs are three to fogr orders of magnitude higher than the levels found in two samples from the designated reference site near Angoon in Southeast Alaska.

The Angoon reference data showed only 0.6-1 ppb of LACs and up to 0. 1 ppb of HACs.

Chitons. In Cycle III, 4,000 ppb of LACs and 1,800 ppb of HACs were found in a composite sample, compared to the 1 ppb and none detected, respectively, found at Angoon (n = 2). In Cycle I, a sample showed 13 ppb of LACs and 3 ppb of HACs, respectively.

Littleneck Clams (Protothaca staminea). In Cycle I, 830 ppb of LACs and 130 ppb of HACs were found in a sample of littleneck clams. No littleneck clams were sampled at Angoon, but a sample of butter clams from there showed LAC and HAC levels of 0.5 ppb and none detected, respectively.

Snails. In Cycle I, 620 ppb of LACs and 160 ppb of HACs were found in a sample of snails. No snails were sampled at Angoon, but other molluscs there (n = 6) showed LAC and HAC levels of 0.5-1 ppb and up to 0.1 ppb, respectively.

Kodiak Village

Pink Salmon. In seven samples, 4-110 ppb of LACs and 0.2-12 ppb of HACs were found in Cycle II. In Cycle III, the LAC and HAC levels found in three samples were 0.5-3 ppb and none detected, respectively, comparable to the LAC and HAC levels of 2 ppb and none detected, respectively, in pink salmon from Angoon (n = 2).

Sockeye Salmon. A sample showed 11 ppb of LACs, slightly higher than the 2-5 ppb of LACs (n = 6) in other species of salmon from Angoon. No sockeye salmon were collected at Angoon.

Dolly Varden (Salvelinus malma). A trace (1 ppb) of LACs was found in one sample. No Dolly Varden were collected at Angoon.

Halibut (Hippoglossus stenolepis). Trace levels of LACs (up to 0.9 ppb) in three samples, comparable to the 0.4 ppb found in halibut from Angoon.

Rockfish. No ACs were found in rockfish. No rockfish were collected at Angoon.

Mussels. In Cycle I, a sample contained 1,500 ppb of LACs and 160 ppb of HACs as compared to the two samples from Angoon, which had 0.61 ppb of LACs and up to 0.1 ppb of HACs.

Butter Clams (Saxidomus giganteus). In Cycle II, a sample contained 410 ppb of LACs and 50 ppb of HACs compared to the sample from Angoon, which had LAC and HAC levels of 0.5 ppb and none detected, respectively.

Littleneck Clams. In Cycle III, two samples contained 120-270 ppb of LACs and 24-87 ppb of HACs as compared to the other bivalves (mussels and butter clams, n = 3) from Angoon, which had 0.5-1 ppb of LACs and up to 0.1 ppb of HACs. No littleneck clams were collected at Angoon.

Chitons. In Cycle II, a sample contained 230 ppb of LACs and 27 ppb of HACs, whereas in Cycle IIEI, another sample contained LAC and HAC levels of 90 ppb and 30 ppb, respectively. The two samples from Angoon contained 1 ppb LACs and no detectable HACs.

Dungeness Crabs (Cancer magister). Traces of LACs (0.2-0.6 ppb) were found in two samples. No reference samples were available from Angoon.

Chenega Bay --

Pink Salmon. A sample showed 20 ppb of LACs in Cycle II. The 19 other samples (Cycles II and III) showed only up to 3 ppb of LACs, which is quite comparable to the 2 ppb of LACs found in two samples from Angoon.

Halibut, Pacific Cod (Gadus macrocephalus) and Rockfish. Traces of LACs were detected, which were comparable to those from the Angoon reference area (0.4-0.6 ppb).

Mussels. Levels of ACs were fairly similar in five samples collected throughout all cycles (96-220 ppb of LACs and 15-26 ppb of HACs). Two samples from Angoon contained LAC and HAC levels of 0.6-1 ppb arrd up to 0.1 ppb, respectively.

Butter Clams. In two samples, 15-37 ppb of LACs and 3-5 ppb of HACs were found, as compared to a sample from Angoon, which had LAC and HAC levels of 0.5 ppb and none detected, respectively.

Old Harbor --

Pink Salmon. Up to 4 ppb of LACs in 18 samples were comparable to two samples from Angoon (2 ppb).

Smoked Salmon. A sample of smoked salmon showed 7,100-7,800 ppb of LACs and 650-700 ppb of HACs, approximately three orders of magnitude greater than the unsmoked salmon.

Halibut and Pacific Cod. The levels of LACs found in halibut (up to 1 ppb, n = 3) and a Pacific cod (0.7 ppb) were similar to levels found in the same species from Angoon (LAC and HAC levels of 0.4 and 0.6 ppb, respectively).

Butter Clams and Littleneck Clams. Two samples from Cycle I had 2-4 ppb of LACs and 0.6-7 ppb of HACs, as compared to 0.5 ppb and none detected, respectively, from an Angoon sample. Four samples from Cycle II showed LAC and HAC levels of 2-6 ppb and 0.3-5 ppb, respectively. In Cycle III three samples from site 4 showed 210-280 ppb of LACs and 20-25 ppb of HACs, while one sample from site 3 had levels comparable to those from Angoon.

Chitons. A sample from Cycle I had 2 ppb of LACs and 0.1 ppb of HACs, whereas in Cycles III and IH these LAC and HAC levels of were 0.50.9 ppb and none detected, respectively, (n = 2), which is comparable to Angoon (LAC and HAC levels of 1 ppb and *none detected*, respectively, n = 2).

Tatitlek --

Pink Salmon. In Cycles I and II, levels of ACs in pink salmon from Tatitlek were below the 2 ppb of LACs found in pink salmon from Angoon.

Coho Salmon. In Cycle III, seven samples showed 3-19 ppb of LACs and up to 2 ppb of HACs. Three of these samples had 14 ppb or more of ACs, compared to three samples from Angoon that had LAC and HAC levels of 2-4 ppb and none detected, respectively.

Smoked Salmon. A sample of smoked salmon showed 20,000-21,000 ppb of LACs and 1,800-3,000 ppb of HACs, some four orders of magnitude greater than the levels in unsmoked salmon.

Mussels. In Cycle II, the 3 ppb of LACs in three samples was slightly higher than the 0.6-1 ppb in two samples from Angoon. In Cycle III, the 0.8-1 ppb of LACs in three samples were comparable to those of the Angoon samples.

Chitons. Low levels of ACs in two samples (up to 1 ppb) were indistinguishable from those in Angoon samples.

Larsen Bay --

Pink Salmon. In Cycle I, 1-12 ppb of LACs and up to 0.4 ppb of HACs were found in two samples, compared to LAC and HAC levels of 2 ppb and none detected, respectively, in two samples from Angoon. In a Cycle II sample, values were comparable to those from Angoon (2 ppb, n = 2), while in Cycle III, levels of LACs (up to 1 ppb) in 11 samples were below those of Angoon.

Sockeye Salmon. In Cycle II, 1-6 ppb of LACs and up to 0.2 ppb of HACs were found in six samples, quite similar to the LAC and HAC levels of 2-5 ppb and up to 0.1, respectively, in other species of salmon from Angoon (n = 2). No sockeye salmon were collected at Angoon.

Halibut and Pacific Cod. The very low levels of ACs found were similar to those found in the same species from Angoon (up to 1 ppb).

Butter Clams. Levels of LACs (0.5-4 ppb) in seven samples of butter clams were comparable to those in a sample of butter clams from Angoon (0.5 ppb).

Chitons, Snails, Limpets, Sea Urchins, and Crabs. The low levels of ACs found were similar to, or slightly higher than, those found in some of these species at Angoon (up to 1 ppb).

Ouzinkie -

Pink Salmon. The 0.9-5 ppb of LACs in nine samples in Cycle II were comparable to, or slightly higher than, those in Angoon samples (2 ppb, n = 2).

Coho Salmon. In Cycle III, the 0.6-6 ppb of LACs in eight samples were comparable to the 2-4 ppb in Angoon samples (n = 3). Traces of HACs (0.2-0.6 ppb) were also detected in three samples, as compared to none detected in the Angoon samples (n = 3).

Halibut. Up to 1 ppb of ACs found in five samples were comparable to those in Angoon halibut (0.4-1 ppb).

Butter Clams. In four samples, the 0.9-7 ppb of LACs and up to 2 ppb of HACs were comparable to, or slightly higher than, those in Angoon samples (LAC and HAC levels of 0.5 ppb and none detected, respectively, n = 1).

Mussels and Chitons. Levels of ACs found in a sample each of mussels (0.9 ppb) and chitons (0.5 ppb) were comparable to those for Angoon (0.4-1 ppb).

Chiniak -

Pink Salmon, Sockeye Salmon, Chum Salmon (0. keta), and Halibut. The levels of LACs (0.4-4 ppb) in six samples of pink salmon and two of halibut (0.8-1 ppb) from Chiniak were comparable to those from the same species sampled at Angoon (2 ppb, n = 2 and 0.4 ppb, n = 1, respectively). Additionally, samples of sockeye salmon and chum salmon contained 0.8-5 ppb of the LACs, similar to the levels for pink salmon from Angoon (2 ppb, n = 2).

Butter Clams, Littleneck Clams, Cockles, and Chitons. The levels of LACs (0.1-2 ppb) in 14 samples of such molluscs were comparable to those in similar mollusc samples from Angoon (0.5-1 ppb, n = 5). In addition, samples of butter clams and littleneck clams had traces of HACs (0.3-0.4 ppb, n = 3), compared to none detected for Angoon.

Akhiok --

Pink Salmon. The 1-4 ppb of LACs and 0.1-0.4 ppb of HACs were comparable to those in samples from Angoon (LAC and HAC levels of 2 ppb and none detected, respectively, n = 2).

Coho Salmon and Sockeye Salmon. No ACs were found in samples of either of these species at this site.

Mussels, Butter Clams, Littleneck Clams, and Chitons. Up to 1 ppb of LACs in seven samples were comparable to the levels in such molluscs from Angoon (0.5-1 ppb, n 5).

Port Lions

Pink Salmon. In 10 samples from Port Lions, up to 3 ppb of LACs and up to 0.2 ppb of HACs were comparable to those in samples from Angoon (LAC and HAC levels of 2 ppb and none detected, respectively, n = 2).

Coho Salmon, Halibut, and Sole. The 0.2-3 ppb of LACs in six samples of coho salmon, four samples of halibut and one sample of sole from Port Lions were comparable to the levels in these species from Angoon (0.4-4 ppb, n = 4).

Crab, Butter Clams, Littleneck Clams, Chitons, and Snails. The 0.4-3 ppb of ACs in these samples were comparable to those for samples from Angoon (0.5-1 ppb, n = 5).

Port Graham and English Bay

Pink Salmon. Up to 1 ppb of ACs in seven samples were comparable *to* those in samples from Angoon (2 ppb, n = 2).

Halibut. The level of ACs in a sample was similar to that from Angoon (0.4 ppb; n = 1).

Irish Lord. The levels of ACs in two samples were not much different from those of other fish from Angoon. No Irish Lords were collected from Angoon.

Mussels. The 1-5 ppb of LACs in 10 samples were slightly elevated compared to Angoon (0.6-1 ppb, n = 2). The HACs (up to 12 ppb) were sometimes moderately elevated compared to Angoon mussels (up to 0.1 ppb, n = 2).

Littleneck Clams and Cockles. One sample of each showed moderately elevated levels of LACs (3-20 ppb) and HACs (9-10 ppb) compared to similar molluscs from Angoon (LAC and HAC levels of 0.5-1 ppb and up to 0.1 ppb, respectively, n = 6).

Chitons. Three samples showed 0.2-0.7 ppb of LACs, which is comparable to the LAC levels in samples from Angoon (1 ppb, n = 2).

Snails. A sample showed 3 ppb of LACs and 0.9 ppb of HACs, slightly elevated compared to other molluscs from Angoon (LAC and HAC levels of 0.5-1 ppb and up to 0.1 ppb, respectively, n = 6).

Karluk --

Pink Salmon, Coho Salmon, Sockeye Salmon, Mussels, Butter Clams, and Chitons. Very low levels of LACs (up to 0.7 ppb) were found, which were comparable to, or lower than the levels in these species from Angoon (up to 4 ppb, n = 10).

Kasitsna --

Mussels. Two samples from Kasitsna showed 0.7-1 ppb of 2-3 ring ACs, comparable to the 0.6-1 ppb found in Angoon mussels (n = 2).

Butter Clams. The level of LACs (2 ppb) in a sample was similar to that in a sample from Angoon (0.5 ppb, n = 1).

Chitons. Levels of LACs (2 ppb) in a sample were similar to that in a sample from Angoon (1 ppb, n = 2).

SUMMARY

After the *Exxon Valdez* oil spill in Prince William Sound, native Alaskans were concerned that their seafood could be contaminated by the oil. NOAA, with funding from Exxon, analyzed edible flesh of fish and shellfish collected from 13 native subsistence fishing grounds. Flesh samples were sub ected to extraction and GC/MS analysis for aromatic contaminants from petroleum, including alkylated and unsubstituted aromatic hydrocarbons with 2-7 benzenoid rings and related dibenzothiophenes (Table 1). The hundreds of analyses reported via memo in August, October, and November, 1989 are summarized herein.

Molluscs, mainly mussels, clams, chitons, and snails from Windy Bay, Kodiak, Chenega Bay, and Old Harbor showed consistent GC/MS evidence of exposure to ACs (tissue levels exceeded 100 ppb). Mussels from Windy Bay and Kodiak had the highest levels (1,700-18,000 ppb). Otherwise, levels of aromatic contaminants in molluscs, crabs, and urchins from other areas were generally less than 10 ppb. This is comparable to the levels found in shellfish collected near the village of Angoon, a designated reference area in southeast Alaska.

Generally, the edible flesh of fish analyzed contained relatively low levels of ACs. Three samples of pink salmon from the village of Kodiak averaged 60-100 ppb of ACs, while another eight samples of pink and coho, salmon from Kodiak, Chenega Bay, Tatitlek, and Larsen Bay had 12-59 ppb of ACs. Otherwise, the AC levels in the flesh of salmon from other subsistence fishing areas and the bottomfish from all fishing areas were generally less than 7 ppb, comparable to the levels detected in the same or related species from the reference site.

Statistical analyses of the data revealed that the sample sizes (n) for individual species were often too small to draw statistical distinctions with respect to the reference site, where n = 1-3 for any single species. To broaden the statistical base, samples were grouped by taxonomic affiliation (e.g., salmon or bottomfish) and habitat (e.g., intertidal or benthic). The combining of data for all intertidal molluscs increased the sample size to a reasonable value (n = 147) and had the added advantage of including most of the villages in the statistical analyses. The AC levels in edible flesh of molluscs from Windy Bay, Kodiak, and Chenega Bay were then found to be significantly different from those in molluscs from the reference site near Angoon. However, the AC levels in salmon and bottomfish were not significantly different from those in fish from Angoon. With greater sample numbers available, the AC levels in salmon from Kodiak were found to be significantly different (higher) from those in salmon from Chenega Bay, Old Harbor, and Port Graham and English Bay. The very low levels of ACs in the edible flesh of bottomfish did not warrant further statistical analysis.

As there are significant differences in the rates of uptake, metabolism, excretion, and types of toxic effects exerted by the various ACs measured, the data are also presented to show the levels of 2-3 ring aromatic hydrocarbons and dibenzothiophenes (LACs) separately from the levels of 4-7 ring aromatic hydrocarbons (HACs). The LACs are more prone to dissolution, evaporation, and bacterial degradation and hence, their levels in the environment generally would decline as the spilled oil weathers. The LACs, known for their acute toxicity in experimental animals, are also more rapidly excreted from the body than are HACs. Conversely, HACs are more resistant to dissolution, evaporation, and bacterial degradation. Hence, they tend to persist in the environment. The HACs are metabolized by fish to a greater extent than are the LACs and they have been shown to exert chronic toxicity in experimental animals (e.g., carcinogenicity, tetratogenicity, and reproductive dysfunction).

In this study, the levels of LACs in molluscs ranged from not detected to 16,000 ppb and levels of HACs ranged from not detected to 2,500 ppb. For fish muscle, the levels of LACs ranged from not detected to 110 ppb, and levels of HACs ranged from not detected to 12 ppb. Benzo[a]pyrene, a carcinogenic HAC, was detected in molluscs from Windy Bay and Chenega Bay at levels of 0.1 to 7 ppb, but was not detected in fish. Only two samples of smoked salmon from Old Harbor and Tatitlek were analyzed in this study; they contained 7,500 and 20,000 ppb of LACs and 670 to 2,400 ppb HACs, respectively. The concentrations of benzo[alpyrene in these samples were 6 ppb (Old Harbor) and 20 ppb (Tatitlek). At present there are no national guidelines established for acceptable levels of aromatic contaminants in food products; however in an unofficial advisory opinion, the Food and Drug Administration has indicated that little additional risk is involved in the consumption of the nonsmoked subsistence foods harvested after the *Exxon Valdez* oil spill.[2]

The main use of the analyses of bile from fish " was to assess exposure to ACs and prioritize the GC/MS analyses of the corresponding samples of edible flesh. For each species, edible flesh samples were analyzed as individual samples or as composite samples according to the levels of fluorescent aromatic compounds (FACs) in bile. Interesingly, unsubstituted ACs predominated in fish muscle,[3] which could be due to the more rapid metabolism of alkylated ACs than of unsubstituted ACs by fish liver. Conversely, molluscs which have little ability to metabolize ACs had both alkylated and unsubstituted ACs, and the pattern more closely resembled that of Prudhoe Bay crude oil.[3]

The results to date provide a) important information on the level of contamination of subsistence fish and shellfish from fishing areas of native Alaskan villages in and near Prince William Sound and b) a reference database against which future temporal changes of petroleum derived ACs in the edible flesh of fish and shellfish can be evaluated.

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[2] FDA advisory opinion on the safety of aromatic hydrocarbon residues found in subsistence foods that were affected by the *Exxon Valdez* oil spill by the Center for Food Safety and Applied Nutrition's (CFSAN) Quantitative Risk Assessment Committee (QRAC). Guidelines (Report of August 9, 1990) transmitted to Chairman of Alaska Oil Spill Task Force, August 21, 1990, from Fred R. Shank, Director, CFSAN, Department of Health and Human Services, Food and Drug Administration, Washington, D.C. 20204.

[3] GC/MS observations on sample extracts.

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APPENDIX A

SUMARY OF CONCENTRATIONS: LACS/HACS, PLUS FIELD AND LABORATORY SAMPLE NUMBERS

Explanatory notes for Tables A-1 through- A-26,

Results on sample extracts were determined by gas chromatography/mass spectrometry (GC/MS) using sequenced multiple ion detection.

Cycles I, II, and III refer to samples collected in July, August, and September 1989, respectively.

A hyphen (-) indicates that the analyte was not detected above the limit of detection which ranged from 0.02 to 1 ng/g (ppb) wet weight. This applies to individual contaminants, as well as groupings of contaminants (e.g., C2-phenanthrenes/anthracenes).

Low levels of naphthalene found were indistinguishable from those of blank analyses and were not included in the sums.

Table A-1. Windy Bay shellfish: Mussels and clams. Sums of the concentrations, ng/g (ppb) wet weight, of aromatic contaminants listed in Table 1 (LAC / HAC) in edible flesh. Angoon = reference site.

					Angoon				
Site	1	1	1	2	1	1	2	2	2
Lab no.	47	242	243	666	232	324	231	325	328
No. of field samples comprising lab sample	1	1	1	1	1	1	1	Split samples 1	1
Cycle No.	I	III	III	I	II	II	II	II	II
Molluscs:									
mussels	3300 / 440	16000 / 2500 *	2400 / 550		0.6 / -	1 / 0.1			
clams									
butter							0.5 / -		
horse								0.5 / -	0.8 / -
littleneck				830 / 130					

* One of the mussels in this sample package had a black oil-like substance in it and no tissue. It was not included in the analysis. The remaining mussels from this package were used for the composite and were carefully dissected to avoid contamination from the one mussel.

Table A-1 (continued). Windy Bay shellfish: Chitons and snails. Sums of the concentrations, ng/g (ppb) wet weight, of aromatic contaminants listed in Table 1 (LAC / HAC) in edible flesh. Angoon = reference site.

							Angoon			
Site	1	1	1	1	1	2	2	2	1	1
Lab no.	76	360	684	232	324	231	325	328	326	327
No. of field samples comprising lab sample	1	1	1	1	1	1	Split samples 1	1	1	1
Cycle No.	I	III	I	II	II	II	II	II	II	II
Molluscs:										
mussels				0.6 / -	1 / 0.1					
clams										
butter						0.5 / -				
horse							0.5 / -	0.8 / -		
chitons	12 / 3	4000 / 1800							1 / -	1 / -
snails			620 / 160							

Table A-2. Kodiak Village fish: Pink salmon. Sums of the concentrations, ng/g (ppb) wet weight, of aromatic contaminants listed in Table 1 (LAC / HAC) in edible flesh. Angoon = reference site.

										Angoon					
Site	5	5	5	5	5	5	5	5	5	3	3	3	3	3	3
Lab No.	166	195	187	188	189	628	637	629	630	229	320	230	319	323	321
No. of field samples comprising lab sample	Split samples 1	1	1	3	2	Split samples 2	2	2	2	3	3	3	3	2	3
Cycle No.	II	II	II	II	II	II	II	II	II	II	II	II	II	II	II
Salmon:															
pink	110 / 12	72 / 8	54 / 5	22 / 2	6 / 0.2	84 / 10	22 / 3	4 / 0.2	32 / 5	2 / -	2 / -				
coho												2 / -	4 / -	2 / -	
chinook															5 / 0.1

Table A-2 (continued). Kodiak Village fish: Pink salmon (continued), sockeye salmon, and Dolly Varden. Sums of the concentrations, ng/g (ppb) wet weight, of aromatic contaminants listed in Table 1 (LAC / HAC) in edible flesh. Angoon = reference site.

									Angoon					
Site	5	5	5	5	5	5	5	5	3	3	3	3	3	3
Lab No.	488	489	490	492	539	540	194	94	229	320	230	319	323	321
No. of field samples comprising lab sample	Split samples 1	1	Split samples 1	1	Split samples 1	1	1	2	3	3	3	3	2	3
Cycle No.	III	III	III	III	III	III	II	I	II	II	II	II	II	II
Salmon:														
pink	0.7 / -	0.5 / -	1 / -	1 / -	0.9 / -	3 / -			2 / -	2 / -				
coho											2 / -	4 / -	2 / -	
sockeye							11 / 0.5							
chinook														5 / 0.1
Dolly Varden								1 / -						

Table A-2 (continued). Kodiak Village fish: Halibut and rockfish. Sums of the concentrations, ng/g (ppb) wet weight, of aromatic contaminants listed in Table 1 (LAC / HAC) in edible flesh. Angoon = reference site.

					Angoon	
Site	2	6	6	1	3	3
Lab No.	4	193	508	24	228	322
No. of field samples comprising lab sample	2	2	1	2	3	2
Cycle No.	I	II	III	I	II	II
Halibut	- / -	0.3 / -	0.9 / -		0.4 / -	
Pacific cod						0.6 / -
Rockfish				- / -		

Table A-3. Kodiak Village shellfish: Mussels, clams, chitons, and crabs. Sums of the concentrations, ng/g (ppb) wet weight, of aromatic contaminants listed in Table 1 (LAC / HAC) in edible flesh. Angoon = reference site.

									Angoon						
Site	3	3	3	3	3	3	4	5	1	1	2	2	2	1	1
Lab No.	48	212	437	447	208	396	96	341	232	324	231	325	328	326	327
No. of field samples comprising lab sample	1	1	1	1	1	1	1	1	1	1	1	Split samples 1	1	1	1
Cycle No.	I	II	III	III	II	III	I	II	II	II	II	II	II	II	II
Molluscs:															
mussels	1500 / 160								0.6 / -	1 / 0.1					
clams															
butter		410 / 50									0.5 / -				
horse												0.5 / -	0.8 / -		
littleneck			270 / 87	120 / 24											
chitons					230 / 27	90 / 30								1 / -	1 / -
Crabs:															
Dungeness							0.2 / -	0.6 / -							

Table A-4. Chenega Bay fish: Pink salmon. Sums of the concentrations, ng/g (ppb) wet weight, of aromatic contaminants listed in Table 1 (LAC / HAC) in edible flesh. Angoon = reference site.

									Angoon					
Site	3	3	3	4	4	4	4	4	3	3	3	3	3	3
Lab No.	137	138	152	452	453	456	454	455	229	320	230	319	323	321
No. of field samples comprising lab sample	2	3	3	1	Split samples 1	1	1	1	3	3	3	3	2	3
Cycle No.	II	II	II	III	III	III	III	III	II	II	II	II	II	II
Salmon:														
pink	0.9 / -	20 / -	- / -	0.3 / -	2 / -	2 / -	1 / -	0.2 / -	2 / -	2 / -				
coho											2 / -	4 / -	2 / -	
chinook														5 / 0.1

Table A-4 (continued). Chenega Bay fish: Pink salmon (continued). Sums of the concentrations, ng/g (ppb) wet weight, of aromatic contaminants listed in Table 1 (LAC / HAC) in edible flesh. Angoon = reference site.

									Angoon					
Site	4	4	4	4	4	4	4	4	3	3	3	3	3	3
Lab No.	465	466	467	468	469	470	471	472	229	320	230	319	323	321
No. of field samples comprising lab sample	1	1	1	1	1	1	1	1	3	3	3	3	2	3
Cycle No.	III	III	III	III	III	III	III	III	II	II	II	II	II	II
Salmon:														
pink	- / -	0.4 / -	- / -	- / -	- / -	- / -	0.6 / -	- / -	2 / -	2 / -				
coho											2 / -	4 / -	2 / -	
chinook														5 / 0.1

Table A-4 (continued). Chenega Bay fish: Pink salmon (continued). Sums of the concentrations, ng/g (ppb) wet weight, of aromatic contaminants listed in Table 1 (LAC / HAC) in edible flesh. Angoon = reference site.

						Angoon					
Site	4	4	4	4	4	3	3	3	3	3	3
Lab No.	473	474	483	484	593	229	320	230	319	323	321
No. of field samples comprising lab sample	1	1	1	2	1	3	3	3	3	2	3
Cycle No.	III	III	III	III	III	II	II	II	II	II	II
Salmon:											
pink	3 / -	1 / -	0.3 / -	0.8 / -	0.7 / -	2 / -	2 / -				
coho								2 / -	4 / -	2 / -	
chinook											5 / 0.1

Table A-4 (continued). Chenega Bay fish: Halibut, Pacific cod, and rockfish. Sums of the concentrations, ng/g (ppb) wet weight, of aromatic contaminants listed in Table 1 (LAC / HAC) in edible flesh. Angoon = reference site.

												Angoon	
Site	2	2	2	2	2	2	2	2	2	2	2	3	3
Lab No.	28	130	131	485	23	149	151	487	42	150	157	228	322
No. of field samples comprising lab sample	2	2	2	3	3	1	1	1	2	1	1	3	2
Cycle No.	I	II	II	III	I	II	II	III	I	II	II	II	II
Halibut	- / -	- / -	- / -	0.5 / -								0.4 / -	
Pacific cod					- / -	- / -	- / -	0.3 / -					0.6 / -
Rockfish									- / -	- / -	- / -		

Table A-5. Chenega Bay shellfish: Mussels. Sums of the concentrations, ng/g (ppb) wet weight, of aromatic contaminants listed in Table 1 (LAC / HAC) in edible flesh. Angoon = reference site.

						Angoon						
Site	1	1	1	1	1	1	1	2	2	2	1	1
Lab No.	44	114	304	305	306	232	324	231	325	328	326	327
No. of field samples comprising lab sample	2	1	1	1	1	1	1	1	Split samples 1	1	1	1
Cycle No.	I	II	III	III	III	II	II	II	II	II	II	II
Molluscs:												
mussels	220 / 20	160 / 22	200 / 22	190 / 26	96 / 15	0.6 / -	1 / 0.1					
clams												
butter								0.5 / -				
horse									0.5 / -	0.8 / -		
chitons											1 / -	1 / -

Table A-5 (continued). Chenega Bay shellfish: Clams. Sums of the concentrations, ng/g (ppb) wet weight, of aromatic contaminants listed in Table 1 (LAC / HAC) in edible flesh. Angoon = reference site.

			Angoon						
Site	1	1	1	1	2	2	2	1	1
Lab No.	664	665	232	324	231	325	328	326	327
No. of field samples comprising lab sample	1	1	1	1	1	Split samples 1	1	1	1
Cycle No.	I	I	II	II	II	II	II	II	II
Molluscs:									
mussels			0.6 / -	1 / 0.1					
clams									
butter	37 / 5	15 / 3			0.5 / -				
horse						0.5 / -	0.8 / -		
chitons								1 / -	1 / -

Table A-6. Old Harbor fish: Pink salmon. Sums of the concentrations, ng/g (ppb) wet weight, of aromatic contaminants listed in Table 1 (LAC / HAC) in edible flesh. Angoon = reference site.

								Angoon					
Site	2	2	2	2	2	2	2	3	3	3	3	3	3
Lab No.	11	262	269	270	279	650	541	229	320	230	319	323	321
No. of field samples comprising lab sample	1	1	1	3	3	2	1	3	3	3	3	2	3
Cycle No.	I	II	II	II	II	II	III	II	II	II	II	II	II
Salmon:													
pink	- / -	1 / -	2 / 0.1	1 / -	1 / -	4 / 0.3	- / -	2 / -	2 / -				
coho										2 / -	4 / -	2 / -	
chinook													5 / 0.1

Table A-6 (continued). Old Harbor fish: Pink salmon (continued). Sums of the concentrations, ng/g (ppb) wet weight, of aromatic contaminants listed in Table 1 (LAC / HAC) in edible flesh. Angoon = reference site.

								Angoon					
Site	2	2	2	2	2	2	2	3	3	3	3	3	3
Lab No.	544	545	546	555	556	557	558	229	320	230	319	323	321
No. of field samples comprising lab sample	1	1	1	1	1	1	1	3	3	3	3	2	3
Cycle No.	III	III	III	III	III	III	III	II	II	II	II	II	II
Salmon:													
pink	- / -	- / -	- / -	- / -	- / -	- / -	- / -	2 / -	2 / -				
coho										2 / -	4 / -	2 / -	
chinook													5 / 0.1

Table A-6 (continued). Old Harbor fish: Pink salmon (continued), Dolly Varden, and smoked salmon. Sums of the concentrations, ng/g (ppb) wet weight of aromatic contaminants listed in Table 1 (LAC / HAC) in edible flesh. Angoon = reference site.

										Angoon			
Site	2	2	2	2	1	1	2	3	3	3	3	3	3
Lab No.	559	573	598	599	241	244	703	229	320	230	319	323	321
No. of field samples comprising lab sample	1	2	1	2	1	1	1	3	3	3	3	2	3
Cycle No.	III	III	III	III	1	1	1	II	II	II	II	II	II
Salmon:													
pink	- / -	- / -	0.2 / -	0.2 / -				2 / -	2 / -				
coho										2 / -	4 / -	2 / -	
chinook													5 / 0.1
smoked salmon					7100 / 650	7800 / 700							
Dolly Varden							1 / -						

Table A-6 (continued). Old Harbor fish: Halibut and Pacific cod. Sums of the concentrations, ng/g (ppb) wet weight, of aromatic contaminants listed in Table 1 (LAC / HAC) in edible flesh. Angoon = reference site.

						Angoon	
Site	1	1	1	1	2	3	3
Lab No.	40	283	707	26	524	228	322
No. of field samples comprising lab sample	1	3	1	2	1	3	2
Cycle No.	I	II	II	I	III	II	II
Halibut	-/-	1/-	0.8/-			0.4/-	
Pacific cod				-/-	0.7/-		0.6/-

Table A-7. Old Harbor shellfish: Mussels and clams. Sums of the concentrations, ng/g (ppb) wet weight, of aromatic contaminants listed in Table 1 (LAC / HAC) in edible flesh. Angoon = reference site.

								Angoon						
Site	3	3	3	3	3	3	4	1	1	2	2	2	1	1
Lab No.	60	669	225	226	431	432	670	232	324	231	325	328	326	327
No. of field samples comprising lab sample	1	1	1	1	1	1	1	1	1	1	Split samples 1	1	1	1
Cycle No.	I	I	II	II	III	III	I	II	II	II	II	II	II	II
Molluscs:														
mussels	- / -							0.6 / -	1 / 0.1					
clams														
butter		2 / 0.6	2 / 0.8	0.7 / 0.3	1 / 1	0.3 / -	4 / 7			0.5 / -				
horse											0.5 / -	0.8 / -		
chitons													1 / -	1 / -

Table A-7 (continued). Old Harbor shellfish: Clams (continued). Sums of the concentrations, ng/g (ppb) wet weight, of aromatic contaminants listed in Table 1 (LAC / HAC) in edible flesh. Angoon = reference site.

									Angoon			
Site	4	4	4	4	4	1	1	2	2	2	1	1
Lab No.	227	247	418	419	433	232	324	231	325	328	326	327
No. of field samples comprising lab sample	1	1	Split samples 1	1	1	1	1	1	Split samples 1	1	1	1
Cycle No.	II	II	III	III	III	II	II	II	II	II	II	II
Molluscs:												
mussels						0.6 / -	1 / 0.1					
clams												
butter	6 / 5	4 / 3	230 / 21	330 / 29	210 / 20			0.5 / -				
horse									0.5 / -	0.8 / -		
chitons											1 / -	1 / -

Table A-7 (continued). Old Harbor shellfish: Clams (continued), chitons, urchins, and crabs. Sums of the concentrations, ng/g (ppb) wet weight, of aromatic contaminants listed in Table 1 (LAC / HAC) in edible flesh. Angoon = reference site.

								Angoon						
Site	3	4	3	3	3	3	2	1	1	2	2	2	1	1
Lab No.	615	616	79	345	401	691	98	232	324	231	325	328	326	327
No. of field samples comprising lab sample	1	1	1	1	1	1	2	1	1	1	Split samples 1	1	1	1
Cycle No.	III	III	I	II	III	I	I	II	II	II	II	II	II	II
Molluscs:														
mussels								0.6 / -	1 / 0.1					
clams														
butter										0.5 / -				
horse											0.5 / -	0.8 / -		
littleneck	2 / 0.7	200 / 19											1 / -	1 / -
chitons			2 / 0.1	0.9 / -	0.5 / -									
Urchins						5 / 2								
Crabs:														
Tanner							0.1 / -							

Table A-8. Tatitlek fish: Pink salmon and coho salmon. Sums of the concentrations, ng/g (ppb) wet weight, of aromatic contaminants listed in Table 1 (LAC / HAC) in edible flesh. Angoon = reference site.

												Angoon			
Site	2	3	3	3	3	3	7	7	7	3	3	3	3	3	3
Lab No.	1	134	139	135	136	153	362	363	364	229	320	230	319	323	321
No. of field samples comprising lab sample	3	Split samples 1	1	1	1	3	3	3	2	3	3	3	3	2	3
Cycle No.	I	II	II	II	II	II	III	III	III	II	II	II	II	II	II
Salmon:															
pink	0.05 / -	- / -	- / -	- / -	- / -	- / -				2 / -	2 / -				
coho							14 / 1	15 / 1	19 / 2			2 / -	4 / -	2 / -	
chinook															5 / 0.1

Table A-8 (continued). Tatitlek fish: Coho salmon (continued) and smoked salmon. Sums of the concentrations, ng/g (ppb) wet weight, of aromatic contaminants listed in Table 1 (LAC / HAC) in edible flesh. Angoon = reference site; na = not applicable.

							Angoon					
Site	7	7	7	7	na	na	3	3	3	3	3	3
Lab No.	448	449	450	451	526	527	229	320	230	319	323	321
No. of field samples comprising lab sample	2	3	3	2	na	na	3	3	3	3	2	3
Cycle No.	III	III	III	III	na	na	II	II	II	II	II	II
Salmon:												
pink							2 / -	2 / -				
coho	3 / 0.1	5 / 0.2	3 / -	3 / -					2 / -	4 / -	2 / -	
chinook												5 / 0.1
smoked salmon					20000 / 3000	21000 / 1800						

Table A-8 (continued). Tatitlek fish: Halibut, Pacific cod, and rockfish. Sums of the concentrations, ng/g (ppb) wet weight, of aromatic contaminants listed in Table 1 (LAC / HAC) in edible flesh. Angoon = reference site.

						Angoon	
Site	4	6	4	3	4	3	3
Lab No.	27	132	22	701	702	228	322
No. of field samples comprising lab sample	2	2	2	1	1	3	2
Cycle No.	I	II	I	I	I	II	II
Halibut	- / -	- / -				0.4 / -	
Pacific cod			- / -				0.6 / -
Rockfish				1 / -	0.6 / -		

Table A-9. Tatitlek shellfish: Mussels. Sums of the concentrations, ng/g (ppb) wet weight, of aromatic contaminants listed in Table 1 (LAC / HAC) in edible flesh. Angoon = reference site.

									Angoon						
Site	1	1	5	5	5	5	5	5	1	1	2	2		1	1
Lab No.	43	66	111	112	113	307	308	309	232	324	231	325	328	326	327
No. of field samples comprising lab sample	Split samples 2	2	1	1	1	1	1	1	1	1	1	Split samples 1	1	1	1
Cycle No.	I	I	II	II	II	III	III	III	II	II	II	II	II	II	II
Molluscs:															
mussels	- / -	- / -	3 / 0.2	3 / 0.1	3 / 0.3	0.8 / -	1 / -	0.9 / -	0.6 / -	1 / 0.1					
clams															
butter											0.5 / -				
horse												0.5 / -	0.8 / -		
chitons														1 / -	1 / -

Table A-9 (continued). Tatitlek shellfish: Chitons. Sums of the concentrations, ng/g (ppb) wet weight, of aromatic contaminants listed in Table 1 (LAC / HAC) in edible flesh. Angoon = reference site.

			Angoon						
Site	5	5	1	1	2	2		1	1
Lab No.	120	357	232	324	231	325	328	326	327
No. of field samples comprising lab sample	1	1	1	1	1	Split samples 1	1	1	1
Cycle No.	II	III	II	II	II	II	II	II	II
Molluscs:									
mussels			0.6 / -	1 / 0.1					
clams									
butter					0.5 / -				
horse						0.5 / -	0.8 / -		
chitons	- / -	1 / -						1 / -	1 / -

Table A-10. **Larsen Bay fish: Pink salmon. Sums of the concentrations, ng/g (ppb) wet weight, of aromatic contaminants listed in Table 1 (LAC / HAC) in edible flesh. Angoon = reference site.**

								Angoon					
Site	6	7	7	7	8	8	8	3	3	3	3	3	3
Lab No.	281	3	29	10	504	505	506	229	320	230	319	323	321
No. of field samples comprising lab sample	3	Split samples 1	1	1	1	1	1	3	3	3	3	2	3
Cycle No.	II	I	I	I	III	III	III	II	II	II	II	II	II
Salmon:													
pink	2 / -	13 / 0.7	12 / 0.2	1 / -	0.3 / -	0.8 / -	0.8 / -	2 / -	2 / -				
coho										2 / -	4 / -	2 / -	
chinook													5 / 0.1

Table A-10 (continued). Larsen Bay fish: Pink salmon (continued). Sums of the concentrations, ng/g (ppb) wet weight, of aromatic contaminants listed in Table 1 (LAC / HAC) in edible flesh. Angoon = reference site.

									Angoon					
Site	8	8	8	8	8	8	8	8	3	3	3	3	3	3
Lab No.	507	543	581	582	594	595	596	597	229	320	230	319	323	321
No. of field samples comprising lab sample	1	1	3	3	1	1	1	1	3	3	3	3	2	3
Cycle No.	III	III	III	III	III	III	III	III	II	II	II	II	II	II
Salmon:														
pink	0.5 / -	- / -	0.2 / -	0.3 / -	1 / 0.1	0.2 / -	0.7 / -	0.7 / -	2 / -	2 / -				
coho											2 / -	4 / -	2 / -	
chinook														5 / 0.1

Table A-10 (continued). Larsen Bay fish: Sockeye salmon and chum salmon. Sums of the concentrations, ng/g (ppb) wet weight, of aromatic contaminants listed in Table 1 (LAC / HAC) in edible flesh. Angoon = reference site.

							Angoon					
Site	6	6	6	6	6	6	3	3	3	3	3	3
Lab No.	264	282	286	652	653	655	229	320	230	319	323	321
No. of field samples comprising lab sample	3	3	3	3	2	1	3	3	3	3	2	3
Cycle No.	II	II	II	II	II	II	II	II	II	II	II	II
Salmon:												
pink							2 / -	2 / -				
coho									2 / -	4 / -	2 / -	
sockeye	6 / 0.2	3 / -	2 / -	6 / 0.1	3 / -							
chum						1 / -						
chinook												5 / 0.1

Table A-10 (continued). Larsen Bay fish: Halibut and Pacific cod. Sums of the concentrations, ng/g (ppb) wet weight, of aromatic contaminants listed in Table 1 (LAC / HAC) in edible flesh. Angoon = reference site.

								Angoon	
Site	5	6	6	8	8	6	6	3	3
Lab No.	41	284	708	520	521	704	285	228	322
No. of field samples comprising lab sample	1	3	1	2	2	1	2	3	2
Cycle No.	I	II	II	III	III	I	II	II	II
Halibut	- / -	0.3 / -	0.7 / -	0.5 / -	0.6 / -			0.4 / -	
Pacific cod						0.5 / -	0.3 / -		0.6 / -

Table A-11. Larsen Bay shellfish: Mussels and clams. Sums of the concentrations, ng/g (ppb) wet weight, of aromatic contaminants listed in Table 1 (LAC / HAC) in edible flesh. Angoon = reference site.

									Angoon						
Site	1	1	1	1	2	2	2	2	1	1	2	2	2	1	1
Lab No.	61	673	416	435	682	249	250	260	232	324	231	325	328	326	327
No. of field samples comprising lab sample	1	1	1	1	1	1	1	1	1	1	1	Split samples 1	1	1	1
Cycle No.	I	I	III	III	I	II	II	II	II	II	II	II	II	II	II
Molluscs:															
mussels	1 / 0.3								0.6 / -	1 / 0.1					
clams															
butter		3 / 1	0.5 / -	1 / -	2 / 0.1	4 / 0.8	1 / 0.2	4 / 0.8			0.5 / -				
horse												0.5 / -	0.8 / -		
chitons														1 / -	1 / -

Table A-11 (continued). Larsen Bay shellfish: Chitons. Sums of the concentrations, ng/g (ppb) wet weight, of aromatic contaminants listed in Table 1 (LAC / HAC) in edible flesh. Angoon = reference site.

				Angoon						
Site	1	1	2	1	1	2	2	2	1	1
Lab No.	81	346	411	232	324	231	325	328	326	327
No. of field samples comprising lab sample	1	1	1	1	1	1	Split samples 1	1	1	1
Cycle No.	I	II	III	II	II	II	II	II	II	II
Molluscs:										
mussels				0.6 / -	1 / 0.1					
clams										
butter						0.5 / -				
horse							0.5 / -	0.8 / -		
chitons	0.6 / 0.06	0.9 / 0.6	0.4 / -						1 / -	1 / -

Table A-11 (continued). Larsen Bay shellfish: Snails, limpets, urchins, and crabs. Sums of the concentrations, ng/g (ppb) wet weight, of aromatic contaminants listed in Table 1 (LAC / HAC) in edible flesh. Angoon = reference site.

							Angoon						
Site	4	1	3	4	4	4	1	1	2	2	2	1	1
Lab No.	686	690	692	99	100	689	232	324	231	325	328	326	327
No. of field samples comprising lab sample	1	1	1	1	1	1	1	1	1	Split samples 1	1	1	1
Cycle No.	I	I	I	I	I	I	II	II	II	II	II	II	II
Molluscs:													
mussels							0.6 / -	1 / 0.1					
clams													
butter									0.5 / -				
horse										0.5 / -	0.8 / -		
chitons												1 / -	1 / -
snails	1 / -												
limpets		2 / 0.1											
Urchins			2 / 1										
Crabs:													
Dungeness				0.1 / -									
Tanner					0.2 / -								
king						2 / -							

Table A-12. Ouzinkie Fish: Pink salmon. Sums of the concentrations, ng/g (ppb) wet weight, of aromatic contaminants listed in Table 1 (LAC / HAC) in edible flesh. Angoon = reference site.

								Angoon					
Site	1	5	5	5	5	5	5	3	3	3	3	3	3
Lab No.	9	175	191	192	631	632	633	229	320	230	319	323	321
No. of field samples comprising lab sample	2	3	2	3	2	2	2	3	3	3	3	2	3
Cycle No.	I	II	II	II	II	II	II	II	II	II	II	II	II
Salmon:													
pink	- / -	1 / -	3 / -	5 / 0.5	1 / -	1 / -	1 / -	2 / -	2 / -				
coho										2 / -	4 / -	2 / -	
chinook													5 / 0.1

Table A-12 (continued). Ouzinkie fish: Pink salmon (continued) and coho salmon. Sums of the concentrations, ng/g (ppb) wet weight, of aromatic contaminants listed in Table 1 (LAC / HAC) in edible flesh. Angoon = reference site.

									Angoon					
Site	5	5	5	6	6	6	6	6	3	3	3	3	3	3
Lab No.	634	635	636	528	542	563	574	575	229	320	230	319	323	321
No. of field samples comprising lab sample	2	2	2	1	1	2	3	3	3	3	3	3	2	3
Cycle No.	II	II	II	III	III	III	III	III	II	II	II	II	II	II
Salmon:														
pink	1 / -	0.9 / -	1 / -						2 / -	2 / -				
coho				6 / 0.6	0.8 / -	2 / -	0.6 / -	0.6 / -			2 / -	4 / -	2 / -	
chinook														5 / 0.1

Table A-12 (continued). Ouzinkie fish: coho salmon (continued). Sums of the concentrations, ng/g (ppb) wet weight, of aromatic contaminants listed in Table 1 (LAC / HAC) in edible flesh. Angoon = reference site.

				Angoon					
Site	6	6	6	3	3	3	3	3	3
Lab No.	609	610	611	229	320	230	319	323	321
No. of field samples comprising lab sample	2	2	2	3	3	3	3	2	3
Cycle No.	III	III	III	II	II	II	II	II	II
Salmon:									
pink				2 / -	2 / -				
coho	4 / 0.2	2 / -	5 / 0.4			2 / -	4 / -	2 / -	
chinook									5 / 0.1

Table A-12 (continued). Ouzinkie fish: Halibut. Sums of the concentrations, ng/g (ppb) wet weight, of aromatic contaminants listed in Table 1 (LAC / HAC) in edible flesh. Angoon = reference site.

						Angoon	
Site	1	3	3	3	3	3	3
Lab No.	8	171	172	510	519	228	322
No. of field samples comprising lab sample	2	2	2	2	2	3	2
Cycle No.	I	II	II	III	III	II	II
Halibut	- / -	0.2 / -	1 / 0.1	- / -	0.3 / -	0.4 / -	
Pacific cod							0.6 / -

Table A-13. Ouzinkie shellfish: Mussels and clams. Sums of the concentrations, ng/g (ppb) wet weight, of aromatic contaminants listed in Table 1 (LAC / HAC) in edible flesh. Angoon = reference site.

								Angoon						
Site	2	2	2	3	4	2	2	1	1	2	2	2	1	1
Lab No.	395	63	434	672	207	671	214	232	324	231	325	328	326	327
No. of field samples comprising lab sample	1	1	1	1	1	1	1	1	1	1	Split samples 1	1	1	1
Cycle No.	III	I	III	I	II	I	II	II	II	II	II	II	II	II
Molluscs:														
mussels	0.9 / -							0.6 / -	1 / 0.1					
clams														
butter		- / -	0.9 / -	7 / 2	3 / 0.5					0.5 / -				
horse											0.5 / -	0.8 / -		
littleneck						1 / -	0.6 / -							
chitons													1 / -	1 / -

Table A-13 (continued). Ouzinkie shellfish: Chitons. Sums of the concentrations, ng/g (ppb) wet weight, of aromatic contaminants listed in Table 1 (LAC / HAC) in edible flesh. Angoon = reference site.

			Angoon						
Site	2	2	1	1	2	2	2	1	1
Lab No.	80	410	232	324	231	325	328	326	327
No. of field samples comprising lab sample	1	1	1	1	1	Split samples 1	1	1	1
Cycle No.	I	III	II	II	II	II	II	II	II
Molluscs:									
mussels			0.6 / -	1 / 0.1					
clams									
butter					0.5 / -				
horse						0.5 / -	0.8 / -		
littleneck									
chitons	0.1 / -	0.5 / -						1 / -	1 / -

Table A-14. Chiniak fish: Pink salmon. Sums of the concentrations, ng/g (ppb) wet weight, of aromatic contaminants listed in Table 1 (LAC / HAC) in edible flesh. Angoon = reference site.

												Angoon			
Site	5	5	5	5	5	5	5	7	7	3	3	3	3	3	3
Lab No.	261	288	265	266	287	648	649	501	502	229	320	230	319	323	321
No. of field samples comprising lab sample	Split samples 1	1	3	1	3	2	2	1	1	3	3	3	3	2	3
Cycle No.	II	II	II	II	II	II	II	III	III	II	II	II	II	II	II
Salmon:															
pink	2 / -	0.4 / -	3 / 0.2	1 / -	2 / -	4 / 0.2	4 / 0.2	0.3 / -	0.3 / -	2 / -	2 / -				
coho												2 / -	4 / -	2 / -	
chinook															5 / 0.1

Table A-14 (continued). Chiniak fish: Pink salmon (continued), sockeye salmon, and chum salmon. Sums of the concentrations, ng/g (ppb) wet weight, of aromatic contaminants listed in Table 1 (LAC / HAC) in edible flesh. Angoon = reference site.

									Angoon					
Site	7	7	7	7	5	5	5	7	3	3	3	3	3	3
Lab No.	503	579	580	600	651	280	654	525	229	320	230	319	323	321
No. of field samples comprising lab sample	1	3	3	3	1	3	3	2	3	3	3	3	2	3
Cycle No.	III	III	III	III	II	II	II	III	II	II	II	II	II	II
Salmon:														
pink	0.3 / -	0.3 / -	- / -	0.3 / -					2 / -	2 / -				
coho											2 / -	4 / -	2 / -	
sockeye					1 / -									
chum						5 / 0.2	0.8 / -	0.4 / -						
chinook														5 / 0.1

Table A-14 (continued). Chiniak fish: Halibut and rockfish. Sums of the concentrations, ng/g (ppb) wet weight, of aromatic contaminants listed in Table 1 (LAC / HAC) in edible flesh. Angoon = reference site.

				Angoon	
Site	6	6	4	3	3
Lab No.	706	509	25	228	322
No. of field samples comprising lab sample	1	2	2	3	2
Cycle No.	II	III	I	II	II
Halibut	0.8 / -	1 / -		0.4 / -	
Pacific cod					0.6 / -
Rockfish			- / -		

Table A-15. Chiniak shellfish: Mussels and clams. Sums of the concentrations, ng/g (ppb) wet weight, of aromatic contaminants listed in Table 1 (LAC / HAC) in edible flesh. Angoon = reference site.

						Angoon						
Site	1	2	1	1	1	1	1	2	2	2	1	1
Lab No.	57	58	667	413	428	232	324	231	325	328	326	327
No. of field samples comprising lab sample	1	1	1	1	1	1	1	1	Split samples 1	1	1	1
Cycle No.	I	I	I	III	III	II	II	II	II	II	II	II
Molluscs:												
mussels	- / -	- / -				0.6 / -	1 / 0.1					
clams												
butter			1 / 0.1	0.2 / -	0.6 / 0.3			0.5 / -				
horse									0.5 / -	0.8 / -		
chitons											1 / -	1 / -

Table A-15 (continued). Chiniak shellfish: Clams (continued). Sums of the concentrations, ng/g (ppb) wet weight, of aromatic contaminants listed in Table 1 (LAC / HAC) in edible flesh. Angoon = reference site.

								Angoon						
Site	2	2	2	2	1	1	2	1	1	2	2	2	1	1
Lab No.	668	223	415	429	246	613	614	232	324	231	325	328	326	327
											Split samples			
No. of field samples comprising lab sample	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Cycle No.	I	II	III	III	II	III	III	II	II	II	II	II	II	II
Molluscs:														
mussels								0.6 / -	1 / 0.1					
clams														
butter	0.3 / -	0.5 / -	0.3 / -	0.9 / -						0.5 / -				
horse											0.5 / -	0.8 / -		
littleneck					0.6 / 0.3	2 / 0.4	1 / 0.1							
chitons													1 / -	1 / -

Table A-15 (continued). Chiniak shellfish: Clams (continued) and chitons. Sums of the concentrations, ng/g (ppb) wet weight, of aromatic contaminants listed in Table 1 (LAC / HAC) in edible flesh. Angoon = reference site.

							Angoon						
Site	2	2	2	2	2	2	1	1	2	2	2	1	1
Lab No.	303	612	618	77	343	344	232	324	231	325	328	326	327
No. of field samples comprising lab sample	1	Split samples 1	1	1	1	1	1	1	1	Split samples 1	1	1	1
Cycle No.	II	III	III	I	II	II	II	II	II	II	II	II	II
Molluscs:													
mussels							0.6 / -	1 / 0.1					
clams													
butter									0.5 / -				
horse										0.5 / -	0.8 / -		
cockles	0.8 / 0.1	0.7 / -	0.5 / -										
chitons				1 / 0.1	1 / 0.1	1 / 0.1						1 / -	1 / -

Table A-15 (continued). Chiniak shellfish: Chitons (continued), snails, and crabs. Sums of the concentrations, ng/g (ppb) wet weight, of aromatic contaminants listed in Table 1 (LAC / HAC) in edible flesh. Angoon = reference site.

					Angoon						
Site	2	2	2	3	1	1	2	2	2	1	1
Lab No.	397	398	685	97	232	324	231	325	328	326	327
No. of field samples comprising lab sample	1	1	1	1	1	1	1	Split samples 1	1	1	1
Cycle No.	III	III	I	I	II	II	II	II	II	II	II
Molluscs:											
mussels					0.6 / -	1 / 0.1					
clams											
butter							0.5 / -				
horse								0.5 / -	0.8 / -		
chitons	0.5 / -	0.1 / -									
snails			1 / -							1 / -	1 / -
Crabs:											
Dungeness				0.1 / -							

Table A-16. Akhiok fish: Pink salmon, coho salmon, and sockeye salmon. Sums of the concentrations, ng/g (ppb) wet weight, of aromatic contaminants listed in Table 1 (LAC / HAC) in edible flesh. Angoon = reference site.

					Angoon					
Site	4	4	4	1	3	3	3	3	3	3
Lab No.	263	267	560	5	229	320	230	319	323	321
No. of field samples comprising lab sample	1	3	3	2	3	3	3	3	2	3
Cycle No.	II	II	III	I	II	II	II	II	II	II
Salmon:										
pink	4/0.4	1/0.1			2/-	2/-				
coho			-/-				2/-	4/-	2/-	
sockeye				-/-						
chinook										5/0.1

Table A-17. Akhiok shellfish: Mussels, clams, and chitons. Sums of the concentrations, ng/g (ppb) wet weight, of aromatic contaminants listed in Table 1 (LAC / HAC) in edible flesh. Angoon = reference site.

									Angoon						
Site	2	3	2	2	2	3	3	2	1	1	2	2	2	1	1
Lab No.	392	251	62	417	430	301	310	399	232	324	231	325	328	326	327
No. of field samples comprising lab sample	1	1	1	1	1	Split samples 1	1	1	1	1	1	Split samples 1	1	1	1
Cycle No.	III	II	I	III	III	II	II	III	II	II	II	II	II	II	II
Molluscs:															
mussels	0.3 / -	0.4 / -							0.6 / -	1 / 0.1					
clams															
butter			- / -	0.4 / -	0.3 / -						0.5 / -				
horse												0.5 / -	0.8 / -		
littleneck						0.3 / -	0.7 / -								
chitons								1 / -						1 / -	1 / -

Table A-18. Port Lions fish: Pink salmon. Sums of the concentrations, ng/g (ppb) wet weight, of aromatic contaminants listed in Table 1 (LAC / HAC) in edible flesh. Angoon = reference site.

										Angoon			
Site	3	3	7	7	7	7	7	3	3	3	3	3	3
Lab No.	6	169	167	168	173	174	190	229	320	230	319	323	321
No. of field samples comprising lab sample	2	1	1	3	1	3	3	3	3	3	3	2	3
Cycle No.	I	II	II	II	II	II	II	II	II	II	II	II	II
Salmon:													
pink	- / -	3 / 0.2	0.4 / -	0.5 / -	- / -	1 / -	0.3 / -	2 / -	2 / -				
coho										2 / -	4 / -	2 / -	
chinook													5 / 0.1

Table A-18 (continued). Port Lions fish: Pink salmon (continued) and coho salmon. Sums of the concentrations, ng/g (ppb) wet weight, of aromatic contaminants listed in Table 1 (LAC / HAC) in edible flesh. Angoon = reference site.

							Angoon					
Site	7	7	7	3	3	3	3	3	3	3	3	3
Lab No.	196	646	647	564	576	577	229	320	230	319	323	321
No. of field samples comprising lab sample	3	2	2	2	2	3	3	3	3	3	2	3
Cycle No.	II	II	II	III	III	III	II	II	II	II	II	II
Salmon:												
pink	0.2 / -	0.9 / -	0.8 / -				2 / -	2 / -				
coho				2 / -	0.6 / -	0.2 / -			2 / -	4 / -	2 / -	
chinook												5 / 0.1

Table A-18 (continued). Port Lions fish: Coho salmon (continued). Sums of the concentrations, ng/g (ppb) wet weight, of aromatic contaminants listed in Table 1 (LAC / HAC) in edible flesh. Angoon = reference site.

				Angoon					
Site	3	3	3	3	3	3	3	3	3
Lab No.	578	591	592	229	320	230	319	323	321
No. of field samples comprising lab sample	2	2	2	3	3	3	3	2	3
Cycle No.	III	III	III	II	II	II	II	II	II
Salmon:									
pink				2 / -	2 / -				
coho	0.3 / -	3 / 0.1	2 / -			2 / -	4 / -	2 / -	
chinook									5 / 0.1

Table A-18 (continued). Port Lions fish: Halibut and yellowfin sole. Sums of the concentrations, ng/g (ppb) wet weight, of aromatic contaminants listed in Table 1 (LAC / HAC) in edible flesh. Angoon = reference site.

						Angoon	
Site	3	6	8	8	6	3	3
Lab No.	170	21	522	523	705	228	322
No. of field samples comprising lab sample	3	2	2	2	1	3	2
Cycle No.	II	I	III	III	I	II	II
Halibut	0.3 / -	- / -	0.4 / -	0.6 / -		0.4 / -	
Yellowfin sole					0.8 / -		
Pacific cod							0.6 / -

Table A-19. Port Lions shellfish: Clams. Sums of the concentrations, ng/g (ppb) wet weight, of aromatic contaminants listed in Table 1 (LAC / HAC) in edible flesh. Angoon = reference site.

					Angoon						
Site	1	1	1	1	1	1	2	2	2	1	1
Lab No.	64	205	206	414	232	324	231	325	328	326	327
No. of field samples comprising lab sample	1	1	1	1	1	1	1	Split samples 1	1	1	1
Cycle No.	I	II	II	III	II	II	II	II	II	II	II
Molluscs:											
mussels					0.6 / -	1 / 0.1					
clams											
butter	0.9 / 0.4	1 / 0.2	1 / 1	1 / 1			0.5 / -				
horse								0.5 / -	0.8 / -		
chitons										1 / -	1 / -

Table A-19 (continued). Port Lions shellfish: Clams (continued). Sums of the concentrations, ng/g (ppb) wet weight, of aromatic contaminants listed in Table 1 (LAC / HAC) in edible flesh. Angoon = reference site.

						Angoon						
Site	1	2	2	1	1	1	1	2	2	2	1	1
Lab No.	436	65	211	213	617	232	324	231	325	328	326	327
No. of field samples comprising lab sample	1	1	1	1	1	1	1	1	Split samples 1	1	1	1
Cycle No.	III	I	II	II	III	II	II	II	II	II	II	II
Molluscs:												
mussels						0.6 / -	1 / 0.1					
clams												
butter	1 / 1	2 / 0.1	2 / 1					0.5 / -				
horse									0.5 / -	0.8 / -		
littleneck				2 / 1	1 / 1							
chitons											1 / -	1 / -

Table A-19 (continued). Port Lions shellfish: Chitons. Sums of the concentrations, ng/g (ppb) wet weight, of aromatic contaminants listed in Table 1 (LAC / HAC) in edible flesh. Angoon = reference site.

							Angoon						
Site	1	1	1	2	2	2	1	1	2	2	2	1	1
Lab No.	82	210	412	83	84	209	232	324	231	325	328	326	327
No. of field samples comprising lab sample	1	1	1	Split samples 1	1	1	1	1	1	Split samples 1	1	1	1
Cycle No.	I	II	III	I	I	II	II	II	II	II	II	II	II
Molluscs:													
mussels							0.6 / -	1 / 0.1					
clams													
butter									0.5 / -				
horse										0.5 / -	0.8 / -		
chitons	0.6 / -	2 / -	1 / -	0.3 / -	0.4 / -	1 / -						1/ -	1 / -

Table A-19 (continued). Port Lions shellfish: Snails. Sums of the concentrations, ng/g (ppb) wet weight, of aromatic contaminants listed in Table 1 (LAC / HAC) in edible flesh. Angoon = reference site.

			Angoon						
Site	1	2	1	1	2	2	2	1	1
Lab No.	687	688	232	324	231	325	328	326	327
No. of field samples comprising lab sample	1	1	1	1	1	Split samples 1	1	1	1
Cycle No.	I	I	II	II	II	II	II	II	II
Molluscs:									
mussels			0.6 / -	1 / 0.1					
clams									
butter					0.5 / -				
horse						0.5 / -	0.8 / -		
chitons								1 / -	1 / -
snails	0.8 / -	0.9 / -							

Table A-19 (continued). Port Lions shellfish: Crabs. Sums of the concentrations, ng/g (ppb) wet weight, of aromatic contaminants listed in Table 1 (LAC / HAC) in edible flesh. Angoon = reference site.

					Angoon						
Site	5	4	4	4	1	1	2	2	2	1	1
Lab No.	102	101	491	342	232	324	231	325	328	326	327
No. of field samples comprising lab sample	1	1	1	1	1	1	1	Split samples 1	1	1	1
Cycle No.	I	I	III	II	II	II	II	II	II	II	II
Molluscs:											
mussels					0.6 / -	1 / 0.1					
clams											
butter							0.5 / -				
horse								0.5 / -	0.8 / -		
chitons										1 / -	1 / -
Crabs:											
Dungeness	0.1 / -										
Tanner		0.1 / -	0.7 / -								
king				3 / -							

Table A-20. Port Graham/English Bay fish: Pink salmon and coho salmon. Sums of the concentrations, ng/g (ppb) wet weight, of aromatic contaminants listed in Table 1 (LAC / HAC) in edible flesh. Angoon = reference site.

										Angoon					
Site	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
Lab No.	2	133	148	154	155	156	537	93	538	229	320	230	319	323	321
No. of field samples comprising lab sample	1	1	1	2	2	3	3	1	3	3	3	3	3	2	3
Cycle No.	I	II	II	II	II	II	III	I	III	II	II	II	II	II	II
Salmon:															
pink	- / -	1 / -	- / -	- / -	- / -	- / -	- / -			2 / -	2 / -				
coho								1 / -	- / -			2 / -	4 / -	2 / -	
chinook															5 / 0.1

Table A-20 (continued). Port Graham/English Bay fish: Halibut and Irish lord. Sums of the concentrations, ng/g (ppb) wet weight, of aromatic contaminants listed in Table 1 (LAC / HAC) in edible flesh. Angoon = reference site.

					Angoon	
Site	2	5	2	2	3	3
Lab No.	39	486	709	710	228	322
No. of field samples comprising lab sample	1	1	1	1	3	2
Cycle No.	I	III	I	I	II	II
Halibut	- / -	0.2 / -			0.4 / -	
Pacific cod						0.6 / -
Irish lord			0.6 / -	0.4 / -		

Table A-21. Port Graham/English Bay shellfish: Mussels. Sums of the concentrations, ng/g (ppb) wet weight, of aromatic contaminants listed in Table 1 (LAC / HAC) in edible flesh. Angoon = reference site.

						Angoon						
Site	1	1	1	1	1	1	1	2	2	2	1	1
Lab No.	45	115	116	337	338	232	324	231	325	328	326	327
No. of field samples comprising lab sample	2	1	1	1	1	1	1	1	Split samples 1	1	1	1
Cycle No.	I	II	II	III	III	II	II	II	II	II	II	II
Molluscs:												
mussels	- / -	4 / 0.4	1 / -	1 / -	2 / -	0.6 / -	1 / 0.1					
clams												
butter								0.5 / -				
horse									0.5 / -	0.8 / -		
chitons											1 / -	1 / -

Table A-21 (continued). Port Graham/English Bay shellfish: Mussels (continued). Sums of the concentrations, ng/g (ppb) wet weight, of aromatic contaminants listed in Table 1 (LAC / HAC) in edible flesh. Angoon = reference site.

						Angoon						
Site	1	4	4	4	4	1	1	2	2	2	1	1
Lab No.	339	46	117	118	119	232	324	231	325	328	326	327
No. of field samples comprising lab sample	1	1	1	1	1	1	1	1	Split samples 1	1	1	1
Cycle No.	III	I	II	II	II	II	II	II	II	II	II	II
Molluscs:												
mussels	1 / -	2 / 0.2	5 / 12	4 / 9	2 / 3	0.6 / -	1 / 0.1					
clams												
butter								0.5 / -				
horse									0.5 / -	0.8 / -		
chitons											1 / -	1 / -

Table A-21 (continued). Port Graham/English Bay shellfish: Clams, chitons, and snails. Sums of the concentrations, ng/g (ppb) wet weight, of aromatic contaminants listed in Table 1 (LAC / HAC) in edible flesh. Angoon = reference site.

							Angoon						
Site	1	1	1	1	1	4	1	1	2	2	2	1	1
Lab No.	340	302	75	121	359	683	232	324	231	325	328	326	327
No. of field samples comprising lab sample	1	1	1	1	1	1	1	1	1	Split samples 1	1	1	1
Cycle No.	II	II	I	II	III	I	II	II	II	II	II	II	II
Molluscs:													
mussels							0.6 / -	1 / 0.1					
clams													
butter									0.5 / -				
horse										0.5 / -	0.8 / -		
littleneck	20 / 9												
cockles		3 / 10											
chitons			0.7 / -	0.2 / -	0.7 / -							1 / -	1 / -
snails						3 / 0.9							

Table A-22. Karluk fish: Pink salmon, coho salmon, sockeye salmon, and Dolly Varden. Sums of the concentrations, ng/g (ppb) wet weight, of aromatic contaminants listed in Table 1 (LAC / HAC) in edible flesh. Angoon = reference site.

									Angoon			
Site	1	1	1	1	2	1	3	3	3	3	3	3
Lab No.	7	561	562	20	268	95	229	320	230	319	323	321
No. of field samples comprising lab sample	2	2	3	2	2	2	3	3	3	3	2	3
Cycle No.	I	III	III	I	II	I	II	II	II	II	II	II
Salmon:												
pink	- / -						2 / -	2 / -				
coho		0.5 / -	0.5 / -						2 / -	4 / -	2 / -	
sockeye				0.2 / -	0.7 / -							
chinook												5 / 0.1
Dolly Varden						0.6 / -						

Table A-23. Karluk shellfish: Mussels, clams, and chitons. Sums of the concentrations, ng/g (ppb) wet weight, of aromatic contaminants listed in Table 1 (LAC / HAC) in edible flesh. Angoon = reference site.

								Angoon						
Site	1	2	2	2	2	1	2	1	1	2	2	2	1	1
Lab No.	59	245	393	394	224	78	400	232	324	231	325	328	326	327
No. of field samples comprising lab sample	1	1	1	1	1	1	1	1	1	1	Split samples 1	1	1	1
Cycle No.	I	II	III	III	II	I	III	II	II	II	II	II	II	II
Molluscs:														
mussels	- / -	0.4 / -	0.3 / -	0.3 / -				0.6 / -	1 / 0.1					
clams														
butter					0.3 / -					0.5 / -				
horse											0.5 / -	0.8 / -		
chitons						0.2 / -	- / -						1 / -	1 / -

Table A-24. Kasitsna shellfish: Mussels, clams, and chitons. Sums of the concentrations, ng/g (ppb) wet weight, of aromatic contaminants listed in Table 1 (LAC / HAC) in edible flesh. Angoon = reference site.

					Angoon						
Site	1	1	1	1	1	1	2	2	2	1	1
Lab No.	355	356	361	358	232	324	231	325	328	326	327
No. of field samples comprising lab sample	1	1	1	1	1	1	1	Split samples 1	1	1	1
Cycle No.	III	III	III	III	II	II	II	II	II	II	II
Molluscs:											
mussels	1 / -	0.7 / -			0.6 / -	1 / 0.1					
clams											
butter			2 / 0.4				0.5 / -				
horse								0.5 / -	0.8 / -		
chitons				2 / -						1 / -	1 / -

Table A-25. Angoon fish: Pink salmon, coho salmon, chinook salmon, halibut, and Pacific cod. Sums of the concentrations, ng/g (ppb) wet weight, of aromatic contaminants listed in Table 1 (LAC / HAC) in edible flesh.

	Angoon							
Site	3	3	3	3	3	3	3	3
Lab No.	229	320	230	319	323	321	228	322
No. of field samples comprising lab sample	3	3	3	3	2	3	3	2
Cycle No.	II	II	II	II	II	II	II	II
Salmon:								
pink	2 / -	2 / -						
coho			2 / -	4 / -	2 / -			
chinook						5 / 0.1		
Halibut							0.4 / -	
Pacific cod								0.6 / -

Table A-26. Angoon shellfish: Mussels, clams, and chitons. Sums of the concentrations, ng/g (ppb) wet weight, of aromatic contaminants listed in Table 1 (LAC / HAC) in edible flesh.

	Angoon						
Site	1	1	2	2	2	1	1
Lab No.	232	324	231	325	328	326	327
No. of field samples comprising lab sample	1	1	1	Split samples 1	1	1	1
Cycle No.	II	II	II	II	II	II	II
Molluscs:							
mussels	0.6 / -	1 / 0.1					
clams							
butter			0.5 / -				
horse				0.5 / -	0.8 / -		
chitons						1 / -	1 / -

APPENDIX B

CONCENTRATIONS OF INDIVIDUAL AROMATIC CONTAMINANTS IN FISH

Explanatory Notes for Tables B-1 through B-15.

Naphthalene-d8 was the internal standard for naphthalene through C4-naphthalenes. Acenaphthene-d10 was the internal standard for acenaphthylene through C1-fluoranthenes/pyrene. Benzo[a]pyrene-d12 was the internal standard for benz[a]anthracene through benzo[ghi]perylene. Percent recoveries for the internal standards (surrogates) averaged 91%, RSD = 19%, n = 662. Percent recoveries of the surrogates include split or duplicate samples.

Results on sample extracts were determined by gas chromatography/mass spectrometry (GC/MS), using sequenced multiple ion detection.

A hyphen (-) indicates that the analyte was not detected above the limit of detection which ranged from 0.02 to 1 ng/g (ppb) wet weight. This applies to individual contaminants, as well as groupings of contaminants (e.g., C2-phenanthrenes/anthracenes).

Low levels of naphthalene found (a) were indistinguishable from those of blank analyses and are unlikely to indicate exposure to petroleum in the absence of 1- and 2-methylnaphthalene.

Table B-1. Pink salmon. Concentrations, ng/g (ppb) wet weight, of aromatic contaminants (ACs) in edible flesh .

ACs	Village:						<- Kodiak ->								
	Site:	KOD5	KOD5	KOD5	KOD5	KOD5	KOD5	KOD5	KOD5	KOD5	KOD5	KOD5	KOD5	KOD5	KOD5	KOD5
	Cycle:	II	II	II	II	II	II	II	II	II	III	III	III	III	III	III
	D & M no.:	214	214	219	209 215 216	206 217	207 208	207 208	210 213	222 218	496	496	497	497	498	498
		>Split samples<					>Split samples<				>Split samples<		>Split samples<		>Split samples<	
	Lab no.:	166	195	187	188	189	628	637	629	630	488	489	490	492	539	540
naphthalene		a	a	a	a	a	a	a	a	a	a	a	a	a	a	a
C1-naphthalenes		7	5	3	2	0.6	4	0.9	0.2	1	-	-	-	-	-	-
C2-naphthalenes		14	10	6	1	-	8	0.7	-	0.9	-	-	-	-	-	-
C3-naphthalenes		9	6	6	1	0.5	8	0.5	-	0.7	-	-	-	-	-	-
C4-naphthalenes		0.1	0.1	0.2	-	-	0.3	-	-	-	-	-	-	-	-	-
acenaphthylene		0.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-
acenaphthene		14	9	6	4	0.2	9	3	-	5	-	-	-	-	-	-
fluorene		15	10	7	3	1	12	3	-	5	-	-	-	-	-	-
C1-fluorenes		3	2	2	0.3	0.3	4	0.5	-	0.5	-	-	-	-	-	-
C2-fluorenes		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C3-fluorenes		-	-	-	-	-	-	-	-	-	-	-	-	0.3	-	-
phenanthrene		37	24	18	10	3	30	12	4	17	0.7	0.5	1	0.7	0.9	3
C1-phenanthrenes/anthracenes		3	1	2	0.2	-	3	0.4	-	0.3	-	-	-	-	-	-
C2-phenanthrenes/anthracenes		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C3-phenanthrenes/anthracenes		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C4-phenanthrenes/anthracenes		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
dibenzothiophene		5	4	3	1	0.5	5	1	0.2	2	-	-	-	-	-	-
C1-dibenzothiophenes		1	0.6	1	-	-	1	-	-	-	-	-	-	-	-	-
C2-dibenzothiophenes		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C3-dibenzothiophenes		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Sum of LACs		110	72	54	22	6	84	22	4	32	0.7	0.5	1	1	0.9	3
fluoranthene		12	8	5	2	0.2	10	3	0.2	5	-	-	-	-	-	-
pyrene		0.3	-	-	-	-	0.1	-	-	-	-	-	-	-	-	-
C1-fluoranthenes/pyrenes		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
benz[a]anthracene		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
chrysene		0.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C1-chrysenes/benz[a]anthracenes		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C2-chrysenes/benz[a]anthracenes		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C3-chrysenes/benz[a]anthracenes		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C4-chrysenes/benz[a]anthracenes		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
benzo[b]fluoranthene		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
benzo[k]fluoranthene		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
benzo[a]pyrene		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
indeno[1,2,3-cd]pyrene		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
dibenz[a,h]anthracene		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
benzo[ghi]perylene		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Sum of HACs		12	8	5	2	0.2	10	3	0.2	5	-	-	-	-	-	-
sample weight, grams:		5.10	5.25	5.00	5.11	5.40	5.03	5.07	5.17	5.36	5.38	5.33	5.35	5.40	5.04	5.34

Table B-2. Pink salmon. Concentrations, ng/g (ppb) wet weight, of aromatic contaminants (ACs) in edible flesh.

ACs																			
	Village:								<- Chenega Bay ->										
	Site:	CHE3	CHE3	CHE3	CHE4	CHE4	CHE4	CHE4	CHE4	CHE4	CHE4	CHE4	CHE4	CHE4	CHE4	CHE4	CHE4	CHE4	CHE4
	Cycle:	II	II	II	III	III	III	III	III	III	III	III	III	III	III	III	III	III	III
	D & M no.:	142	145	143	462	464	464	442	443	445	446	447	448	449	450	451	460	461	463
		144	146	141		>Split samples<													
			147	140															
	Lab no.:	137	138	152	452	453	456	454	455	465	466	467	468	469	470	471	472	473	474
naphthalene		a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a
C1-naphthalenes		0.4	3	-	-	0.1	0.2	0.2	-	-	-	-	-	-	-	-	-	-	-
C2-naphthalenes		-	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C3-naphthalenes		-	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C4-naphthalenes		-	-	-	-	-	-	0.06	-	-	-	-	-	-	-	-	-	-	-
acenaphthylene		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
acenaphthene		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
fluorene		-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C1-fluorenes		-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C2-fluorenes		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C3-fluorenes		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
phenanthrene		0.5	5	-	0.3	2	2	0.9	0.2	-	0.4	-	-	-	-	0.6	-	3	1
C1-phenanthrenes/anthracenes		-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C2-phenanthrenes/anthracenes		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C3-phenanthrenes/anthracenes		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C4-phenanthrenes/anthracenes		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
dibenzothiophene		-	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C1-dibenzothiophenes		-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C2-dibenzothiophenes		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C3-dibenzothiophenes		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Sum of LACs		0.9	20	-	0.3	2	2	1	0.2	-	0.4	-	-	-	-	0.6	-	3	1
fluoranthene		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
pyrene		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C1-fluoranthenes/pyrenes		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
benz[a]anthracene		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
chrysene		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C1-chrysenes/benz[a]anthracenes		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C2-chrysenes/benz[a]anthracenes		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C3-chrysenes/benz[a]anthracenes		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C4-chrysenes/benz[a]anthracenes		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
benzo[b]fluoranthene		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
benzo[k]fluoranthene		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
benzo[a]pyrene		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
indeno[1,2,3-cd]pyrene		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
dibenz[a,h]anthracene		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
benzo[ghi]perylene		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Sum of HACs		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
sample weight, grams:		5.07	5.38	4.47	5.01	5.42	5.44	5.08	4.93	5.29	5.08	5.01	5.04	5.52	5.67	5.68	5.03	5.48	5.16

Table B-3. Pink salmon. Concentrations, ng/g (ppb) wet weight, of aromatic contaminants (ACs) in edible flesh.

	Village:	<- Chenega Bay ->								<- Old Harbor ->									
	Site:	CHE4	CHE4	CHE4	OHA2	OHA2	OHA2	OHA2	OHA2	OHA2	OHA2	OHA2	OHA2	OHA2	OHA2	OHA2	OHA2	OHA2	OHA2
	Cycle:	III	III	III	I	II	II	II	II	II	III	III	III	III	III	III	III	III	III
	D & M no.:	465	466 467	444	117	326	327	328 329 330	333 334 335	331 332	617	616	622	623	624	625	626	627	628
ACs	Lab no.:	483	484	593	11	262	269	270	279	650	541	544	545	546	555	556	557	558	559
naphthalene		a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a
C1-naphthalenes		-	-	0.3	-	0.5	1	0.4	0.3	1	-	-	-	-	-	-	-	-	-
C2-naphthalenes		-	-	-	-	-	-	-	-	0.1	-	-	-	-	-	-	-	-	-
C3-naphthalenes		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C4-naphthalenes		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
acenaphthylene		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
acenaphthene		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
fluorene		-	-	-	-	-	-	-	-	0.2	-	-	-	-	-	-	-	-	-
C1-fluorenes		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C2-fluorenes		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C3-fluorenes		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
phenanthrene		0.3	0.8	0.4	-	0.6	1	1	0.8	3	-	-	-	-	-	-	-	-	-
C1-phenanthrenes/anthracenes		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C2-phenanthrenes/anthracenes		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C3-phenanthrenes/anthracenes		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C4-phenanthrenes/anthracenes		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
dibenzothiophene		-	-	-	-	-	-	-	-	0.2	-	-	-	-	-	-	-	-	-
C1-dibenzothiophenes		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C2-dibenzothiophenes		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C3-dibenzothiophenes		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Sum of LACs		**0.3**	**0.8**	**0.7**	-	**1**	**2**	**1**	**1**	**4**	-	-	-	-	-	-	-	-	-
fluoranthene		-	-	-	-	-	0.1	-	-	0.3	-	-	-	-	-	-	-	-	-
pyrene		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C1-fluoranthenes/pyrenes		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
benz[a]anthracene		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
chrysene		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C1-chrysenes/benz[a]anthracenes		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C2-chrysenes/benz[a]anthracenes		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C3-chrysenes/benz[a]anthracenes		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C4-chrysenes/benz[a]anthracenes		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
benzo[b]fluoranthene		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
benzo[k]fluoranthene		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
benzo[a]pyrene		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
indeno[1,2,3-cd]pyrene		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
dibenz[a,h]anthracene		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
benzo[ghi]perylene		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Sum of HACs		-	-	-	-	-	0.1	-	-	0.3	-	-	-	-	-	-	-	-	-
sample weight, grams:		5.13	5.42	5.17	3.10	5.38	5.11	4.77	5.52	5.14	5.48	5.56	5.39	5.11	5.34	5.11	5.31	5.30	5.23

Table B-4. Pink salmon. Concentrations, ng/g (ppb) wet weight, of aromatic contaminants (ACs) in edible flesh.

Village:	<- Old Harbor ->				<- Tatitlek ->						<- Larsen Bay ->							
Site:	OHA2	OHA2	OHA2	TAT2	TAT3	TAT3	TAT3	TAT3	TAT3	LAB6	LAB7	LAB7	LAB7	LAB8	LAB8	LAB8	LAB8	LAB8
Cycle:	III	III	III	I	II	II	II	II	II	II	I	I	I	III	III	III	III	III
D & M no.:	618	629	620	4	153	153	155	162	150	299	106	107	107	590	592	597	598	596
	619		621	5	>Split samples<				151	312		>Split samples<						
ACs				6					161	301								
Lab no.:	573	598	599	1	134	139	135	136	153	281	10	3	29	504	505	506	507	543
naphthalene	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a
C1-naphthalenes	-	-	-	-	-	-	-	-	-	0.4	-	-	-	-	-	-	-	-
C2-naphthalenes	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C3-naphthalenes	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C4-naphthalenes	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
acenaphthylene	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
acenaphthene	-	-	-	-	-	-	-	-	-	-	-	1	0.1	-	-	-	-	-
fluorene	-	-	-	-	-	-	-	-	-	-	-	1	0.3	-	-	-	-	-
C1-fluorenes	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C2-fluorenes	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C3-fluorenes	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
phenanthrene	-	0.2	0.2	0.05	-	-	-	-	-	2	1	11	12	0.3	0.8	0.8	0.5	-
C1-phenanthrenes/anthracenes	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C2-phenanthrenes/anthracenes	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C3-phenanthrenes/anthracenes	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C4-phenanthrenes/anthracenes	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
dibenzothiophene	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C1-dibenzothiophenes	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C2-dibenzothiophenes	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C3-dibenzothiophenes	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Sum of LACs	-	0.2	0.2	0.05	-	-	-	-	-	2	1	13	12	0.3	0.8	0.8	0.5	-
fluoranthene	-	-	-	-	-	-	-	-	-	-	-	0.7	0.2	-	-	-	-	-
pyrene	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C1-fluoranthenes/pyrenes	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
benz[a]anthracene	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
chrysene	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C1-chrysenes/benz[a]anthracenes	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C2-chrysenes/benz[a]anthracenes	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C3-chrysenes/benz[a]anthracenes	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C4-chrysenes/benz[a]anthracenes	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
benzo[b]fluoranthene	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
benzo[k]fluoranthene	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
benzo[a]pyrene	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
indeno[1,2,3-cd]pyrene	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
dibenz[a,h]anthracene	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
benzo[ghi]perylene	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Sum of HACs	-	-	-	-	-	-	-	-	-	-	-	0.7	0.2	-	-	-	-	-
sample weight, grams:	5.39	5.36	5.08	3.83	5.25	5.12	5.40	5.20	4.47	4.62	3.47	3.00	4.01	5.40	5.28	5.35	5.27	5.32

Table B-5. Pink salmon. Concentrations, ng/g (ppb) wet weight, of aromatic contaminants (ACs) in edible flesh.

ACs																		
Village:	<- Larsen Bay ->						<- Ouzinkie ->										<- Akhiok ->	
Site:	LAB8	LAB8	LAB8	LAB8	LAB8	LAB8	OUZ1	OUZ5	OUZ5	OUZ5	OUZ5	OUZ5	OUZ5	OUZ5	OUZ5	OUZ5	AKH4	AKH4
Cycle:	III	III	III	III	III	III	I	II	II	II	II	II	II	II	II	II	II	II
D & M no.:	591 593 602	595 600 603	599	604	601	594	57 58	254 257 270	263 264	258 259 268	265 271	272 273	274 275	260 261	262 255	256 269	357	282 356 283
Lab no.:	581	582	594	595	596	597	9	175	191	192	631	632	633	634	635	636	263	267
naphthalene	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a
C1-naphthalenes	-	-	-	-	0.2	0.2	-	0.2	0.8	0.3	-	-	-	-	-	-	1	0.2
C2-naphthalenes	-	-	-	-	-	-	-	-	0.3	0.3	-	-	-	-	-	-	-	-
C3-naphthalenes	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C4-naphthalenes	-	-	0.09	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
acenaphthylene	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
acenaphthene	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.2	-
fluorene	-	-	-	-	-	-	-	-	0.1	0.4	-	-	-	-	-	-	0.3	-
C1-fluorenes	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C2-fluorenes	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C3-fluorenes	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
phenanthrene	0.2	0.3	0.9	0.2	0.5	0.5	-	1	2	4	1	1	1	1	0.9	1	3	1
C1-phenanthrenes/anthracenes	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C2-phenanthrenes/anthracenes	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C3-phenanthrenes/anthracenes	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C4-phenanthrenes/anthracenes	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
dibenzothiophene	-	-	-	-	-	-	-	-	0.2	0.2	-	-	-	-	-	-	-	-
C1-dibenzothiophenes	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C2-dibenzothiophenes	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C3-dibenzothiophenes	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Sum of LACs	0.2	0.3	1	0.2	0.7	0.7	-	1	3	5	1	1	1	1	0.9	1	4	1
fluoranthene	-	-	0.1	-	-	-	-	-	-	0.5	-	-	-	-	-	-	0.4	0.1
pyrene	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C1-fluoranthenes/pyrenes	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
benz[a]anthracene	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
chrysene	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C1-chrysenes/benz[a]anthracenes	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C2-chrysenes/benz[a]anthracenes	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C3-chrysenes/benz[a]anthracenes	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C4-chrysenes/benz[a]anthracenes	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
benzo[b]fluoranthene	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
benzo[k]fluoranthene	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
benzo[a]pyrene	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
indeno[1,2,3-cd]pyrene	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
dibenz[a,h]anthracene	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
benzo[ghi]perylene	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Sum of HACs	-	-	0.1	-	-	-	-	-	-	0.5	-	-	-	-	-	-	0.4	0.1
sample weight, grams:	5.34	5.33	5.17	5.28	5.24	5.34	3.23	4.72	5.21	4.73	5.03	5.04	5.11	5.16	5.13	5.03	5.23	5.78

Table B-6. Pink salmon. Concentrations, ng/g (ppb) wet weight, of aromatic contaminants (ACs) in edible flesh.

ACs	Village:					<- Chiniak ->								<- Port Lions ->				
	Site: CHI5	CHI5	CHI5	CHI5	CHI5	CHI5	CHI5	CHI7	CHI7	CHI7	CHI7	CHI7	CHI7	PTL3	PTL3	PTL7	PTL7	PTL7
	Cycle: II	II	II	II	II	II	II	III	III	III	III	III	III	I	II	II	II	II
	D & M no.: 338	338	339	346	340	344	352	509	502	505	500	504	511	69	234	242	286	241
	>Split samples<		343		341	342	349				501	508	506	70			287	
			345		348						507	516	517				289	
	Lab no.: 261	288	265	266	287	648	649	501	502	503	579	580	600	6	169	167	168	173
naphthalene	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a
C1-naphthalenes	1	0.1	0.5	0.5	0.6	0.8	0.7	-	-	-	-	-	-	-	0.4	0.2	0.1	-
C2-naphthalenes	-	-	0.1	-	-	0.1	0.1	-	-	-	-	-	-	-	0.04	-	-	-
C3-naphthalenes	-	-	0.1	-	-	0.1	0.1	-	-	-	-	-	-	-	-	-	-	-
C4-naphthalenes	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
acenaphthylene	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
acenaphthene	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
fluorene	-	-	0.2	-	-	0.1	0.2	-	-	-	-	-	-	-	0.2	-	-	-
C1-fluorenes	-	-	0.1	-	-	0.2	0.2	-	-	-	-	-	-	-	-	-	-	-
C2-fluorenes	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C3-fluorenes	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
phenanthrene	0.6	0.3	2	0.6	1	2	2	0.3	0.3	0.3	0.3	-	0.3	-	2	0.2	0.4	-
C1-phenanthrenes/anthracenes	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C2-phenanthrenes/anthracenes	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C3-phenanthrenes/anthracenes	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C4-phenanthrenes/anthracenes	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
dibenzothiophene	-	-	0.1	-	-	0.2	0.2	-	-	-	-	-	-	-	-	-	-	-
C1-dibenzothiophenes	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C2-dibenzothiophenes	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C3-dibenzothiophenes	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Sum of LACs	**2**	**0.4**	**3**	**1**	**2**	**4**	**4**	**0.3**	**0.3**	**0.3**	**0.3**	**-**	**0.3**	**-**	**3**	**0.4**	**0.5**	**-**
fluoranthene	-	-	0.2	-	-	0.2	0.2	-	-	-	-	-	-	-	0.2	-	-	-
pyrene	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C1-fluoranthenes/pyrenes	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
benz[a]anthracene	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
chrysene	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C1-chrysenes/benz[a]anthracenes	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C2-chrysenes/benz[a]anthracenes	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C3-chrysenes/benz[a]anthracenes	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C4-chrysenes/benz[a]anthracenes	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
benzo[b]fluoranthene	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
benzo[k]fluoranthene	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
benzo[a]pyrene	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
indeno[1,2,3-cd]pyrene	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
dibenz[a,h]anthracene	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
benzo[ghi]perylene	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Sum of HACs	**-**	**-**	**0.2**	**-**	**-**	**0.2**	**0.2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**0.2**	**-**	**-**	**-**
sample weight, grams:	5.09	5.43	5.37	4.91	5.01	5.00	5.27	5.38	5.23	5.31	5.17	5.11	5.36	3.06	5.56	5.21	5.82	5.35

Table B-7. Pink salmon. Concentrations, ng/g (ppb) wet weight, of aromatic contaminants (ACs) in edible flesh.

ACs	Village:	<- Port Lions ->					<- Port Graham/ English Bay ->							Karluk	<-Angoon ->	
	Site:	PTL7	PTL7	PTL7	PTL7	PTL7	PTG3	PTG3	PTG3	PTG3	PTG3	PTG3	PTG3	KAR1	AGN3	AGN3
	Cycle:	II	II	II	II	II	I	II	II	II	II	II	III	I	II	II
	D & M no.:	243 284 290	240 244 245	246 247 248	239 285	288 291	31	135	128	127 129	130 133	134 131 132	480 479 485	84 83	187 188 189	180 190 185
	Lab no.:	174	190	196	646	647	2	133	148	154	155	156	537	7	229	320
naphthalene		a	a	a	a	a	a	a	a	a	a	a	a	a	a	a
C1-naphthalenes		0.2	-	-	0.5	0.3	-	-	-	-	-	-	-	-	1	0.9
C2-naphthalenes		-	-	-	-	-	-	-	-	-	-	-	-	-	0.09	-
C3-naphthalenes		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C4-naphthalenes		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
acenaphthylene		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
acenaphthene		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
fluorene		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C1-fluorenes		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C2-fluorenes		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C3-fluorenes		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
phenanthrene		1	0.3	0.2	0.4	0.5	-	1	-	-	-	-	-	-	1	1
C1-phenanthrenes/anthracenes		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C2-phenanthrenes/anthracenes		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C3-phenanthrenes/anthracenes		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C4-phenanthrenes/anthracenes		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
dibenzothiophene		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C1-dibenzothiophenes		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C2-dibenzothiophenes		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C3-dibenzothiophenes		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Sum of LACs		1	0.3	0.2	0.9	0.8	-	1	-	-	-	-	-	-	2	2
fluoranthene		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
pyrene		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C1-fluoranthenes/pyrenes		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
benz[a]anthracene		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
chrysene		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C1-chrysenes/benz[a]anthracenes		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C2-chrysenes/benz[a]anthracenes		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C3-chrysenes/benz[a]anthracenes		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C4-chrysenes/benz[a]anthracenes		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
benzo[b]fluoranthene		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
benzo[k]fluoranthene		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
benzo[a]pyrene		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
indeno[1,2,3-cd]pyrene		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
dibenz[a,h]anthracene		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
benzo[ghi]perylene		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Sum of HACs		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
sample weight, grams:		5.24	5.14	5.51	5.01	5.05	3.20	5.04	4.53	4.41	4.46	4.87	5.40	3.43	5.58	5.37

Table B-8. Coho salmon. Concentrations, ng/g (ppb) wet weight, of aromatic contaminants (ACs) in edible flesh.

ACs															
	Village:		<- Tatitlek ->							<- Ouzinkie ->					
	Site:	TAT7	TAT7	TAT7	TAT7	TAT7	TAT7	TAT7	OUZ6	OUZ6	OUZ6	OUZ6	OUZ6	OUZ6	OUZ6	OUZ6
	Cycle:	III	III	III	III	III	III	III	III	III	III	III	III	III	III	III
	D & M no.:	434	425	430	440	431	436	424	201	455	202	361	456	200	360	454
		437	426	432	441	433	438	429			452	362	457	203	453	459
		439	428			435	427					363	458			
	Lab no.:	362	363	364	448	449	450	451	528	542	563	574	575	609	610	611
naphthalene		a	a	a	a	a	a	a	a	a	a	a	a	a	a	a
C1-naphthalenes		2	2	2	0.3	0.7	0.2	0.2	0.4	-	0.5	-	-	1	0.7	0.9
C2-naphthalenes		2	2	3	-	0.2	-	2	-	-	-	-	-	0.4	-	-
C3-naphthalenes		2	1	2	-	0.2	-	-	-	-	-	-	-	0.2	-	-
C4-naphthalenes		-	-	0.1	-	-	0.2	-	0.7	-	-	-	-	-	-	-
acenaphthylene		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
acenaphthene		1	0.9	1	-	-	-	-	-	-	-	-	-	-	-	-
fluorene		1	1	2	-	0.2	-	-	-	-	-	-	-	0.3	-	-
C1-fluorenes		0.3	0.3	0.4	-	-	-	-	-	-	-	-	-	-	-	-
C2-fluorenes		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C3-fluorenes		-	-	-	-	-	-	-	0.3	-	-	-	-	0.3	0.2	0.6
phenanthrene		4	5	6	2	3	2	1	3	0.8	1	0.6	0.6	2	1	3
C1-phenanthrenes/anthracenes		0.2	0.4	0.6	-	-	-	-	-	-	-	-	-	-	-	-
C2-phenanthrenes/anthracenes		-	-	-	-	-	-	-	0.3	-	-	-	-	-	-	-
C3-phenanthrenes/anthracenes		-	-	-	-	-	-	-	0.7	-	-	-	-	-	-	-
C4-phenanthrenes/anthracenes		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
dibenzothiophene		1	2	2	0.4	1	0.3	-	-	-	-	-	-	0.3	-	0.2
C1-dibenzothiophenes		0.1	0.09	0.2	-	-	-	-	-	-	-	-	-	-	-	-
C2-dibenzothiophenes		-	-	-	-	-	-	-	0.4	-	-	-	-	-	-	-
C3-dibenzothiophenes		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Sum of LACs		**14**	**15**	**19**	**3**	**5**	**3**	**3**	**6**	**0.8**	**2**	**0.6**	**0.6**	**4**	**2**	**5**
fluoranthene		1	1	2	0.1	0.2	-	-	-	-	-	-	-	0.2	-	0.4
pyrene		0.1	-	0.3	-	-	-	-	0.6	-	-	-	-	-	-	-
C1-fluoranthenes/pyrenes		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
benz[a]anthracene		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
chrysene		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C1-chrysenes/benz[a]anthracenes		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C2-chrysenes/benz[a]anthracenes		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C3-chrysenes/benz[a]anthracenes		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C4-chrysenes/benz[a]anthracenes		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
benzo[b]fluoranthene		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
benzo[k]fluoranthene		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
benzo[a]pyrene		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
indeno[1,2,3-cd]pyrene		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
dibenz[a,h]anthracene		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
benzo[ghi]perylene		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Sum of HACs		**1**	**1**	**2**	**0.1**	**0.2**	**-**	**-**	**0.6**	**-**	**-**	**-**	**-**	**0.2**	**-**	**0.4**
sample weight, grams:		4.74	5.28	5.25	4.90	5.22	5.07	5.11	5.34	5.38	5.28	5.33	5.28	5.22	5.47	5.18

Table B-9. Coho salmon. Concentrations, ng/g (ppb) wet weight, of aromatic contaminants (ACs) in edible flesh.

ACs	Village:	<- Port Lions ->						Port Gra./Eng.Bay		<- Karluk ->		Akhiok	<- Angoon ->		
	Site:	PTL3	PTL3	PTL3	PTL3	PTL3	PTL3	PTG3	PTG3	KAR1	KAR1	AKH4	AGN3	AGN3	AGN3
	Cycle:	III	III	III	III	III	III	I	III	III	III	III	II	II	II
	D & M no.:	572 578	574 521	573 575 576	579 577	520 522	523 580	30	481 482 483	372 373	374 375 376	381 382 383	181 182 184	177 178 186	193 192
	Lab no.:	564	576	577	578	591	60-592	60-93	60-538	60-561	60-562	560	60-230	60-319	60-323
naphthalene		a	a	a	a	a	a	a	a	a	a	a	a	a	a
C1-naphthalenes		0.8	0.09	-	-	0.8	0.6	0.5	-	-	0.2	-	1	2	1
C2-naphthalenes		-	-	-	-	0.1	-	-	-	-	-	-	0.2	0.7	0.2
C3-naphthalenes		-	-	-	-	-	-	-	-	-	-	-	-	0.1	-
C4-naphthalenes		-	-	-	-	-	-	-	-	-	-	-	-	-	-
acenaphthylene		-	-	-	-	-	-	-	-	-	-	-	-	-	-
acenaphthene		-	-	-	-	-	-	-	-	-	-	-	-	-	-
fluorene		-	-	-	-	-	-	-	-	-	-	-	-	0.1	-
C1-fluorenes		-	-	-	-	-	-	-	-	-	-	-	-	-	-
C2-fluorenes		-	-	-	-	-	-	-	-	-	-	-	-	-	-
C3-fluorenes		-	-	-	-	-	-	-	-	-	-	-	-	-	-
phenanthrene		1	0.6	0.2	0.3	2	1	0.7	-	0.5	0.3	-	1	1	1
C1-phenanthrenes/anthracenes		-	-	-	-	-	-	-	-	-	-	-	-	-	-
C2-phenanthrenes/anthracenes		-	-	-	-	-	-	-	-	-	-	-	-	-	-
C3-phenanthrenes/anthracenes		-	-	-	-	-	-	-	-	-	-	-	-	-	-
C4-phenanthrenes/anthracenes		-	-	-	-	-	-	-	-	-	-	-	-	-	-
dibenzothiophene		-	-	-	-	0.1	-	-	-	-	-	-	-	-	-
C1-dibenzothiophenes		-	-	-	-	-	-	-	-	-	-	-	-	-	-
C2-dibenzothiophenes		-	-	-	-	-	-	-	-	-	-	-	-	-	-
C3-dibenzothiophenes		-	-	-	-	-	-	-	-	-	-	-	-	-	-
Sum of LACs		2	0.6	0.2	0.3	3	2	1	-	0.5	0.5	-	2	4	2
fluoranthene		-	-	-	-	0.1	-	-	-	-	-	-	-	-	-
pyrene		-	-	-	-	-	-	-	-	-	-	-	-	-	-
C1-fluoranthenes/pyrenes		-	-	-	-	-	-	-	-	-	-	-	-	-	-
benz[a]anthracene		-	-	-	-	-	-	-	-	-	-	-	-	-	-
chrysene		-	-	-	-	-	-	-	-	-	-	-	-	-	-
C1-chrysenes/benz[a]anthracenes		-	-	-	-	-	-	-	-	-	-	-	-	-	-
C2-chrysenes/benz[a]anthracenes		-	-	-	-	-	-	-	-	-	-	-	-	-	-
C3-chrysenes/benz[a]anthracenes		-	-	-	-	-	-	-	-	-	-	-	-	-	-
C4-chrysenes/benz[a]anthracenes		-	-	-	-	-	-	-	-	-	-	-	-	-	-
benzo[b]fluoranthene		-	-	-	-	-	-	-	-	-	-	-	-	-	-
benzo[k]fluoranthene		-	-	-	-	-	-	-	-	-	-	-	-	-	-
benzo[a]pyrene		-	-	-	-	-	-	-	-	-	-	-	-	-	-
indeno[1,2,3-cd]pyrene		-	-	-	-	-	-	-	-	-	-	-	-	-	-
dibenz[a,h]anthracene		-	-	-	-	-	-	-	-	-	-	-	-	-	-
benzo[ghi]perylene		-	-	-	-	-	-	-	-	-	-	-	-	-	-
Sum of HACs		-	-	-	-	0.1	-	-	-	-	-	-	-	-	-
sample weight, grams:		5.26	5.45	5.49	5.10	5.35	5.03	4.99	5.16	5.13	5.15	5.17	5.09	5.54	4.85

Table B-10. Sockeye salmon. Concentrations, ng/g (ppb) wet weight, of aromatic contaminants (ACs) in edible flesh.

ACs											
	Village:	Kodiak	<- Larsen Bay ->					Chiniak	Akhiok	<- Karluk ->	
	Site:	KOD5	LAB6	LAB6	LAB6	LAB6	LAB6	CHI5	AKH1	KAR1	KAR1
	Cycle:	II	II	II	II	II	II	II	I	I	II
	D & M no.:	211	296	298	309	307	295	347	91	86	280
			297	304	311	308	300		92	87	281
			302	306	303	305					
	Lab no.:	194	264	282	286	652	653	651	5	20	268
naphthalene		a	a	a	a	a	a	a	a	a	a
C1-naphthalenes		0.9	2	0.6	0.7	2	0.9	0.5	-	-	0.3
C2-naphthalenes		0.9	0.7	0.1	-	0.5	-	-	-	-	-
C3-naphthalenes		1	0.1	-	-	0.06	-	-	-	-	-
C4-naphthalenes		-	-	-	-	-	-	-	-	0.2	-
acenaphthylene		-	-	-	-	-	-	-	-	-	-
acenaphthene		0.8	-	-	-	-	-	-	-	-	-
fluorene		2	0.8	0.3	0.2	0.5	-	-	-	-	-
C1-fluorenes		0.4	-	-	-	0.2	-	-	-	-	-
C2-fluorenes		-	-	-	-	-	-	-	-	-	-
C3-fluorenes		-	-	-	-	-	-	-	-	-	-
phenanthrene		4	2	2	1	2	2	0.7	-	-	0.4
C1-phenanthrenes/anthracenes		0.1	0.1	-	-	-	-	-	-	-	-
C2-phenanthrenes/anthracenes		-	-	-	-	-	-	-	-	-	-
C3-phenanthrenes/anthracenes		-	-	-	-	-	-	-	-	-	-
C4-phenanthrenes/anthracenes		-	-	-	-	-	-	-	-	-	-
dibenzothiophene		1	0.7	0.4	0.1	0.6	0.2	-	-	-	-
C1-dibenzothiophenes		-	-	-	-	-	-	-	-	-	-
C2-dibenzothiophenes		-	-	-	-	-	-	-	-	-	-
C3-dibenzothiophenes		-	-	-	-	-	-	-	-	-	-
Sum of LACs		**11**	**6**	**3**	**2**	**6**	**3**	**1**	**-**	**0.2**	**0.7**
fluoranthene		0.5	0.2	-	-	0.1	-	-	-	-	-
pyrene		-	-	-	-	-	-	-	-	-	-
C1-fluoranthenes/pyrenes		-	-	-	-	-	-	-	-	-	-
benz[a]anthracene		-	-	-	-	-	-	-	-	-	-
chrysene		-	-	-	-	-	-	-	-	-	-
C1-chrysenes/benz[a]anthracenes		-	-	-	-	-	-	-	-	-	-
C2-chrysenes/benz[a]anthracenes		-	-	-	-	-	-	-	-	-	-
C3-chrysenes/benz[a]anthracenes		-	-	-	-	-	-	-	-	-	-
C4-chrysenes/benz[a]anthracenes		-	-	-	-	-	-	-	-	-	-
benzo[b]fluoranthene		-	-	-	-	-	-	-	-	-	-
benzo[k]fluoranthene		-	-	-	-	-	-	-	-	-	-
benzo[a]pyrene		-	-	-	-	-	-	-	-	-	-
indeno[1,2,3-cd]pyrene		-	-	-	-	-	-	-	-	-	-
dibenz[a,h]anthracene		-	-	-	-	-	-	-	-	-	-
benzo[ghi]perylene		-	-	-	-	-	-	-	-	-	-
Sum of HACs		**0.5**	**0.2**	**-**	**-**	**0.1**	**-**	**-**	**-**	**-**	**-**

Table B-11. Chum salmon, chinook salmon, Dolly Varden and smoked salmon. Concentrations, ng/g (ppb) wet weight, of aromatic contaminants (ACs) in edible flesh.

ACs													
	Fish:	<- Chum ->				Chinook	<- Dolly Varden ->			<- Smoked salmon ->			
	Village:	Larsen Bay	<-Chiniak->			Angoon	Kodiak	Karluk	<-Old Harbor->			<-Tatitlek->	
	Site:	LAB6	CHI5	CHI5	CHI7	AGN3	KOD5	KAR1	OHA2	OHA	OHA	TAT	TAT
	Cycle:	II	II	II	III	II	I	I	I	>split samples<			
	D & M no.:	310	350	351	503	191	46	81	111				
			355	336	510	194	56	82					
			353	354		183							
	Lab no.:	655	280	654	525	321	94	95	703	241	244	526	527
naphthalene		a	a	a	a	a	a	a	a	450	510	1200	1200
C1-naphthalenes		0.3	1	0.3	-	2	0.4	0.2	0.7	320	400	800	950
C2-naphthalenes		-	0.4	-	-	0.8	0.07	-	-	410	530	930	1500
C3-naphthalenes		-	0.3	-	-	0.08	-	-	-	510	610	770	1400
C4-naphthalenes		-	-	-	-	-	-	-	-	380	370	650	1200
acenaphthylene		-	-	-	-	-	-	-	-	580	640	3000	3400
acenaphthene		-	-	-	-	-	-	-	-	75	91	280	280
fluorene		-	0.6	-	-	0.3	-	-	-	410	450	1800	2100
C1-fluorenes		-	-	-	-	-	-	-	-	340	380	940	1000
C2-fluorenes		-	-	-	-	-	-	-	-	740	780	1700	1400
C3-fluorenes		-	-	-	-	-	-	-	-	210	190	260	130
phenanthrene		1	2	0.5	0.4	2	0.7	0.4	0.7	1800	1800	5100	4600
C1-phenanthrenes/anthracenes		-	0.07	-	-	-	-	-	-	560	610	1800	1400
C2-phenanthrenes/anthracenes		-	-	-	-	-	-	-	-	230	250	710	370
C3-phenanthrenes/anthracenes		-	-	-	-	-	-	-	-	87	94	220	110
C4-phenanthrenes/anthracenes		-	-	-	-	-	-	-	-	2	2	4	0.9
dibenzothiophene		-	0.3	-	-	-	-	-	-	14	14	44	39
C1-dibenzothiophenes		-	-	-	-	-	-	-	-	11	13	23	26
C2-dibenzothiophenes		-	-	-	-	-	-	-	-	6	10	10	11
C3-dibenzothiophenes		-	-	-	-	-	-	-	-	0.3	7	4	3
Sum of LACs		**1**	**5**	**0.8**	**0.4**	**5**	**1**	**0.6**	**1**	**7100**	**7800**	**20000**	**21000**
fluoranthene		-	0.2	-	-	0.1	-	-	-	280	310	1400	820
pyrene		-	-	-	-	-	-	-	-	200	210	1000	590
C1-fluoranthenes/pyrenes		-	-	-	-	-	-	-	-	97	100	440	250
benz[a]anthracene		-	-	-	-	-	-	-	-	13	14	45	32
chrysene		-	-	-	-	-	-	-	-	23	24	41	29
C1-chrysenes/benz[a]anthracenes		-	-	-	-	-	-	-	-	8	11	7	5
C2-chrysenes/benz[a]anthracenes		-	-	-	-	-	-	-	-	-	1	0.5	0.7
C3-chrysenes/benz[a]anthracenes		-	-	-	-	-	-	-	-	-	-	0.3	0.3
C4-chrysenes/benz[a]anthracenes		-	-	-	-	-	-	-	-	-	-	-	-
benzo[b]fluoranthene		-	-	-	-	-	-	-	-	6	7	16	12
benzo[k]fluoranthene		-	-	-	-	-	-	-	-	6	6	21	16
benzo[a]pyrene		-	-	-	-	-	-	-	-	7	6	20	17
indeno[1,2,3-cd]pyrene		-	-	-	-	-	-	-	-	3	4	9	8
dibenz[a,h]anthracene		-	-	-	-	-	-	-	-	0.2	0.6	-	-
benzo[ghi]perylene		-	-	-	-	-	-	-	-	3	3	8	7
Sum of HACs		-	**0.2**	-	-	**0.1**	-	-	-	**650**	**700**	**3000**	**1800**
sample weight, grams:		5.08	5.23	5.10	5.26	5.17	5.28	5.24	5.29	4.83	5.23	2.09	2.19

Table B-12. Halibut. Concentrations, ng/g (ppb) wet weight, of aromatic contaminants (ACs) in edible flesh.

	Village:	<- Kodiak ->			<- Chenega Bay ->			<- Old Harbor ->				<- Tatitlek ->		<- Larsen Bay ->				
	Site:	KOD2	KOD6	KOD6	CHE2	CHE2	CHE2	CHE2	OHA1	OHA1	OHA1	TAT4	TAT6	LAB5	LAB6	LAB6	LAB8	LAB8
	Cycle:	I	II	III	I	II	II	III	I	II	II	I	II	I	II	II	III	III
	D & M no.:	49	220	499	19	169	171	472	120	323	322	27	148	104	292	251	605	607
		50	221		18	170	94	473		324		28	149		293		606	608
ACs								474		325					294			
	Lab no.:	4	193	508	28	130	131	485	40	283	707	27	132	41	284	708	520	521
naphthalene		a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a
C1-naphthalenes		-	0.1	0.3	-	-	-	-	-	0.3	0.3	-	-	-	0.1	0.2	0.2	0.2
C2-naphthalenes		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C3-naphthalenes		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C4-naphthalenes		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
acenaphthylene		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
acenaphthene		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
fluorene		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C1-fluorenes		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C2-fluorenes		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C3-fluorenes		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
phenanthrene		-	0.2	0.6	-	-	-	0.5	-	0.9	0.5	-	-	-	0.2	0.5	0.3	0.4
C1-phenanthrenes/anthracenes		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C2-phenanthrenes/anthracenes		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C3-phenanthrenes/anthracenes		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C4-phenanthrenes/anthracenes		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
dibenzothiophene		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C1-dibenzothiophenes		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C2-dibenzothiophenes		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C3-dibenzothiophenes		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Sum of LACs		-	0.3	0.9	-	-	-	0.5	-	1	0.8	-	-	-	0.3	0.7	0.5	0.6
fluoranthene		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
pyrene		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C1-fluoranthenes/pyrenes		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
benz[a]anthracene		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
chrysene		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C1-chrysenes/benz[a]anthracenes		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C2-chrysenes/benz[a]anthracenes		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C3-chrysenes/benz[a]anthracenes		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C4-chrysenes/benz[a]anthracenes		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
benzo[b]fluoranthene		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
benzo[k]fluoranthene		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
benzo[a]pyrene		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
indeno[1,2,3-cd]pyrene		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
dibenz[a,h]anthracene		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
benzo[ghi]perylene		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Sum of HACs		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
sample weight, grams:		3.22	5.26	5.38	4.14	5.08	5.02	5.36	4.78	4.70	5.15	3.85	4.99	4.46	5.13	5.15	5.23	5.42

Table B-13. Halibut. Concentrations, ng/g (ppb) wet weight, of aromatic contaminants (ACs) in edible flesh.

ACs														
Village:		<- Ouzinkie ->				<- Chiniak ->			<- Pt. Lions ->			Pt. Gra./ Eng. Bay		Angoon
Site:	OUZ1	OUZ3	OUZ3	OUZ3	OUZ3	CHI6	CHI6	PTL3	PTL6	PTL8	PTL8	PTG2	PTG5	AGN3
Cycle:	I	II	II	III	III	II	III	II	I	III	III	I	III	II
D & M no.:	90	266	276	364	366	337	512	236	75	582	584	23	484	196
	85	267	277	365	367		513	237	76	583	585			197
								238						179
Lab no.:	8	171	172	510	519	706	509	170	21	522	523	39	486	228
naphthalene	a	a	a	a	a	a	a	a	a	a	a	a	a	a
C1-naphthalenes	-	0.07	0.6	-	-	0.4	0.2	0.1	-	-	-	-	-	0.2
C2-naphthalenes	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C3-naphthalenes	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C4-naphthalenes	-	-	-	-	-	-	-	-	-	-	-	-	-	-
acenaphthylene	-	-	-	-	-	-	-	-	-	-	-	-	-	-
acenaphthene	-	-	-	-	-	-	-	-	-	-	-	-	-	-
fluorene	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C1-fluorenes	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C2-fluorenes	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C3-fluorenes	-	-	-	-	-	-	0.5	-	-	-	-	-	-	-
phenanthrene	-	0.1	0.5	-	0.3	0.4	0.6	0.2	-	0.4	0.6	-	0.2	0.2
C1-phenanthrenes/anthracenes	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C2-phenanthrenes/anthracenes	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C3-phenanthrenes/anthracenes	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C4-phenanthrenes/anthracenes	-	-	-	-	-	-	-	-	-	-	-	-	-	-
dibenzothiophene	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C1-dibenzothiophenes	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C2-dibenzothiophenes	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C3-dibenzothiophenes	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Sum of LACs	-	0.2	1	-	0.3	0.8	1	0.3	-	0.4	0.6	-	0.2	0.4
fluoranthene	-	-	0.1	-	-	-	-	-	-	-	-	-	-	-
pyrene	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C1-fluoranthenes/pyrenes	-	-	-	-	-	-	-	-	-	-	-	-	-	-
benz[a]anthracene	-	-	-	-	-	-	-	-	-	-	-	-	-	-
chrysene	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C1-chrysenes/benz[a]anthracenes	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C2-chrysenes/benz[a]anthracenes	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C3-chrysenes/benz[a]anthracenes	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C4-chrysenes/benz[a]anthracenes	-	-	-	-	-	-	-	-	-	-	-	-	-	-
benzo[b]fluoranthene	-	-	-	-	-	-	-	-	-	-	-	-	-	-
benzo[k]fluoranthene	-	-	-	-	-	-	-	-	-	-	-	-	-	-
benzo[a]pyrene	-	-	-	-	-	-	-	-	-	-	-	-	-	-
indeno[1,2,3-cd]pyrene	-	-	-	-	-	-	-	-	-	-	-	-	-	-
dibenz[a,h]anthracene	-	-	-	-	-	-	-	-	-	-	-	-	-	-
benzo[ghi]perylene	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Sum of HACs	-	-	0.1	-	-	-	-	-	-	-	-	-	-	-
sample weight, grams:	3.22	6.13	5.63	5.07	5.29	5.13	5.08	5.51	4.68	5.22	5.20	4.61	5.54	4.97

Table B-14. Pacific Cod. Concentrations, ng/g (ppb) wet weight, of aromatic contaminants (ACs) in edible flesh.

ACs											
	Village:		<-Chenega Bay->			Old Harbor		Tatitlek	Larsen Bay		Angoon
	Site:	CHE2	CHE2	CHE2	CHE2	OHA1	OHA2	TAT4	LAB6	LAB6	AGN3
	Cycle:	I	II	II	III	I	III	I	I	II	II
	D & M no.:	014 015 013	166	165	471	108 112	631	025 026	105	249 250	195 198
	Lab no.:	23	149	151	487	26	524	22	704	285	322
naphthalene		a	a	a	a	a	a	a	a	a	a
C1-naphthalenes		-	-	-	-	-	-	-	0.2	0.1	0.2
C2-naphthalenes		-	-	-	-	-	-	-	-	-	-
C3-naphthalenes		-	-	-	-	-	-	-	-	-	-
C4-naphthalenes		-	-	-	-	-	-	-	-	-	-
acenaphthylene		-	-	-	-	-	-	-	-	-	-
acenaphthene		-	-	-	-	-	-	-	-	-	-
fluorene		-	-	-	-	-	-	-	-	-	-
C1-fluorenes		-	-	-	-	-	-	-	-	-	-
C2-fluorenes		-	-	-	-	-	-	-	-	-	-
C3-fluorenes		-	-	-	-	-	-	-	-	-	-
phenanthrene		-	-	-	0.3	-	0.7	-	0.3	0.2	0.4
C1-phenanthrenes/anthracenes		-	-	-	-	-	-	-	-	-	-
C2-phenanthrenes/anthracenes		-	-	-	-	-	-	-	-	-	-
C3-phenanthrenes/anthracenes		-	-	-	-	-	-	-	-	-	-
C4-phenanthrenes/anthracenes		-	-	-	-	-	-	-	-	-	-
dibenzothiophene		-	-	-	-	-	-	-	-	-	-
C1-dibenzothiophenes		-	-	-	-	-	-	-	-	-	-
C2-dibenzothiophenes		-	-	-	-	-	-	-	-	-	-
C3-dibenzothiophenes		-	-	-	-	-	-	-	-	-	-
Sum of LACs		-	-	-	**0.3**	-	**0.7**	-	**0.5**	**0.3**	**0.6**
fluoranthene		-	-	-	-	-	-	-	-	-	-
pyrene		-	-	-	-	-	-	-	-	-	-
C1-fluoranthenes/pyrenes		-	-	-	-	-	-	-	-	-	-
benz[a]anthracene		-	-	-	-	-	-	-	-	-	-
chrysene		-	-	-	-	-	-	-	-	-	-
C1-chrysenes/benz[a]anthracenes		-	-	-	-	-	-	-	-	-	-
C2-chrysenes/benz[a]anthracenes		-	-	-	-	-	-	-	-	-	-
C3-chrysenes/benz[a]anthracenes		-	-	-	-	-	-	-	-	-	-
C4-chrysenes/benz[a]anthracenes		-	-	-	-	-	-	-	-	-	-
benzo[b]fluoranthene		-	-	-	-	-	-	-	-	-	-
benzo[k]fluoranthene		-	-	-	-	-	-	-	-	-	-
benzo[a]pyrene		-	-	-	-	-	-	-	-	-	-
indeno[1,2,3-cd]pyrene		-	-	-	-	-	-	-	-	-	-
dibenz[a,h]anthracene		-	-	-	-	-	-	-	-	-	-
benzo[ghi]perylene		-	-	-	-	-	-	-	-	-	-
Sum of HACs		-	-	-	-	-	-	-	-	-	-
sample weight, grams:		3.82	4.50	4.62	5.39	3.80	5.06	3.65	5.16	5.47	5.00

Table B-15. Rockfish, Irish Lord and Yellowfin Sole. Concentrations, ng/g (ppb) wet weight, of aromatic contaminants (ACs) in edible flesh.

ACs	Fish:	<- Rockfish ->							<- Irish Lord ->		Yf. Sole
	Village:	Kodiak	<-Chenega Bay->			<-Tatitlek->		Chiniak	Port Graham/ English Bay		
	Site:	KOD1	CHE2	CHE2	CHE2	TAT3	TAT4	CHI4	PTG2	PTG2	Pt. Lions PTL6
	Cycle:	I	I	II	II	I	I	I	I	I	I
	D & M no.:	047 048	016 017	168	167	007	008	044 045	029	024	074
	Lab no.:	24	42	150	157	701	702	25	709	710	705
naphthalene		a	a	a	a	a	a	a	a	a	a
C1-naphthalenes		-	-	-	-	0.4	0.3	-	0.2	0.2	0.4
C2-naphthalenes		-	-	-	-	-	-	-	-	-	-
C3-naphthalenes		-	-	-	-	-	-	-	-	-	-
C4-naphthalenes		-	-	-	-	-	-	-	-	-	-
acenaphthylene		-	-	-	-	-	-	-	-	-	-
acenaphthene		-	-	-	-	-	-	-	-	-	-
fluorene		-	-	-	-	-	-	-	-	-	-
C1-fluorenes		-	-	-	-	-	-	-	-	-	-
C2-fluorenes		-	-	-	-	-	-	-	-	-	-
C3-fluorenes		-	-	-	-	-	-	-	-	-	-
phenanthrene		-	-	-	-	0.7	0.3	-	0.4	0.2	0.4
C1-phenanthrenes/anthracenes		-	-	-	-	-	-	-	-	-	-
C2-phenanthrenes/anthracenes		-	-	-	-	-	-	-	-	-	-
C3-phenanthrenes/anthracenes		-	-	-	-	-	-	-	-	-	-
C4-phenanthrenes/anthracenes		-	-	-	-	-	-	-	-	-	-
dibenzothiophene		-	-	-	-	-	-	-	-	-	-
C1-dibenzothiophenes		-	-	-	-	-	-	-	-	-	-
C2-dibenzothiophenes		-	-	-	-	-	-	-	-	-	-
C3-dibenzothiophenes		-	-	-	-	-	-	-	-	-	-
Sum of LACs		-	-	-	-	1	0.6	-	0.6	0.4	0.8
fluoranthene		-	-	-	-	-	-	-	-	-	-
pyrene		-	-	-	-	-	-	-	-	-	-
C1-fluoranthenes/pyrenes		-	-	-	-	-	-	-	-	-	-
benz[a]anthracene		-	-	-	-	-	-	-	-	-	-
chrysene		-	-	-	-	-	-	-	-	-	-
C1-chrysenes/benz[a]anthracenes		-	-	-	-	-	-	-	-	-	-
C2-chrysenes/benz[a]anthracenes		-	-	-	-	-	-	-	-	-	-
C3-chrysenes/benz[a]anthracenes		-	-	-	-	-	-	-	-	-	-
C4-chrysenes/benz[a]anthracenes		-	-	-	-	-	-	-	-	-	-
benzo[b]fluoranthene		-	-	-	-	-	-	-	-	-	-
benzo[k]fluoranthene		-	-	-	-	-	-	-	-	-	-
benzo[a]pyrene		-	-	-	-	-	-	-	-	-	-
indeno[1,2,3-cd]pyrene		-	-	-	-	-	-	-	-	-	-
dibenz[a,h]anthracene		-	-	-	-	-	-	-	-	-	-
benzo[ghi]perylene		-	-	-	-	-	-	-	-	-	-
Sum of HACs		-	-	-	-	-	-	-	-	-	-
sample weight, grams:		4.01	4.68	4.56	4.70	5.27	5.19	4.26	5.33	5.23	5.33

APPENDIX C

CONCENTRATIONS OF INDIVIDUAL CONTAMINANTS IN SHELLFISH

Explanatory Notes for Tables C-1 through C-12.

Naphthalene-d8 was the internal standard for naphthalene through C4-naphthalenes. Acenaphthene-d10 was the internal standard for acenaphthylene through C1-fluoranthenes/pyrene. Benzo[a]pyrene-d12 was the internal standard for benz[a]anthracene through benzo[ghi]perylene. Percent recoveries for the internal standards (surrogates) averaged 88%, RSD = 15%, n = 452. Percent recoveries of the surrogates include split or duplicate samples.

Results on sample extracts were determined by gas chromatography/mass spectrometry (GC/MS), using sequenced multiple ion detection.

A hyphen (-) indicates that the analyte was not detected above the limit of detection which ranged from 0.02 to 1 ng/g (ppb) wet weight. This applies to individual contaminants, as well as groupings of contaminants (e.g., C2-phenanthrenes/anthracenes).

Low levels of naphthalene (a) found were indistinguishable from those of blank analyses and are unlikely to indicate exposure to petroleum in the absence of 1- and 2-methylnaphthalene.

Table C-1. Mussels. Concentrations, ng/g (ppb) wet weight, of aromatic contaminants (ACs) in edible flesh.

ACs																				
Village:	<-Windy Bay->			Kodiak	<-Chenega Bay->					<-Port Graham/English Bay->										Lars. B.
Site:	WNB1	WNB1	WNB1	KOD3	CHE1	CHE1	CHE1	CHE1	CHE1	PTG1	PTG4	PTG1	PTG1	PTG4	PTG4	PTG4	PTG1	PTG1	PTG1	LAB1
Cycle:	I	III	III	I	I	II	III	III	III	I	I	II	II	II	II	II	III	III	III	I
D & M no.:	036	490	491	051	009 010	164	468	469	470	020 021	033	126	125	121	122	123	476	477	478	077
Lab no.:	47	242	243	48	44	114	304	305	306	45	46	115	116	117	118	119	337	338	339	61
naphthalene	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a
C1-naphthalenes	-	16	0.3	-	-	0.7	0.5	0.2	0.5	-	-	0.3	0.1	0.2	0.3	0.09	0.7	0.7	0.5	-
C2-naphthalenes	0.3	120	1	4	-	0.2	0.2	0.1	0.1	-	-	-	-	-	-	-	-	-	-	-
C3-naphthalenes	54	340	14	41	0.5	2	2	1	1	-	-	-	-	-	-	-	-	-	-	-
C4-naphthalenes	34	560	46	85	1	4	3	3	3	-	-	-	-	-	-	-	-	-	-	-
acenaphthylene	-	0.07	-	-	-	1	-	-	-	-	-	1	-	-	-	-	-	-	-	-
acenaphthene	-	0.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
fluorene	-	14	0.4	2	-	0.5	0.2	0.1	0.3	-	-	-	-	0.1	-	-	-	-	-	-
C1-fluorenes	10	88	7	27	0.2	1	1	1	0.9	-	-	-	-	-	-	-	-	-	-	-
C2-fluorenes	81	600	54	110	3	4	4	3	2	-	-	-	-	-	-	-	-	-	-	-
C3-fluorenes	78	180	31	73	0.2	0.4	0.6	2	0.7	-	-	-	-	-	-	-	-	-	-	-
phenanthrene	17	72	6	34	5	7	5	4	4	-	2	3	0.9	4	3	2	0.7	0.8	0.7	1
C1-phenanthrenes/anthracenes	140	560	63	140	18	12	10	9	7	-	-	-	-	0.2	0.3	-	-	-	-	-
C2-phenanthrenes/anthracenes	540	2400	330	250	52	29	22	23	15	-	-	-	-	0.09	0.1	-	-	-	-	-
C3-phenanthrenes/anthracenes	740	3700	630	150	46	29	22	23	14	-	-	-	-	-	-	-	-	-	-	-
C4-phenanthrenes/anthracenes	160	980	200	5	0.5	4	3	6	2	-	-	-	-	-	-	-	-	-	-	-
dibenzothiophene	11	70	4	14	0.5	1	3	2	1	-	-	-	-	0.1	-	-	-	-	-	-
C1-dibenzothiophenes	100	420	48	99	10	8	14	11	5	-	-	-	-	-	-	-	-	-	-	-
C2-dibenzothiophenes	510	2300	310	270	40	26	49	42	18	-	-	-	-	-	-	-	-	-	-	0.1
C3-dibenzothiophenes	780	3500	620	230	47	33	56	56	21	-	-	-	-	-	-	-	-	-	-	0.06
Sum of LACs	3300	16000	2400	1500	220	160	200	190	96	-	2	4	1	5	4	2	1	2	1	1
fluoranthene	13	47	8	57	5	6	8	7	6	-	0.07	0.4	-	6	4	2	-	-	-	0.3
pyrene	9	56	7	25	2	3	5	4	3	-	0.1	-	-	2	2	0.5	-	-	-	-
C1-fluoranthenes/pyrenes	68	450	60	14	0.4	1	3	3	1	-	-	-	-	-	-	-	-	-	-	-
benz[a]anthracene	0.7	10	2	6	-	0.8	1	1	0.9	-	-	-	-	0.5	0.1	-	-	-	-	-
chrysene	110	380	73	19	8	4	3	4	2	-	-	-	-	2	2	0.3	-	-	-	-
C1-chrysenes/benz[a]anthracenes	160	520	160	-	5	3	1	3	0.8	-	-	-	-	-	-	-	-	-	-	-
C2-chrysenes/benz[a]anthracenes	68	600	160	-	-	1	0.1	1	0.05	-	-	-	-	-	-	-	-	-	-	-
C3-chrysenes/benz[a]anthracenes	0.2	270	52	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C4-chrysenes/benz[a]anthracenes	-	58	5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
benzo[b]fluoranthene	8	62	15	5	0.1	2	1	2	1	-	-	-	-	1	0.4	0.2	-	-	-	-
benzo[k]fluoranthene	-	56	0.9	37	-	1	0.3	0.7	0.3	-	-	-	-	0.6	0.1	-	-	-	-	-
benzo[a]pyrene	-	7	2	-	-	-	0.09	0.2	0.1	-	-	-	-	-	-	-	-	-	-	-
indeno[1,2,3-cd]pyrene	-	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
dibenz[a,h]anthracene	-	5	0.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
benzo[ghi]perylene	-	17	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Sum of HACs	440	2500	550	160	20	22	22	26	15	-	0.2	0.4	-	12	9	3	-	-	-	0.3
sample weight, grams:	4.58	4.93	5.19	5.31	5.05	4.61	4.83	5.19	4.49	4.78	4.72	2.92	3.77	5.45	5.17	5.33	5.30	5.13	5.35	5.09

Table C-2. Mussels. Concentrations, ng/g (ppb) wet weight, of aromatic contaminants (ACs) in edible flesh.

ACs		<-Tatitlek->							Old H	Ouz.	<-Chiniak->			<-Karluk->			Akhiok		Kasitsna		Angoon	
	Village:	TAT1	TAT1	TAT5	TAT5	TAT5	TAT5	TAT5	TAT5	OHA3	OUZ2	CHI1	CHI2	KAR1	KAR2	KAR2	KAR2	AKH2	AKH3	KAS1	KAS1	AGN1	AGN1
	Site:	I	I	II	II	II	III	III	III	I	III	I	I	I	II	III	III	III	II	III	III	II	II
	Cycle:	001	001	156	157	158	420	421	422	119	089	054	040	079	278	368	369	380	359	487	488	173	174
	D & M no.:	002	002																				
		>duplicate<																					
	Lab no.:	43	66	111	112	113	307	308	309	60	395	57	58	59	245	393	394	392	251	355	356	232	324
naphthalene		a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a
C1-naphthalenes		-	-	0.2	0.2	0.2	0.2	0.4	0.1	-	0.2	-	-	-	0.2	0.1	-	-	0.2	0.3	0.3	0.3	0.3
C2-naphthalenes		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C3-naphthalenes		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C4-naphthalenes		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
acenaphthylene		-	-	0.5	0.6	0.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
acenaphthene		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
fluorene		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C1-fluorenes		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C2-fluorenes		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C3-fluorenes		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
phenanthrene		-	-	2	2	2	0.6	0.7	0.8	-	0.7	-	-	-	0.2	0.2	0.3	0.3	0.2	0.8	0.4	0.3	0.7
C1-phenanthrenes/anthracenes		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C2-phenanthrenes/anthracenes		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C3-phenanthrenes/anthracenes		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C4-phenanthrenes/anthracenes		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
dibenzothiophene		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C1-dibenzothiophenes		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C2-dibenzothiophenes		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C3-dibenzothiophenes		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Sum of LACs		-	-	3	3	3	0.8	1	0.9	-	0.9	-	-	-	0.4	0.3	0.3	0.3	0.4	1	0.7	0.6	1
fluoranthene		-	-	0.2	0.1	0.3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
pyrene		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.1
C1-fluoranthenes/pyrenes		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
benz[a]anthracene		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
chrysene		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C1-chrysenes/benz[a]anthracenes		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C2-chrysenes/benz[a]anthracenes		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C3-chrysenes/benz[a]anthracenes		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C4-chrysenes/benz[a]anthracenes		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
benzo[b]fluoranthene		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
benzo[k]fluoranthene		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
benzo[a]pyrene		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
indeno[1,2,3-cd]pyrene		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
dibenz[a,h]anthracene		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
benzo[ghi]perylene		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Sum of HACs		-	-	0.2	0.1	0.3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.1
sample weight, grams:		5.01	5.10	5.04	5.48	5.31	4.47	5.32	4.08	5.32	5.68	5.10	5.05	5.58	5.33	5.40	5.18	5.21	5.02	5.42	5.32	5.43	5.30

Table C-3. Butter clams. Concentrations, ng/g (ppb) wet weight, of aromatic contaminants (ACs) in edible flesh.

ACs	Village:	Kodiak	Chenega Bay		<- Old Harbor ->											Angoon
	Site:	KOD3	CHE1	CHE1	OHA3	OHA3	OHA3	OHA3	OHA3	OHA4	OHA4	OHA4	OHA4	OHA4	OHA4	AGN2
	Cycle:	II	I	I	I	II	II	III	III	II	I	II	III	III	III	II
	D & M no.:	205	011	012	110	318	319	614	613	320	114	321	609	609	610	176
													>duplicate<			
	Lab no.:	212	664	665	669	225	226	431	432	227	670	247	418	419	433	231
naphthalene		a	a	a	a	a	a	a	a	a	a	a	a	a	a	a
C1-naphthalenes		1	0.7	0.4	0.6	0.2	0.2	0.3	-	0.2	0.1	0.4	0.2	0.4	0.4	0.2
C2-naphthalenes		4	0.6	-	-	-	-	-	-	-	-	-	2	3	0.9	-
C3-naphthalenes		24	2	0.07	-	-	-	-	-	-	-	-	26	33	16	-
C4-naphthalenes		40	0.8	0.06	-	-	-	-	-	-	-	-	23	39	21	-
acenaphthylene		0.06	-	-	-	-	-	-	-	-	-	-	-	-	-	-
acenaphthene		0.8	-	-	-	-	-	-	-	-	-	-	-	-	-	-
fluorene		2	-	-	-	-	-	-	-	-	-	-	0.8	1	0.3	-
C1-fluorenes		8	-	0.1	-	-	-	-	-	-	-	-	9	11	3	-
C2-fluorenes		28	0.1	-	-	-	-	-	-	-	-	-	9	19	14	-
C3-fluorenes		8	0.8	0.5	-	-	-	-	-	-	-	-	-	1	3	-
phenanthrene		16	3	2	1	0.9	0.5	1	0.3	2	3	2	16	19	13	0.3
C1-phenanthrenes/anthracenes		32	7	3	-	0.3	-	-	-	2	1	1	37	46	36	-
C2-phenanthrenes/anthracenes		45	10	4	-	0.1	-	-	-	0.8	0.3	0.4	32	44	40	-
C3-phenanthrenes/anthracenes		22	2	0.1	-	-	-	-	-	-	-	-	5	13	15	-
C4-phenanthrenes/anthracenes		42	-	-	-	-	-	-	-	-	-	-	-	0.05	-	-
dibenzothiophene		5	1	0.2	-	-	-	-	-	-	-	-	-	3	4	-
C1-dibenzothiophenes		66	2	0.8	-	-	-	-	-	0.3	-	0.2	23	30	-	-
C2-dibenzothiophenes		41	7	3	-	-	-	-	-	0.3	0.1	0.1	33	47	25	-
C3-dibenzothiophenes		28	-	1	-	-	-	-	-	-	-	-	10	22	22	-
Sum of LACs		410	37	15	2	2	0.7	1	0.3	6	4	4	230	330	210	0.5
fluoranthene		27	3	2	0.6	0.7	0.3	0.9	-	3	5	2	12	15	10	-
pyrene		14	1	1	-	0.1	-	0.2	-	2	2	1	8	10	7	-
C1-fluoranthenes/pyrenes		4	-	-	-	-	-	-	-	-	-	-	0.3	2	1	-
benz[a]anthracene		0.8	-	-	-	-	-	-	-	0.1	-	-	-	0.4	0.5	-
chrysene		3	0.6	0.3	-	-	-	-	-	0.2	0.1	0.1	0.5	1	1	-
C1-chrysenes/benz[a]anthracenes		0.04	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C2-chrysenes/benz[a]anthracenes		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C3-chrysenes/benz[a]anthracenes		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C4-chrysenes/benz[a]anthracenes		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
benzo[b]fluoranthene		0.7	-	-	-	-	-	-	-	-	-	-	-	0.2	0.5	-
benzo[k]fluoranthene		0.5	-	-	-	-	-	-	-	-	-	-	-	-	0.2	-
benzo[a]pyrene		0.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-
indeno[1,2,3-cd]pyrene		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
dibenz[a,h]anthracene		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
benzo[ghi]perylene		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Sum of HACs		50	5	3	0.6	0.8	0.3	1	-	5	7	3	21	29	20	-
sample weight, grams:		5.11	5.07	5.02	5.03	5.07	5.04	5.26	5.31	5.20	5.05	5.52	5.00	5.65	5.38	5.09

Table C-4. Butter clams. Concentrations, ng/g (ppb) wet weight, of aromatic contaminants (ACs) in edible flesh.

ACs	Village:	<- Larsen Bay ->							<- Ouzinkie ->				<- Akhiok ->			Karluk
	Site:	LAB1	LAB1	LAB1	LAB2	LAB2	LAB2	LAB2	OUZ2	OUZ2	OUZ3	OUZ4	AKH2	AKH2	AKH2	KAR2
	Cycle:	I	III	III	I	II	II	II	I	III	I	II	I	III	III	II
	D & M no.:	096	586	587	097	315	316	314	059	088	062	253	093	377	378	279
	Lab no.:	673	416	435	682	249	250	260	63	434	672	207	62	417	430	224
naphthalene		a	a	a	a	a	a	a	a	a	a	a	a	a	a	a
C1-naphthalenes		0.3	-	0.3	0.9	0.3	0.2	0.7	-	0.2	0.2	0.4	-	-	0.1	0.1
C2-naphthalenes		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C3-naphthalenes		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C4-naphthalenes		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
acenaphthylene		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
acenaphthene		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
fluorene		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C1-fluorenes		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C2-fluorenes		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C3-fluorenes		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
phenanthrene		2	0.5	0.7	1	1	0.8	2	-	0.7	2	1	-	0.4	0.2	0.2
C1-phenanthrenes/anthracenes		0.3	-	-	-	2	-	0.6	-	-	1	0.7	-	-	-	-
C2-phenanthrenes/anthracenes		0.3	-	-	-	0.5	-	0.3	-	-	2	0.4	-	-	-	-
C3-phenanthrenes/anthracenes		-	-	-	-	-	-	-	-	-	0.3	-	-	-	-	-
C4-phenanthrenes/anthracenes		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
dibenzothiophene		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C1-dibenzothiophenes		-	-	-	-	-	-	-	-	-	0.1	0.1	-	-	-	-
C2-dibenzothiophenes		-	-	-	-	0.1	-	-	-	-	1	-	-	-	-	-
C3-dibenzothiophenes		-	-	-	-	-	-	-	-	-	0.4	-	-	-	-	-
Sum of LACs		**3**	**0.5**	**1**	**2**	**4**	**1**	**4**	**-**	**0.9**	**7**	**3**	**-**	**0.4**	**0.3**	**0.3**
fluoranthene		1	-	-	0.1	0.7	0.2	0.7	-	-	1	0.5	-	-	-	-
pyrene		0.3	-	-	-	0.1	-	0.1	-	-	0.5	-	-	-	-	-
C1-fluoranthenes/pyrenes		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
benz[a]anthracene		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
chrysene		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C1-chrysenes/benz[a]anthracenes		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C2-chrysenes/benz[a]anthracenes		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C3-chrysenes/benz[a]anthracenes		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C4-chrysenes/benz[a]anthracenes		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
benzo[b]fluoranthene		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
benzo[k]fluoranthene		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
benzo[a]pyrene		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
indeno[1,2,3-cd]pyrene		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
dibenz[a,h]anthracene		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
benzo[ghi]perylene		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Sum of HACs		**1**	**-**	**-**	**0.1**	**0.8**	**0.2**	**0.8**	**-**	**-**	**2**	**0.5**	**-**	**-**	**-**	**-**
sample weight, grams:		5.08	5.17	5.38	5.11	5.38	5.02	5.16	5.31	5.28	5.02	5.15	5.09	5.84	5.20	5.00

Table C-5. Butter clams. Concentrations, ng/g (ppb) wet weight, of aromatic contaminants (ACs) in edible flesh.

ACs															
Village:	<- Chiniak ->							<- Pt. Lions ->							Kasitsna
Site:	CHI1	CHI1	CHI1	CHI2	CHI2	CHI2	CHI2	PTL1	PTL1	PTL1	PTL1	PTL1	PTL2	PTL2	KAS1
Cycle:	I	III	III	I	II	III	III	I	II	II	III	III	I	II	III
D & M no.:	053	632	633	041	226	636	637	063	229	230	514	515	066	232	489
Lab no.:	667	413	428	668	223	415	429	64	205	206	414	436	65	211	361
naphthalene	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a
C1-naphthalenes	0.5	-	0.1	-	-	-	0.6	-	0.3	0.3	-	0.3	-	0.3	0.4
C2-naphthalenes	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C3-naphthalenes	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C4-naphthalenes	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
acenaphthylene	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
acenaphthene	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
fluorene	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C1-fluorenes	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C2-fluorenes	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C3-fluorenes	0.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-
phenanthrene	0.6	0.2	0.5	0.3	0.5	0.3	0.3	0.9	0.7	1	1	1	2	2	1
C1-phenanthrenes/anthracenes	-	-	-	-	-	-	-	-	-	0.07	-	-	-	0.09	0.4
C2-phenanthrenes/anthracenes	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.4
C3-phenanthrenes/anthracenes	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C4-phenanthrenes/anthracenes	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
dibenzothiophene	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C1-dibenzothiophenes	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C2-dibenzothiophenes	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C3-dibenzothiophenes	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Sum of LACs	1	0.2	0.6	0.3	0.5	0.3	0.9	0.9	1	1	1	1	2	2	2
fluoranthene	0.1	-	0.3	-	-	-	-	0.4	0.2	1	1	1	0.1	1	0.3
pyrene	-	-	-	-	-	-	-	-	-	0.3	-	-	-	0.2	0.09
C1-fluoranthenes/pyrenes	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
benz[a]anthracene	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
chrysene	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C1-chrysenes/benz[a]anthracenes	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C2-chrysenes/benz[a]anthracenes	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C3-chrysenes/benz[a]anthracenes	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C4-chrysenes/benz[a]anthracenes	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
benzo[b]fluoranthene	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
benzo[k]fluoranthene	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
benzo[a]pyrene	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
indeno[1,2,3-cd]pyrene	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
dibenz[a,h]anthracene	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
benzo[ghi]perylene	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Sum of HACs	0.1	-	0.3	-	-	-	-	0.4	0.2	1	1	1	0.1	1	0.4
sample weight, grams:	5.08	5.98	5.26	5.07	5.06	5.53	5.26	5.28	6.00	5.17	5.54	5.43	5.19	5.12	5.34

Table C-6. Littleneck clams. Concentrations, ng/g (ppb) wet weight, of aromatic contaminants (ACs) in edible flesh.

ACs	Village:	Windy Bay	Kodiak		Old Harbor		Ouzinkie		<-Chiniak->			Akhiok		Port Lions		PG/EB
	Site:	WNB2	KOD3	KOD3	OHA3	OHA4	OUZ2	OUZ2	CHI1	CHI1	CHI2	AKH3	AKH3	PTL1	PTL1	PTG1
	Cycle:	I	III	III	III	III	I	II	II	III	III	II	II	II	III	II
	D & M no.:	038	494	495	615	611	060	252	227	634	639	358	358	231	519	137
												>duplicate<				
	Lab no.:	666	437	447	615	616	671	214	246	613	614	301	310	213	617	340
naphthalene		a	a	a	a	a	a	a	a	a	a	a	a	a	a	a
C1-naphthalenes		0.7	0.9	-	0.5	0.2	0.3	0.2	0.2	0.1	0.3	-	0.2	0.2	0.2	0.6
C2-naphthalenes		0.8	2	-	-	0.9	-	-	-	-	-	-	-	-	-	0.1
C3-naphthalenes		7	14	4	-	17	-	-	-	-	-	-	-	-	-	0.2
C4-naphthalenes		13	22	6	-	16	-	-	-	-	-	-	-	-	-	-
acenaphthylene		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
acenaphthene		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
fluorene		0.2	1	-	-	0.4	-	-	-	-	-	-	-	-	-	0.1
C1-fluorenes		4	6	3	-	8	-	-	-	-	-	-	-	-	-	0.09
C2-fluorenes		19	18	6	-	9	-	-	-	-	-	-	-	-	-	-
C3-fluorenes		6	9	2	0.4	3	-	-	-	1	0.3	-	-	-	-	-
phenanthrene		7	8	4	1	15	0.7	0.4	0.4	0.8	0.5	0.3	0.5	1	1	5
C1-phenanthrenes/anthracenes		43	28	14	-	34	-	-	-	-	-	-	-	0.3	-	6
C2-phenanthrenes/anthracenes		130	42	22	-	32	-	-	-	-	-	-	-	0.3	-	3
C3-phenanthrenes/anthracenes		180	20	8	-	9	-	-	-	-	-	-	-	-	-	3
C4-phenanthrenes/anthracenes		45	0.9	-	-	-	-	-	-	-	-	-	-	-	-	-
dibenzothiophene		5	4	2	-	8	-	-	-	-	-	-	-	-	-	0.4
C1-dibenzothiophenes		27	17	9	-	21	-	-	-	-	-	-	-	-	-	1
C2-dibenzothiophenes		120	44	24	-	18	-	-	-	-	-	-	-	-	-	0.08
C3-dibenzothiophenes		220	31	15	-	10	-	-	-	-	-	-	-	-	-	-
Sum of LACs		**830**	**270**	**120**	**2**	**200**	**1**	**0.6**	**0.6**	**2**	**1**	**0.3**	**0.7**	**2**	**1**	**20**
fluoranthene		4	23	15	0.7	11	-	-	0.3	0.4	0.1	-	-	1	0.9	6
pyrene		3	11	7	-	7	-	-	-	-	-	-	-	0.1	0.1	2
C1-fluoranthenes/pyrenes		20	51	0.9	-	0.5	-	-	-	-	-	-	-	-	-	0.08
benz[a]anthracene		0.3	0.2	-	-	-	-	-	-	-	-	-	-	-	-	0.3
chrysene		24	2	0.8	-	0.3	-	-	-	-	-	-	-	-	-	0.6
C1-chrysenes/benz[a]anthracenes		32	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C2-chrysenes/benz[a]anthracenes		32	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C3-chrysenes/benz[a]anthracenes		11	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C4-chrysenes/benz[a]anthracenes		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
benzo[b]fluoranthene		2	0.2	-	-	-	-	-	-	-	-	-	-	-	-	-
benzo[k]fluoranthene		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
benzo[a]pyrene		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
indeno[1,2,3-cd]pyrene		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
dibenz[a,h]anthracene		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
benzo[ghi]perylene		0.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Sum of HACs		**130**	**87**	**24**	**0.7**	**19**	**-**	**-**	**0.3**	**0.4**	**0.1**	**-**	**-**	**1**	**1**	**9**
sample weight, grams:		5.06	5.35	5.62	5.34	5.24	5.03	5.30	4.99	5.33	5.15	5.35	5.07	5.37	5.26	5.05

Table C-7. Cockles and horse clams. Concentrations, ng/g (ppb) wet weight, of aromatic contaminants (ACs) in edible flesh.

ACs	Mollusc:	Cockle				Horse Clam	
	Village:	<- Chiniak ->			PG/EB	<- Angoon ->	
	Site:	CHI2	CHI2	CHI2	PTG1	AGN2	AGN2
	Cycle:	II	III	III	II	II	II
	D & M no.:	224	638	638	136	175	175
				>duplicate<		>duplicate<	
	Lab no.:	60-303	60-612	60-618	60-302	325	328
naphthalene		a	a	a	a	a	a
C1-naphthalenes		0.2	-	0.1	0.2	0.2	0.4
C2-naphthalenes		-	-	-	-	-	-
C3-naphthalenes		-	-	-	-	-	-
C4-naphthalenes		-	-	-	-	-	-
acenaphthylene		-	-	-	-	-	-
acenaphthene		-	-	-	-	-	-
fluorene		-	-	-	-	-	-
C1-fluorenes		-	-	-	-	-	-
C2-fluorenes		-	-	-	-	-	-
C3-fluorenes		-	0.3	-	-	-	-
phenanthrene		0.6	0.4	0.4	3	0.3	0.4
C1-phenanthrenes/anthracenes		-	-	-	-	-	-
C2-phenanthrenes/anthracenes		-	-	-	-	-	-
C3-phenanthrenes/anthracenes		-	-	-	-	-	-
C4-phenanthrenes/anthracenes		-	-	-	-	-	-
dibenzothiophene		-	-	-	-	-	-
C1-dibenzothiophenes		-	-	-	-	-	-
C2-dibenzothiophenes		-	-	-	-	-	-
C3-dibenzothiophenes		-	-	-	-	-	-
Sum of LACs		**0.8**	**0.7**	**0.5**	**3**	**0.5**	**0.8**
fluoranthene		0.1	-	-	5	-	-
pyrene		-	-	-	3	-	-
C1-fluoranthenes/pyrenes		-	-	-	-	-	-
benz[a]anthracene		-	-	-	0.5	-	-
chrysene		-	-	-	1	-	-
C1-chrysenes/benz[a]anthracenes		-	-	-	-	-	-
C2-chrysenes/benz[a]anthracenes		-	-	-	-	-	-
C3-chrysenes/benz[a]anthracenes		-	-	-	-	-	-
C4-chrysenes/benz[a]anthracenes		-	-	-	-	-	-
benzo[b]fluoranthene		-	-	-	0.3	-	-
benzo[k]fluoranthene		-	-	-	-	-	-
benzo[a]pyrene		-	-	-	-	-	-
indeno[1,2,3-cd]pyrene		-	-	-	-	-	-
dibenz[a,h]anthracene		-	-	-	-	-	-
benzo[ghi]perylene		-	-	-	-	-	-
Sum of HACs		**0.1**	**-**	**-**	**10**	**-**	**-**
sample weight, grams:		5.42	5.26	5.49	5.03	5.32	5.64

Table C-8. Chitons. Concentrations, ng/g (ppb) wet weight, of aromatic contaminants (ACs) in edible flesh.

ACs																		
	Village:	Windy Bay		Kodiak		<- Old Harbor ->			Tatitlek		<- Larsen Bay ->			Ouzinkie		Akhiok	Karluk	
	Site:	WNB1	WNB1	KOD3	KOD3	OHA3	OHA3	OHA3	TAT5	TAT5	LAB1	LAB1	LAB2	OUZ2	OUZ2	AKH2	KAR1	KAR2
	Cycle:	I	III	II	III	I	II	III	II	III	I	II	III	I	III	III	I	III
	D & M no.:	35	492	204	493	109	317	612	159	423	78	313	589	61	199	379	80	370
	Lab no.:	76	360	208	396	79	345	401	120	357	81	346	411	80	410	399	78	400
naphthalene		a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a
C1-naphthalenes		0.4	0.6	3	1	0.5	0.3	-	-	0.8	0.2	0.2	-	-	0.2	0.4	0.1	-
C2-naphthalenes		0.04	0.2	4	0.3	-	-	-	-	-	-	-	-	-	-	-	-	-
C3-naphthalenes		-	3	14	1	-	-	-	-	-	-	-	-	-	-	-	-	-
C4-naphthalenes		0.02	43	27	1	-	-	-	-	-	-	-	-	-	-	-	-	-
acenaphthylene		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
acenaphthene		-	-	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-
fluorene		-	0.2	3	0.3	-	-	-	-	-	-	-	-	-	-	-	-	-
C1-fluorenes		0.03	4	9	3	-	-	-	-	-	-	-	-	-	-	-	-	-
C2-fluorenes		2	98	45	7	-	-	-	-	-	-	-	-	-	-	-	-	-
C3-fluorenes		-	77	12	3	-	-	-	-	-	-	-	-	-	-	-	-	-
phenanthrene		2	5	14	13	0.9	0.6	0.5	-	0.4	0.4	0.7	0.4	0.1	0.3	0.7	0.1	-
C1-phenanthrenes/anthracenes		1	38	30	34	0.02	-	-	-	-	-	-	-	-	-	-	-	-
C2-phenanthrenes/anthracenes		2	380	21	14	1	-	-	-	-	-	-	-	-	-	-	-	-
C3-phenanthrenes/anthracenes		3	1000	19	4	-	-	-	-	-	-	-	-	-	-	-	-	-
C4-phenanthrenes/anthracenes		0.4	310	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-
dibenzothiophene		0.3	3	3	0.5	-	-	-	-	-	-	-	-	-	-	-	-	-
C1-dibenzothiophenes		0.1	25	6	1	-	-	-	-	-	-	-	-	-	-	-	-	-
C2-dibenzothiophenes		0.7	580	11	3	-	-	-	-	-	-	-	-	-	-	-	-	-
C3-dibenzothiophenes		0.9	1400	9	4	-	-	-	-	-	-	-	-	-	-	-	-	-
Sum of LACs		**13**	**4000**	**230**	**90**	**2**	**0.9**	**0.5**	-	**1**	**0.6**	**0.9**	**0.4**	**0.1**	**0.5**	**1**	**0.2**	-
fluoranthene		0.04	11	11	7	0.05	-	-	-	-	0.05	0.4	-	-	-	-	-	-
pyrene		-	22	0.4	7	0.03	-	-	-	-	0.01	0.2	-	-	-	-	-	-
C1-fluoranthenes/pyrenes		0.6	220	9	13	-	-	-	-	-	-	-	-	-	-	-	-	-
benz[a]anthracene		-	5	0.8	0.1	-	-	-	-	-	-	-	-	-	-	-	-	-
chrysene		1	220	4	3	-	-	-	-	-	-	-	-	-	-	-	-	-
C1-chrysenes/benz[a]anthracenes		0.6	370	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C2-chrysenes/benz[a]anthracenes		1	400	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C3-chrysenes/benz[a]anthracenes		0.02	230	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C4-chrysenes/benz[a]anthracenes		-	270	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
benzo[b]fluoranthene		-	41	0.8	-	-	-	-	-	-	-	-	-	-	-	-	-	-
benzo[k]fluoranthene		-	3	0.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-
benzo[a]pyrene		-	6	0.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-
indeno[1,2,3-cd]pyrene		-	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
dibenz[a,h]anthracene		-	4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
benzo[ghi]perylene		-	19	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Sum of HACs		**3**	**1800**	**27**	**30**	**0.1**	-	-	-	-	**0.06**	**0.6**	-	-	-	-	-	-
sample weight, grams:		5.49	4.98	5.08	3.80	4.58	5.31	5.21	5.05	5.27	5.15	5.50	5.38	5.49	4.99	5.18	5.04	5.13

Table C-9. Chitons. Concentrations, ng/g (ppb) wet weight, of aromatic contaminants (ACs) in edible flesh.

ACs																	
Village:	<- Chiniak ->					<- Port Lions ->						Pt. Gra./Eng. Bay			Kasits.	Angoon	
Site:	CHI2	CHI2	CHI2	CHI2	CHI2	PTL1	PTL1	PTL1	PTL2	PTL2	PTL2	PTG1	PTG1	PTG1	KAS1	AGN1	AGN1
Cycle:	I	II	II	III	III	I	II	III	I	I	II	I	II	III	III	II	II
D & M no.:	43	225	223	635	640	64	228	518	68	68	233	22	124	475	486	163	172
									>duplicate<								
Lab no.:	77	343	344	397	398	82	210	412	83	84	209	75	121	359	358	326	327
naphthalene	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a
C1-naphthalenes	0.2	0.3	0.6	-	-	0.2	1	0.4	0.1	0.1	0.7	0.3	-	0.4	0.8	0.6	0.8
C2-naphthalenes	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.07	-
C3-naphthalenes	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C4-naphthalenes	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
acenaphthylene	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
acenaphthene	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
fluorene	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C1-fluorenes	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C2-fluorenes	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C3-fluorenes	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
phenanthrene	1	0.7	0.6	0.5	0.1	0.4	0.7	0.7	0.2	0.3	0.6	0.4	0.2	0.3	0.7	0.7	0.6
C1-phenanthrenes/anthracenes	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C2-phenanthrenes/anthracenes	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C3-phenanthrenes/anthracenes	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C4-phenanthrenes/anthracenes	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
dibenzothiophene	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C1-dibenzothiophenes	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C2-dibenzothiophenes	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C3-dibenzothiophenes	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Sum of LACs	1	1	1	0.5	0.1	0.6	2	1	0.3	0.4	1	0.7	0.2	0.7	2	1	1
fluoranthene	0.1	0.08	0.09	-	-	-	-	-	-	-	-	-	-	-	-	-	-
pyrene	0.04	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C1-fluoranthenes/pyrenes	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
benz[a]anthracene	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
chrysene	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C1-chrysenes/benz[a]anthracenes	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C2-chrysenes/benz[a]anthracenes	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C3-chrysenes/benz[a]anthracenes	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C4-chrysenes/benz[a]anthracenes	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
benzo[b]fluoranthene	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
benzo[k]fluoranthene	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
benzo[a]pyrene	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
indeno[1,2,3-cd]pyrene	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
dibenz[a,h]anthracene	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
benzo[ghi]perylene	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Sum of HACs	0.1	0.1	0.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-
sample weight, grams:	5.01	5.30	5.37	5.41	5.31	5.03	5.03	5.18	5.10	5.42	5.33	5.19	5.12	5.09	5.50	5.28	5.32

Table C-10. Snails and limpets. Concentrations, ng/g (ppb) wet weight, of aromatic contaminants (ACs) in edible flesh.

ACs	Mollusc:	<- Snails ->						Limpets
	Village:	Windy Bay	Chiniak	<- Port Lions ->		Port Graham	<- Larsen Bay ->	
	Site:	WNB1	CHI2	PTL1	PTL2	PTG4	LAB4	LAB1
	Cycle:	I	I	I	I	I	I	I
	D & M no.:	37	39	65	67	34	101	95
	Lab no.:	684	685	687	688	683	686	690
naphthalene		a	a	a	a	a	a	a
C1-naphthalenes		1	0.8	0.3	0.5	1	0.5	0.9
C2-naphthalenes		-	-	-	-	-	-	-
C3-naphthalenes		-	-	-	-	-	-	-
C4-naphthalenes		3	-	-	-	-	-	-
acenaphthylene		-	-	-	-	-	-	-
acenaphthene		-	-	-	-	-	-	-
fluorene		-	-	-	-	-	-	-
C1-fluorenes		0.3	-	-	-	-	-	-
C2-fluorenes		16	-	-	-	-	-	-
C3-fluorenes		13	-	-	-	-	-	-
phenanthrene		6	0.6	0.5	0.4	2	0.8	0.6
C1-phenanthrenes/anthracenes		11	-	-	-	-	-	-
C2-phenanthrenes/anthracenes		99	-	-	-	-	-	-
C3-phenanthrenes/anthracenes		170	-	-	-	-	-	-
C4-phenanthrenes/anthracenes		40	-	-	-	-	-	-
dibenzothiophene		0.06	-	-	-	-	-	-
C1-dibenzothiophenes		2	-	-	-	-	-	-
C2-dibenzothiophenes		54	-	-	-	-	-	-
C3-dibenzothiophenes		210	-	-	-	-	-	-
Sum of LACs		**620**	**1**	**0.8**	**0.9**	**3**	**1**	**2**
fluoranthene		1	-	-	-	0.6	-	0.1
pyrene		2	-	-	-	0.2	-	-
C1-fluoranthenes/pyrenes		13	-	-	-	-	-	-
benz[a]anthracene		0.5	-	-	-	-	-	-
chrysene		39	-	-	-	0.07	-	-
C1-chrysenes/benz[a]anthracenes		54	-	-	-	-	-	-
C2-chrysenes/benz[a]anthracenes		38	-	-	-	-	-	-
C3-chrysenes/benz[a]anthracenes		10	-	-	-	-	-	-
C4-chrysenes/benz[a]anthracenes		0.9	-	-	-	-	-	-
benzo[b]fluoranthene		2	-	-	-	-	-	-
benzo[k]fluoranthene		-	-	-	-	-	-	-
benzo[a]pyrene		-	-	-	-	-	-	-
indeno[1,2,3-cd]pyrene		-	-	-	-	-	-	-
dibenz[a,h]anthracene		-	-	-	-	-	-	-
benzo[ghi]perylene		0.1	-	-	-	-	-	-
Sum of HACs		**160**	-	-	-	**0.9**	-	**0.1**
		5.14	5.09	5.06	5.19	5.00	5.08	5.03

Table C-11. Dungeness crab, Tanner crab and king crab. Concentrations, ng/g (ppb) wet weight, of aromatic contaminants (ACs) in edible flesh.

ACs	Crab:	<- Dungeness ->					<- Tanner ->				<- King ->	
	Village:	<-Kodiak->		Larsen Bay	Chiniak	Port Lions	Old Harbor	Larsen Bay	<-Port Lions->		Larsen Bay	Port Lions
	Site:	KOD4	KOD5	LAB4	CHI3	PTL5	OHA2	LAB4	PTL4	PTL4	LAB4	PTL4
	Cycle:	I	II	I	I	I	I	I	I	III	I	II
	D & M no.:	52	212	103	55	73	115 116	99 100	71 72	581	102	235
	Lab no.:	96	341	99	97	102	98	100	101	491	689	342
naphthalene		a	a	a	a	a	a	a	a	a	a	a
C1-naphthalenes		0.1	0.2	-	-	-	0.08	0.1	-	-	0.8	1
C2-naphthalenes		-	-	-	-	-	-	-	-	-	-	-
C3-naphthalenes		-	0.08	-	-	-	-	-	-	-	-	-
C4-naphthalenes		-	-	-	-	-	-	-	-	-	-	-
acenaphthylene		-	-	-	-	-	-	-	-	-	-	-
acenaphthene		-	-	-	-	-	-	-	-	-	-	0.5
fluorene		-	-	-	-	-	-	-	-	-	-	0.2
C1-fluorenes		-	-	-	-	-	-	-	-	-	-	-
C2-fluorenes		-	-	-	-	-	-	-	-	-	-	-
C3-fluorenes		-	-	-	-	-	-	-	-	0.3	-	-
phenanthrene		0.09	0.3	0.08	0.1	0.09	0.05	0.1	0.07	0.4	0.9	1
C1-phenanthrenes/anthracenes		-	-	-	-	-	-	-	-	-	-	-
C2-phenanthrenes/anthracenes		-	-	-	-	-	-	-	-	-	-	-
C3-phenanthrenes/anthracenes		-	-	-	-	-	-	-	-	-	-	-
C4-phenanthrenes/anthracenes		-	-	-	-	-	-	-	-	-	-	-
dibenzothiophene		-	-	-	-	-	-	-	-	-	-	-
C1-dibenzothiophenes		-	-	-	-	-	-	-	-	-	-	-
C2-dibenzothiophenes		-	-	-	-	-	-	-	-	-	-	-
C3-dibenzothiophenes		-	-	-	-	-	-	-	-	-	-	-
Sum of LACs		**0.2**	**0.6**	**0.1**	**0.1**	**0.1**	**0.1**	**0.2**	**0.1**	**0.7**	**2**	**3**
fluoranthene		-	-	-	-	-	-	-	-	-	-	-
pyrene		-	-	-	-	-	-	-	-	-	-	-
C1-fluoranthenes/pyrenes		-	-	-	-	-	-	-	-	-	-	-
benz[a]anthracene		-	-	-	-	-	-	-	-	-	-	-
chrysene		-	-	-	-	-	-	-	-	-	-	-
C1-chrysenes/benz[a]anthracenes		-	-	-	-	-	-	-	-	-	-	-
C2-chrysenes/benz[a]anthracenes		-	-	-	-	-	-	-	-	-	-	-
C3-chrysenes/benz[a]anthracenes		-	-	-	-	-	-	-	-	-	-	-
C4-chrysenes/benz[a]anthracenes		-	-	-	-	-	-	-	-	-	-	-
benzo[b]fluoranthene		-	-	-	-	-	-	-	-	-	-	-
benzo[k]fluoranthene		-	-	-	-	-	-	-	-	-	-	-
benzo[a]pyrene		-	-	-	-	-	-	-	-	-	-	-
indeno[1,2,3-cd]pyrene		-	-	-	-	-	-	-	-	-	-	-
dibenz[a,h]anthracene		-	-	-	-	-	-	-	-	-	-	-
benzo[ghi]perylene		-	-	-	-	-	-	-	-	-	-	-
Sum of HACs		-	-	-	-	-	-	-	-	-	-	-
sample weight, grams:		5.13	5.38	5.18	5.25	4.91	5.95	5.11	5.53	5.53	5.00	5.31

Table C-12. Urchins. Concentrations, ng/g (ppb) wet weight, of aromatic contaminants (ACs) in edible flesh.

ACs			
	Village:	Old Harbor	Larsen Bay
	Site:	OHA3	LAB3
	Cycle:	I	I
	D & M no.:	113	98
	Lab no.:	691	692
naphthalene		a	a
C1-naphthalenes		2	0.7
C2-naphthalenes		0.3	-
C3-naphthalenes		-	-
C4-naphthalenes		-	-
acenaphthylene		-	-
acenaphthene		-	-
fluorene		-	-
C1-fluorenes		-	-
C2-fluorenes		-	-
C3-fluorenes		-	-
phenanthrene		2	1
C1-phenanthrenes/anthracenes		0.9	-
C2-phenanthrenes/anthracenes		0.2	-
C3-phenanthrenes/anthracenes		-	-
C4-phenanthrenes/anthracenes		-	-
dibenzothiophene		-	-
C1-dibenzothiophenes		-	-
C2-dibenzothiophenes		-	-
C3-dibenzothiophenes		-	-
Sum of LACs		**5**	**2**
fluoranthene		0.9	0.8
pyrene		0.8	0.3
C1-fluoranthenes/pyrenes		-	-
benz[a]anthracene		-	-
chrysene		0.1	-
C1-chrysenes/benz[a]anthracenes		-	-
C2-chrysenes/benz[a]anthracenes		-	-
C3-chrysenes/benz[a]anthracenes		-	-
C4-chrysenes/benz[a]anthracenes		-	-
benzo[b]fluoranthene		0.3	-
benzo[k]fluoranthene		-	-
benzo[a]pyrene		-	-
indeno[1,2,3-cd]pyrene		-	-
dibenz[a,h]anthracene		-	-
benzo[ghi]perylene		-	-
Sum of HACs		**2**	**1**
sample weight, grams:		5.06	5.01

APPENDIX D

QUALITY ASSURANCE FOR INDIVIDUAL AROMATIC CONTAMINANTS IN FISH AND SHELLFISH

Quality Assurance for Individual Aromatic Contaminants in Fish and Shellfish: Matrix Spikes, Spiked Blanks, and Method Blanks

For each set of 10 samples, a method blank and a matrix spike or a method spiked blank were analyzed for selected aromatic contaminants (ACs) in Table 1.

Matrix Spikes

Thirty-one matrix spikes were analyzed for this project. The results are summarized in Table D-1. Mean percent recoveries for the ACs ranged from 79 to 110% and the relative standard deviations (RSDs) ranged from 7 to 34%.

Spiked Blanks

Spiked method blanks were analyzed with 6 sets of samples (Table D-2). Mean percent recoveries for the ACs ranged from 95 to 120% and the RSDs ranged from 2 to 19%.

Method Blanks

Thirty-seven method blanks were analyzed (Tables D-3a,b). Naphthalene was present in each method blank at about 1 ppb (1 ng/g). The source of the naphthalene appeared to be the dichloromethane solvent, despite the dichloromethane being the highest grade available. Traces of methy1naphthalenes and phenanthrene were also found in some method blanks.

Explanatory Notes for Tables D-1 through D-3a,b.

Naphthalene-d8 was the internal standard for naphthalene through C4-naphthalenes. Acenaphthene-d10 was the internal standard for acenaphthylene through Cl-fluoranthenes/pyrene. Benzo[a]pyrene-d12 was the internal standard for benz[a]anthracene through benzo[ghi]perylene. Percent recoveries for the internal standards (surrogates) averaged 87%, RSD = 15%, n = 216.

Results on sample extracts were determined by gas chromatography/mass spectrometry (GC/MS) using sequenced multiple ion detection.

A hyphen (-) indicates that the analyte was not detected above the limit of detection which ranged from 0.02 to 1 ng/g (ppb) wet weight. This applies to individual contaminants, as well as groupings of contaminants (e.g., C2-phenanthrenes/ anthracenes).

The matrix spike values are the percent recoveries of analytes added to a sample comparable to the type of tissue being analyzed. The matrix spike was then analyzed as a sample.

The spiked blank values are the percent recoveries of analytes added to a method blank and analyzed as a sample.

The relative standard deviation (RSD) is the standard deviation divided by the mean and expressed as a percent.

Table D-1. Matrix spikes. Percent recoveries of aromatic contaminants (ACs) in matrix spikes (n=31).

ACs	mean %	RSD %	Amount spiked ng/g
naphthalene	100	7	65
acenaphthylene	93	15	70
acenaphthene	93	10	63
fluorene	97	12	69
phenanthrene	106	13	68
dibenzothiophene	104	14	120
benz[a]anthracene	97	22	58
chrysene	101	18	68
benzo[b]fluoranthene	91	16	66
benzo[k]fluoranthene	86	12	65
benzo[a]pyrene	88	12	59
indeno[1,2,3-cd]pyrene	82	24	54
dibenz[a,h]anthracene	84	34	43
benzo[ghi]perylene	79	19	56

Table D-2. Spiked blanks. Percent recoveries of aromatic contaminants (ACs) in spiked blanks (n=6).

ACs	mean %	RSD %	Amount spiked ng/g
naphthalene	102	4	65
acenaphthylene	95	7	63
acenaphthene	98	2	69
fluorene	98	4	66
phenanthrene	103	6	68
dibenzothiophene	109	7	120
benz[a]anthracene	124	18	58
chrysene	113	9	68
benzo[b]fluoranthene	110	16	66
benzo[k]fluoranthene	111	12	65
benzo[a]pyrene	96	4	59
indeno[1,2,3-cd]pyrene	109	15	54
dibenz[a,h]anthracene	115	19	43
benzo[ghi]perylene	103	13	56

Table D-3a. Method blanks. Concentrations, ng/g (ppb) wet weight, of aromatic contaminants (ACs) in method blanks.

ACs	Lab no.:	32	50	68	86	104	123	141	159	177	198	216	234	253	272	290	312	348	403
naphthalene		2	-	-	1	0.9	1	0.7	2	0.9	1	2	1	1	1	1	1	1	0.9
C1-naphthalenes		-	-	-	0.04	-	-	-	0.2	-	-	0.1	-	0.2	0.2	0.1	0.1	0.2	-
C2-naphthalenes		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C3-naphthalenes		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C4-naphthalenes		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
acenaphthylene		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
acenaphthene		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
fluorene		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C1-fluorenes		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C2-fluorenes		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C3-fluorenes		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
phenanthrene		-	-	-	0.02	-	-	-	0.1	-	-	0.08	-	-	0.2	0.08	0.1	0.09	-
C1-phenanthrenes/anthracenes		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C2-phenanthrenes/anthracenes		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C3-phenanthrenes/anthracenes		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C4-phenanthrenes/anthracenes		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
dibenzothiophene		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C1-dibenzothiophenes		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C2-dibenzothiophenes		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C3-dibenzothiophenes		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Sum of LACs		**2**	**-**	**-**	**1**	**0.9**	**1**	**0.7**	**2**	**0.9**	**1**	**2**	**1**	**1**	**1**	**1**	**1**	**1**	**0.9**
fluoranthene		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
pyrene		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C1-fluoranthenes/pyrenes		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
benz[a]anthracene		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
chrysene		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C1-chrysenes/benz[a]anthracenes		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C2-chrysenes/benz[a]anthracenes		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C3-chrysenes/benz[a]anthracenes		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C4-chrysenes/benz[a]anthracenes		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
benzo[b]fluoranthene		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
benzo[k]fluoranthene		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
benzo[a]pyrene		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
indeno[1,2,3-cd]pyrene		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
dibenz[a,h]anthracene		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
benzo[ghi]perylene		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Sum of HACs		**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**

Table D-3b. Method blanks. Concentrations, ng/g (ppb) wet weight, of aromatic contaminants (ACs) in method blanks.

ACs	Lab no.: 366	421	439	458	476	494	512	530	548	566	584	602	620	639	657	675	694	712
naphthalene	1	0.9	1	1	0.9	1	1	2	1	2	0.9	1	2	1	2	2	3	3
C1-naphthalenes	-	-	-	-	-	-	-	0.1	-	0.3	-	-	-	-	-	1	0.3	0.3
C2-naphthalenes	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C3-naphthalenes	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C4-naphthalenes	-	-	-	-	-	-	-	0.2	-	-	-	-	-	-	-	-	-	-
acenaphthylene	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
acenaphthene	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
fluorene	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C1-fluorenes	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C2-fluorenes	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C3-fluorenes	-	-	-	-	-	0.2	-	-	-	-	-	-	-	-	-	-	-	-
phenanthrene	0.1	-	-	-	-	0.2	0.1	0.5	-	0.3	-	-	-	-	-	0.5	0.1	0.2
C1-phenanthrenes/anthracenes	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	1
C2-phenanthrenes/anthracenes	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C3-phenanthrenes/anthracenes	-	-	-	-	-	-	0.2	0.2	-	-	-	-	-	-	-	-	-	-
C4-phenanthrenes/anthracenes	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
dibenzothiophene	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C1-dibenzothiophenes	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C2-dibenzothiophenes	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C3-dibenzothiophenes	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Sum of LACs	1	0.9	1	1	0.9	1	1	3	1	3	0.9	1	2	1	2	4	3	4
fluoranthene	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
pyrene	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C1-fluoranthenes/pyrenes	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
benz[a]anthracene	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
chrysene	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C1-chrysenes/benz[a]anthracenes	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C2-chrysenes/benz[a]anthracenes	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C3-chrysenes/benz[a]anthracenes	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C4-chrysenes/benz[a]anthracenes	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
benzo[b]fluoranthene	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
benzo[k]fluoranthene	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
benzo[a]pyrene	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
indeno[1,2,3-cd]pyrene	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
dibenz[a,h]anthracene	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
benzo[ghi]perylene	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Sum of HACs	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-