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

First Year: 1989

Usha Varanasi, Sin-Lam Chan, William D. MacLeod, John E. Stein, Donald W. Brown, Douglas G. Burrows, Karen L. Tilbury, John T. Landahl, Catherine A. Wigren, Tom Hom, Susan M. Pierce

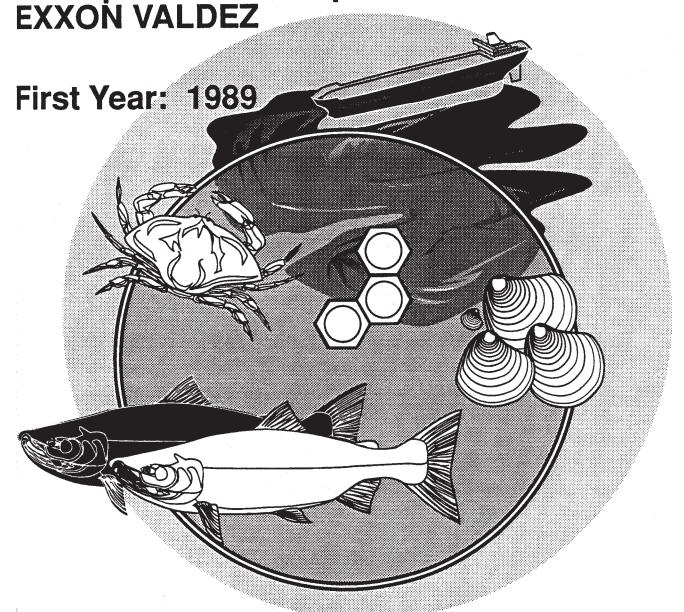
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Environmental Conservation Division Northwest Fisheries Center National Marine Fisheries Service National Oceanic and Atmospheric Administration 2725 Montlake Boulevard East Seattle, Washington 98112

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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 \leq 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 dibenzoiophenes 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)

C1-naphthalenes

C2-naphthalenes

C3-naphthalenes

C4-naphthalenes

acenaphthylene

acenaphthene

fluorene

C1-fluorenes

C2-fluorenes

C3-fluorenes

phenanthrene (PHN)

C1-phenanthrenes/anthracenes

C2-phenanthrenes/anthracenes

C3-phenanthrenes/anthracenes

C4-phenanthrenes/anthracenes

dibenzothiophene

C1-dibenzothiophenes

C2-dibenzothiophenes

C3-dibenzothiophenes

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

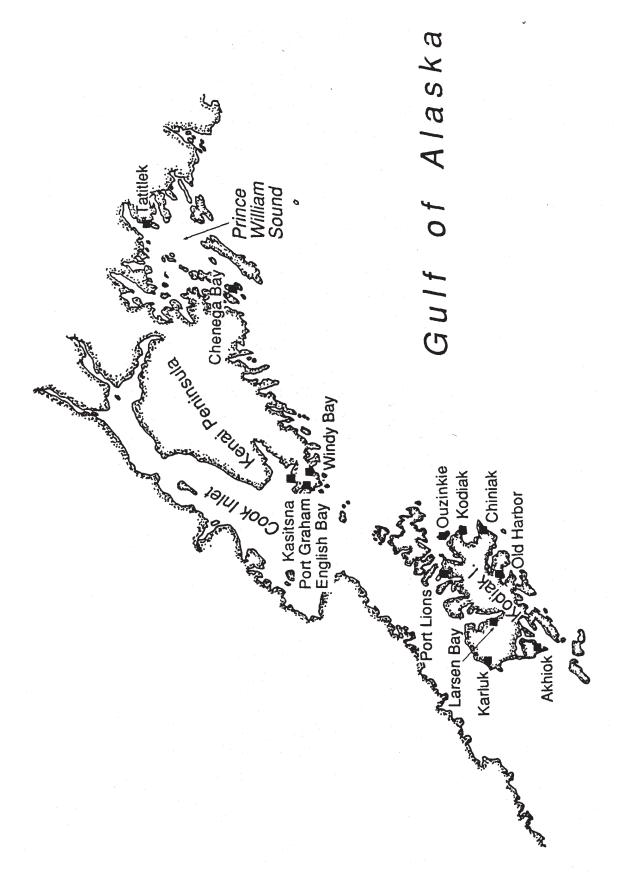


Figure 1. Native Alaskan fishing sites.

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 Waters¹ 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.

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

Table 2. Fish: Species sampling tog tot subsistence smales, cycles 1 - 111, 1989	ICS Sample	1 901 911	or suosis	tence sm	uice, cyci	cs 1 - 111,	1989.						
							Species						
Village,		Pink	Coho	Sockeye	Chum	Chinook	Dolly	Smoked		Yellowfin	Pacific		Irish
Sampling site	Code	salmon	salmon	salmon	salmon	salmon	Varden	salmon	Halibut	sole	poo	Rockfish	lord
Windy Bay 1	WNR 1												
Winds Bon 5	VIAND 2												
Worked Caire 1	WIND 2											•	
Aodiak (City) I	T GOV											2	
Kodiak (city) 2	KOD 2								2				
Kodiak (city) 3	KOD3												
Kodiak (city) 4	KOD 4												
Kodiak (city) 5	KOD 5	16		_			2	ر د ار					
Kodiak (city) 6	KOD 6								3				
Chenega Bay 1	CHE 1												
Chenega Bay 2	CHE 2								6		9	4	
Chenega Bay 3	CHE 3	80											
Chenega Bay 4	CHE 4	18											
Old Harbor 1	OHA 1								5		2		
	OHA 2	25					_				-		
	OHA 3												
Old Harbor 4	OHA 4												,
Old Harbor (smo. salm.) OHASS	OHASS							1					
Tatitlek 1	TAT 1												
Tatitlek 2	TAT 2	3											
Tatitlek 3	TAT3	9										-	
Tatitlek 4	TAT 4								2		2	1	
,	TAT 5												
	TAT 6								2				
	TAT7		18										
Tatitlek (smo. salm.)	TATSS							-					
Larsen Bay 1	LAB 1												
Larsen Bay 2	LAB 2												
Larsen Bay 3	LAB3												
Larsen Bay 4	LAB4												
	LAB 5								1				
	LAB6	3		14	-				4		3		
	LAB7	2											
Larsen Bay 8	LAB8	15							4				

site 1 2 5 6 6	Pink salmon 2											
iie	salmon 2	Coho	Sockeye	Chum	Chinook	_	Smoked		Yellowfin	Pacific		Irish
	7	salmon	salmon	salmon	salmon	Varden	salmon	Halibut	sole	poo	Rockfish	lord
								7				
								œ				
9												
9	20											
		16										
											2	
	12		_	9								
								3				
	12			2								
			2									
Akhiok 2 AKH 2												
Akhiok 3 AKH 3												
Akhiok 4 AKH 4	4	3										
,												
Port Lions 3 PTL 3	3	13						3				
								2	-			
	18											
								4				
Port Gra./Eng. Bay 1 PTG 1												
								-			2	2
	13	4										
								-				
Karluk 1 KAR I	2	5	4			2						
Karluk 2 KAR 2												
Kasitsna 1 KAS 1												
Angoon 3 AGN 3	9	8			3			3		2		

Table 3. Shellfish: Species sampling log	Species s	ampling		absistenc	for subsistence studies, cycles I - III, 1989 Species	cycles I	- III, 198 Species	65					
Village Sampling site	Code	Mussels	Butter clams	Horse clams	Littleneck clams	Cockles	Chitons	Snails	Limpets	Urchins	Dungeness crab	Tanner	King
Windy Bay 1	WNB 1	က					2					4.	
Windy Bay 2	WNB 2				-								
Kodiak City 1	KOD 1												
Kodiak City 2	KOD 2												
Kodiak City 3	KOD 3	-	_		2		2						
Kodiak City 4	K0D4					2					-		
Kodiak City 5	KOD 5										-		
Kodiak City 6	KOD 6												
Chenega Bay 1	CHE 1	9	7										
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	2		-		3			-			
Old Harbor 4	OHA 4		2		-								
Tatitlek 1	TAT 1	3											
Tatitlek 2	TAT 2												
Tatitlek 3	TAT3												
Tatitlek 4	TAT 4												
Tatitlek 5	TAT 5	9					2						
Tatitlek 6	TAT 6												
Tatitlek 7	TAT 7												
Larsen Bay 1	LAB 1	-	3				2		-				
Larsen Bay 2	LAB 2		4										
Larsen Bay 3	LAB3									-			
Larsen Bay 4	LAB4							_			-	2	_
Larsen Bay 5	LAB 5												
Larsen Bay 6	LAB6												
Larsen Bay 7	LAB7												
Larsen Bay 8	LAB8												

Table 3 (continued).	Shellfish	Shellfish: Species s	s sampli	ng log fc	ampling log for subsistence studies, cycles I - III, 1989	nce studi	ies, cycle	s I - III, 1	.686				
				- 1			Species		İ				
Village Sampling site	Code	Mussels	Butter clams	Horse clams	Littleneck clams	Cockles	Chitons	Snails L	Limpets	Urchins	Dungeness crab	Tanner crab	King crab
Ouzinkie 1	OUZ 1												
Ouzinkie 2	OUZ 2	-	2		2		2						T
Ouzinkie 3	OUZ 3		-										
Ouzinkie 4	0UZ 4		1										
Ouzinkie 5	0UZ 5												
Ouzinkie 6	9 Z00												
Chiniak 1	CHI 1	-	3		2								
Chiniak 2	CHI 2	1	4		1	2	5	1					
Chiniak 3	CHI3										-		
Chiniak 4	CHI 4												
Chiniak 5	CHI 5												
Chiniak 6	CHI 6												
Chiniak 7	CHI 7												
Akhiok 1	AKH 1												
Akhiok 2	AKH 2	-	3				1						
Akhiok 3	AKH3	-			1								
Akhiok 4	AKH 4												
Port Lions 1	PTL 1		5		2		3	-					
Port Lions 2	PTL 2		2				2	1					
Port Lions 3	PTL 3								1				
Port Lions 4	PTL 4											3	
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	1			-		3				<i>t</i>		
Port Gra./Eng. Bay 2	PTG 2												
Port Gra./Eng. Bay 3	PTG 3												
Port Gra./Eng. Bay 4	PTG 4	4											
Port Gra./Eng. Bay 5	PTG 5												
Karluk 1	KARI	-											
Karluk 2	KAR 2	3					-						
Kasitsna 1	KAS 1	2	1				-						
Angoon 1	AGN 1	2					2						
Angoon 2	AGN 2		1	1									
Angoon 3	AGN 3							2					

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 μ L) 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.

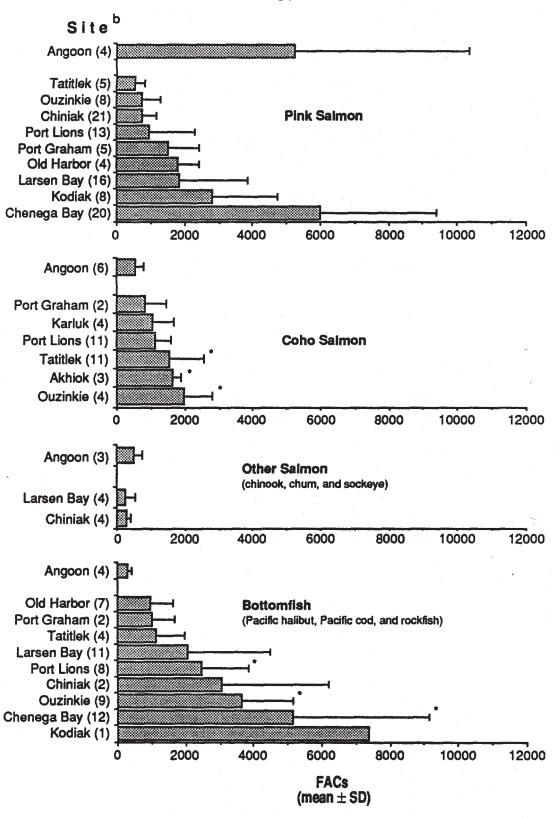
Because in many cases the sample sizes for individual species were too small (especially at Angoon) to permit strong statistical conclusions to be drawn, samples were grouped by taxonomic affiliation and habitat (viz., beach, midwater, or benthic) for purposes of statistical analyses. For example, it 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, $P: \le 0.0001$). 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.

Figure 2. Results of HPLC analyses of bile of salmon and bottomfish for FACs PHN.

b Values in () indicate number of samples analyzed.

^{*} Significantly different from Angoon, the reference site, by nonparametric test ($P \le 0.05$).

Table 4. Mean levels \pm 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)
	1.0	
Pink Salmon		
Angoon (4) b	$4,400 \pm 4,900$	2 ± 1
Tatitlek (5)	$44,000 \pm 40,000$	64 ± 50
Ouzinkie (6)	$7,800 \pm 4,200$	13 ± 7
Chiniak (21)	$35,000 \pm 28,000$	42 ± 26
Port Lions (16)	$23,000 \pm 6,600$	37 ± 15
Port Graham (5)	$27,000 \pm 19,000$	21 ± 17
Old Harbor (16)	$64,000 \pm 25,000$	40 ± 16
Larsen Bay (16)	$56,000 \pm 39,000$	35 ± 17
Kodiak (10)	$100,000 \pm 8,000$	30 ± 29
Chenega Bay (22)	$180,000 \pm 170,000$	30 ± 17
Coho Salmon		
Angoon (6)	1 700 + 700	4+2
Port Graham (2)	$1,700 \pm 700$	4 ± 2
Karluk (4)	$3,900 \pm 3,300$	4 ± 1
Port Lions (11)	$3,200 \pm 2,300$	4±3
Tatitlek (11)	$5,900 \pm 2,900$	6 ± 4 14 ± 6
Akhiok (3)	$19,000 \pm 11,000$	
Ouzinkie (4)	$11,000 \pm 8,000$	7 ± 4
Ouzilikie (4)	$22,000 \pm 12,000$	12 ± 6
Other Salmon		
Angoon (3)	$1,400 \pm 400$	3 ± 2
Larsen Bay (7)	$2,400 \pm 1,300$	14 ± 7
Chiniak (4)	$6,300 \pm 5,200$	23 ± 24
	0,500 1 5,200	23 2 2 1
<u>Bottomfish</u>		
Angoon (4)	$1,000 \pm 600$	3 ± 1
Old Harbor (7)	$4,800 \pm 6,100$	4 ± 4
Port Graham (2)	$2,800 \pm 2,400$	4 ± 5
Tatitlek (4)	$4,400 \pm 1,100$	5 ± 2
Larsen Bay (11)	$3,500 \pm 2,400$	$3\pm \overline{2}$
Port Lions (8)	$3,300 \pm 1,700$	2 ± 2
Chiniak (2)	$4,300 \pm 2,700$	$\frac{\overline{2}}{2}\pm \overline{1}$
Ouzinkie (9)	$4,900 \pm 2,300$	2 ± 2
Chenega Bay (12)	$19,000 \pm 21,000$	4 ± 4
Kodiak (1)	6,000	$\overline{1}$
	•	

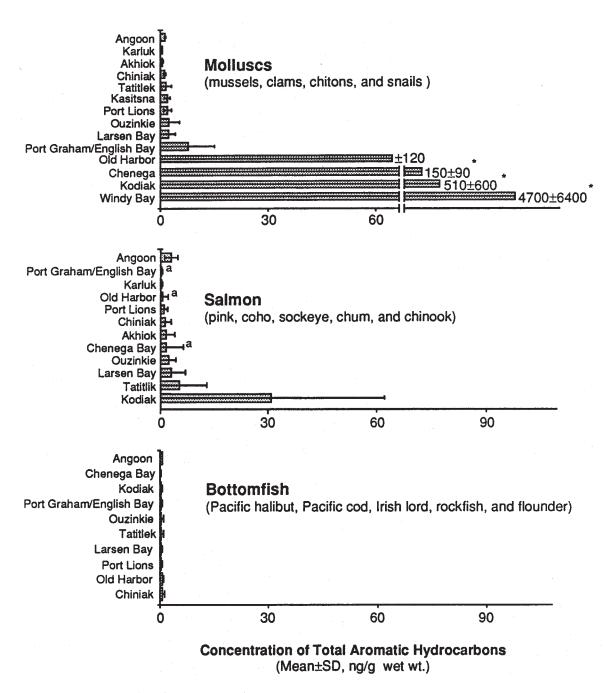
^a Fluorescence response of bile is converted to an equivalent response of a phenanthrene standard.

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).



^{*} significantly different from Angoon by nonparametric test (p≤0.05)

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

a significantly different from Kodiak by nonparametric test (p≤0.05)

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.

sna Angoon	2 / nd	2/nd						· ·												
Karluk Kasitsna																				
Karluk	pu						-								<u>.</u>					
Port Graham/ English Bay	pu	1 / nd	pu	pu	pu	pu	pu													
Port Lions	pu	3/0.2	0.4 / nd	0.5 / nd	pu	1 / nd	0.3 / nd	0.2 / nd	0.9 / nd	0.8 / nd										
Akhiok	4/0.4	1/0.1																		
Chiniak Akhiok	[-2/nd]	3/0.2	1 / nd	2 / nd	4/0.2	4/0.2	0.3 / nd	03/nd	0.3 / nd	0.3 / nd	nd	0.3 / nd								
Ouzinkie	pu	1 / nd	3/nd	5/0/5	1/nd	1/nd	1/nd	1/nd	0.9 / nd	1/nd										
Larsen Bay	2 / nd	r13/0.71	1/nd	0.3 / nd	0.8 / nd	0.8 / nd	0.5 / nd	pu	0.2 / nd	0.3 / nd	1/0/1	0.2 / nd	0.7 / nd	0.7 / nd						
Tatitlek	0.05 / nd	L bu		pu	pu															
Old Harbor	pu	1/nd	2/0.1	1/md	1 / nd	4/0.3	pu	pu	pu	pu	pu	pu	pu	pu	pu	pu	0.2 / nd	0.2 / nd		
Chenega Bay	0.9 / nd	20 / nd	pu	0.3 / nd	[2/nd]	1/md	0.2 / nd	pu	0.4 / nd	pu	pu	pu	pu	0.6 / nd	pu	3/nd	1/nd	0.3 / nd	0.8 / nd	7.7.0
Kodiak Village	-110/121	54/5	22/2	6/0.2	F84/101	4/0.2	32/5	F0.7 / nd1	[hu]	[0.9/nd]	r 2/100 -									
Windy Bay		-																•		
Village:	Salmon: pink													****						

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	Chiniak	Akhiok	Port Lions	Port Graham/ English Bay	Karluk	Karluk Kasitsna Angoon	Angoon
Salmon: coho					14/1		9.0/9		pu	2 / nd	1 / nd	0.5 / nd		2 / nd
					15/1		0.8 / nd			0.6 / nd	pu	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	pu			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 / 7 650 [7800 /]	7100 / 20000 / 2000 / 3000 / 21000 / 21000 / 1800 / 1800 / 210000 / 21000 / 21000 / 21000 / 21000 / 21000 / 21000 / 21000 / 21000 / 21000 / 21000 / 21000 / 21000 / 21000 / 21000 / 21000 / 21									

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	Windy Kodiak Chenega Bay Village Bay	Old Harbor	Old Harbor Tatitlek	Larsen Bay	Ouzinkie	Ouzinkie Chiniak Akhiok	Akhiok	Port Lions	Port Graham/ English Bay	Karluk Kasitsna Angoon	Kasitsna	Angoon
Dolly Varden		1 / nd		1 / nd		·						0.6 / nd		
Halibut		pu	pu	pu	pu	pu	pu	0.8 / nd		0.3 / nd	pu			0.4 / nd
		0.3 / nd	pu	1 / nd	pu	0.3 / nd 0.2 / nd	0.2 / nd	1 / nd		pu	0.2 / nd			
		0.9 / nd	pu	0.8 / nd		0.7 / nd	1/0.1			0.4 / nd				
-			0.5 / nd			0.5 / nd	рц			0.6 / nd				
						0.6 / nd	0.3 / nd							
Yellowfin Sole										0.8 / nd				
Pacific Cod			pu	pu	pu	0.5 / nd								0.6 / nd
			pu	0.7 / nd		0.3 / nd					-	-		
			pu											
			0.3 / nd											
Rockfish		pu	pu		1 / nd			pu						
			pu		0.6 / nd				•					
			pu							* 6 **				
Irish Lord								-		<u></u>	0.6 / nd	,	-	
	-									- V	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

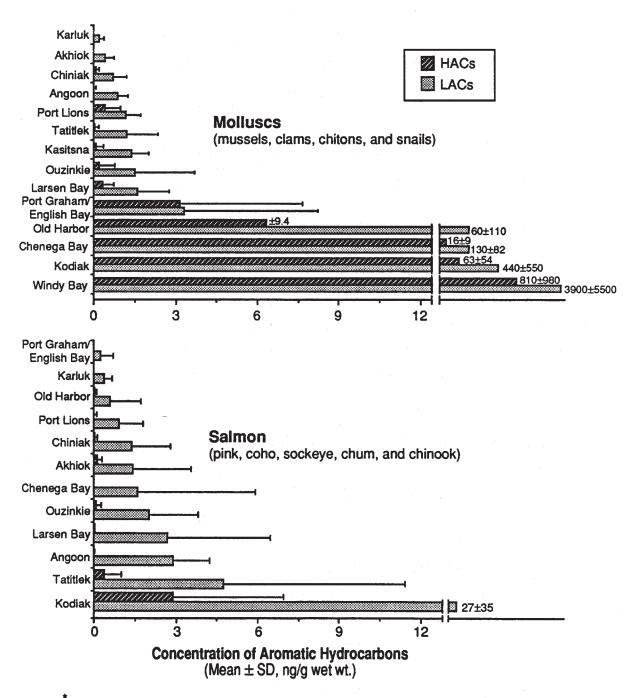
As there are significant differences in the rates of uptake, metabolism, excretion, and types of toxic effects exerted by various ACs, the fish data are also presented in Figure 4 to show the levels of LACs and HACs separately. The HACs are metabolized by fish to a greater extent than are the LACs and 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) wer weight by GC/MS of extract; nd = not detected. Brackets indicate duplicate samples. Reference values are listed under Angoon.

	Distracts muncate deputette samples. Notataire valdes are iisted minel Angood.	o mantidan o	ampies. we		ides and in									
Village:	Windy Bay	Kodiak Village	Chenega Bay	Old Harbor	Tatitlek	Larsen Bay	Ouzinkie Chiniak Akhiok	Chiniak	Akhiok	Port Lions	Port Graham/ English Bay		Karluk Kasitsna Angoon	Angoon
Molluscs: mussels	3300 / 440	1500 / 160	220 / 20	nd	LpuJ	1/0.3	0.9 / nd	둳	0.3 / nd		pu	pu	1/nd	0.6 / nd
	16000 / 2500		160/22		3/0.2			pu	0.4 / nd		4/0.4	0.4 / nd	0.7 / nd	1/0/1
	2400 / 550		200/22		3/0.1		9				1 / nd	0.3 / nd		
			190/26		3/03				-		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	pu	1/0.1	pu	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	0.2 / nd	0.4 / nd	1/0.2				
				0.7/0.3		1/nd	7/2	0.6/0.3 0.3/nd	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				
				9/9		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							e e e e e e e e e e e e e e e e e e e			
horse														0.5 / 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.

Branches indicate dualicate complete Deference values are listed under Among

								0						
Village:	Windy Bay	Kodiak Village	Chenega Bay	Old Harbor	Tatitlek	Larsen Bay	Ouzinkie	Chiniak	Akhiok	Port Lions	Port Graham/ English Bay Karluk Kasitsna Angoon	/ Karluk	Kasitsna	Angoon
Molluscs:														
littleneck	830/130	270 / 87		2/0.7	<u> </u>		1/nd	0.6/0.3	[0.3 / nd]	2/1	50/9			
•		120/24		200 / 19			0.6 / nd	2/0.4	-0.7 / Jild	1/1				
								1/0.1						
cockles			·					0.8 / 0.1			3/10			
								[0.7/nd]						
chitons	13/3	230/27		2/0.1	nd	0.6 / 0.06 0.1 /nd	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	0.5 / nd	1/0.1		2 / nd	0.2 / nd	pu		1/nd
				0.5 / nd		0.4 / nd		1/0.1		1 / nd	0.7 / nd			
	-							0.5 / nd		[0.3 / 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							٠.	
Urchins				5/2		2/1								
Crabs dungeness		0.2 / nd				0.1 / nd		0.1 / nd		0.1 / nd				
1		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 molluses 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.

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.

	2	328	amples		П			-/8.0	
	2	325	Split samples		H			0.5/-	
Angoon	2	231		1	II		0.5/-		
	1	324		1	II	1/0.1			
	-	232		1	II	-/9.0			
Ì								,,,	
	2	999			1				830 / 130
	1	243		_	Ξ	2400 / 550	•		
	_	242		-	Ш	16000 / 2500 *			
	-	47		1		3300 / 440		-	
	Site	Lab no.	No. of field samples	comprising lab sample	Cycle No.	Molluscs: mussels	clams	horse	littleneck

* 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		-	-			-	7	2	2		1
Lab no.	26	360	684		232	324	231	325	328	326	327
No. of field samples							·	Split samples	umples		
nprising lab sample	1	-	_		1	1	,,,,,,,		_		_
Cycle No.	I	III			II	Ш	Π	II	Ш	Ш	
Molluscs:					7.7	1071					
) 	-/000	1.0/1					
clams							0.57.				
							- / (?)				
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.

													Ang	Angoon		
Site	5	5	5	5	5	5	5	5	2		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 Split samples	Split san	nples				Split samples	mples							-		
comprising lab sample	-	1	-	3	2	2	2	2	2		3	3	3	3	2	3
Cycle No.	Ш	=	Ш	Ш		11	=						Ш	H	E	=
Salmon: pink	110/12 72/8 54/5	72/8	54/5	22/2	22/2 6/0.2 84/10 22/3	84 / 10	22/3	4/0.2	32/5	8	2/-	2/-				
													2/-	4/-	21-	
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.

	3 321 3 11 11 5/0.1	3 323 11 11 2/-	Angoon 3 3 3 19 II	3 3 11 11 2/-	3 3 11 11 2/-	3 3 11 11 2/-	2 4 c	5 194 11/0.5	5 540 pples 1 III III 3/-	539 Split san 1 III	5 492 mples 1 III	5 490 Split sa 1 III	5 489 mples 1 III		Site Lab No. No. of field samples comprising lab sample Cycle No. almon: pink coho sockeye chinook
							-/1								Dolly Varden
								11/0.5							sockeye
		2/-	4/-	21-											coho
21- 41-						2/-			3/-	-/6'0	1/-	1/-	0.5/-	0.7 /-	almon: pink
0.71- 0.51- 11- 11- 0.91- 31- 21- 21- 21- 21- 41-		F	ш	F	Е	Ш	I	Ш			Ш	Ħ	Ħ		Cycle No.
Cycle No. III III III III III III III III III I		7	3	9	3	3	2	-	-	1	_	_	_	,	comprising lab sample
sing lab sample 1 1 1 1 1 2 3 4 1 4 1 <td></td> <td>,</td> <td>•</td> <td></td> <td>,</td> <td></td> <td></td> <td></td> <td>ples</td> <td>Split san</td> <td>mples</td> <td></td> <td>umples</td> <td>ı</td> <td>No. of field samples</td>		,	•		,				ples	Split san	mples		umples	ı	No. of field samples
Of field samples Split samples Split samples Split samples 3 4 7 4 7 <td></td> <td>323</td> <td>319</td> <td>230</td> <td>320</td> <td>229</td> <td>¥</td> <td>194</td> <td>\$40</td> <td>539</td> <td>492</td> <td>96</td> <td>489</td> <td></td> <td>. I.ab No.</td>		323	319	230	320	229	¥	194	\$40	539	492	96	489		. I.ab No.
Lab No. of field samples Split samples 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3		3	3	3	3	3	5	5	2	5	5	5	5	2	Site
Site 5 5 5 5 5 5 5 5 5			COOL	Ans											

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	E
Site	2	9	9	-	3		3
Leb No.	4	193	208	24	228		322
No. of field samples	2	2	-	2	3		2
Cycle No.	_	Ш	E				=
Halibut	-/-	037-	-/60		0.4 / -	-/	
Pacific cod							-/9'0
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	, -	-	7	2	7	_	
Lab No.	48	212	437	447	208	396	96	341	232	324	231	325	328	326	327
No. of field samples												Split	Split samples		
comprising lab sample		-		-	-	-	_	1		-	-	-	-	_	-
Cycle No.	-		Ш	Ш	Ш		П	=	E		=	F	=	=	Ш
Molluscs: mussels	1500/160								-/9.0	0.6/- 1/0.1					
clams															
butter		410 / 50									0.5/-				
horse						··						0.5/-	-/8.0		
liuleneck			270 / 87 120 / 24	120/24		· · · ·									,
chitons					230/27 90/30	06/06								1/-	1/-
Crabs: Dungeness							0.2/- 0.6/-	0.6/-							
	1														

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

	_	3 321		3	Ш			5/0.1
	3	323		2	I		2/-	
Angoon	3	319		3	Ш		4/-	
An	3	230		3	Ш		2/-	
	3	320		3	Ш	2/-		
	3	229		3	П	27-		
,	_							
	4	455		_	Ш	0.2 / -		
	4	454		-	Ш	1/-		
	4	456	Split samples	_	Ш	27-		
	4	453	Split s		Ш	2/-		
	4	452			Ш	0.3 / -		
	3	152		3	II	-/-		
	3	138		3	11	0.9/- 20/-		
	3	137		2	П	1		
	Site	Lab No.	No. of field samples	comprising lab sample	Cycle No.	Salmon: pink	coho	chinook

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.

	3	321	3	11			5/0.1
	3	323	2	Ш		2/-	
Angoon	3	319	3			4/-	
Any	3	230	3	Ш		21-	
	3	320	3	II	2/-		
	3	229	33	Ш	2/-		
		2			_•		
	4	472			/-		
	4	471	,	H	0.6 / -		
	4	470	-	Ш	-/-		
	4	469		III	-/-		
	4	468	-	E	-/-		
	4	467	_	E	-/-		
	4	466	_	E	0.4 / -		
	4	465	-	B			
	Site	Lab No.	No. of field samples	Cycle No.	Salmon: pink	coho	chinook

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.

								Ans	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	2	1	 3	3	3	3	2	3
Cycle No.	Ш	Ш	Ш	Ш	Ш	 II	Ш	П	II	Ш	П
c c											
Saimon: pink	3/-	1/-	0.3/-	0.8 /-	0.7/-	2/-	2/-				
										,	
coho								-/2	-/4	-/7	
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.

												Ang	Angoon
Site	2	2	2	2	7	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	2	_	-	3	2
Cycle No.		I	Ħ	Ш		Ш	Ш	Ħ	_	=	П	Ш	П
Helibut	-/-	-1-	-/-	0.57-								0.4 / -	
Pacific cod					-/-	-/-	·/·	0.3/-			•		-/9:0
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.

A										Angoon			
Site	_	_	-	-	_		1		2	2	2	-	-
Lab No.	4	114	304	305	306	7	232	324	231	325	328	326	327
No. of field samples										Split samples	mples	-	
comprising lab sample	2	-	1		_		_		1			1	_
Cycle No.	_	II	III	Ш	Ш				Ш	Ш	ш	Ш	=
Molluscs:													
mussels	220/20	160/22	220/20 160/22 200/22 190/26 96/15	190/26	96/15	0	0.6/-	1/0.1					
clams	-											-	
onne									- / (?)				
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.

į]							
		327		-	Ш							1/-	
	-	326		_	11		· · ·					1/-	
	2	328	Split samples	1	Ш					087-) 		_
Angoon	2	325	Split	,	11					0.57.			
	2	231			Ш				0.5/-				
	-	324		,	Ш		1/0.1						
	1	232		-	Ш		-/9.0						
	_			_									_
	_	665		_	I				15/3				
	-	664		_	I				37/5				
	Site	Lab No.	No. of field samples	comprising lab sample	Cycle No.		mussels	•	ciams	horea		chitons	

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.

	[ļ	,	,	[,	L	,	2	2	3	٣	
Sic	7	7	7	7	7	7	7		1	1	2	า	_	7
Lab No.	11	262	569	270	279	650	541		229	320	230	319		333
No. of field samples														
comprising lab sample	-	_	1	3	3	2	-		3	3	3	3		~
Cycle No.	_	П	11	П		Ш			E	H	=	=		
Salmon: pink	-1-	1/-	2/0.1	1/-	1/-	4/03			2/-	2/-				
coho											2/-	4/-	2/-	
chinook														

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.

											Ang	Angoon		
Site	2	2	2	2	2	2	2	-	3	3	3	3	3	3
Lab No.	¥	545	546	555	556	557	558	_]	229	320	230	319	323	321
No. of field samples														
comprising lab sample	1	-	-	-	-	-	-		3	~	3	3	2	3
Cycle No.	Ш		Ш				E	Ц	=	F	H	Ш	Ш	Ш
										-				
pink	-/-	-/-	-/-	-/-	-/-	-/-			2/-	2/-				
										_			,	
coho											2/-	4/-	2/-	
				-										2 / 0 1
Chinook								-						1.076
_	_	_	_	-	_	-			-		_			

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	oou		
Site	2	2	2	2	-	-	2	3		3	3	3	3	3
¿ Lab No.	559	573	598	299	241	244	703	229	\dashv	320	230	319	323	321
No. of field samples														
comprising lab sample	-	2		2	-	-		3		3	3	3	2	3
Cycle No.	Ш	Ш		Ш	-	-	-			_	=	Ш		П
Salmon:								l						
pink	-/-	-/-	0.2/-	0.27-				2/-		2/-				
coho											2/-	4/-	2/-	
chinook														5/0.1
smoked salmon					7100 / 7800 / 650	7800 /								
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	5
Site	1	1	-	-	2	9		<u>ښ</u>
Lab No.	40	283	707	26	524	228		322
No. of field samples	•	,	-	·	-	~		ç
COMPAISING IND SAMPLE			-			1	\dagger	-
Cycle No.			=			1	†	
Helle		1/2	780			047-		
	. / .		70.0			-		
Pacific cod				-/-	0.7/-	· · ·		-/9.0
							-	

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		324 231 325 328 326 327	Split samples					1/0.1		0.5/-	0.5/- 0.8/-	1/- 1/-
	-	232		-	11		-	- /0.0				
	4	029		_						4/7		
	3	432		1	Ш					0.37-		
	3	431								1/1		
i	3	226		_	Ш	,				0.8 0.7 / 0.3 1 / 1		
	3	225		-	П					2/(
	3	699			I					2/0.6		
	3	8		-	1		•	-/-				
	Site	Lab No.	No. of field samples	comprising lab sample	Cycle No.		Monusca:	mussels	clams	butter	horse	chitons

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.

	1	327		1	ш				1/-
	1	326		_	Ш				1/-
	2	328	mples	1	Ш			0.8 /-	
Angoon	2	325	Split samples	1	Ш			0.5/-	
	2	231			Ш		0.5/-		
	-	324		1	Ш	1/0.1			
	-	232		1	П	-/9'0			
	4	433		1			210/20		
	4	419	Split samples	1	Ш		230/21 330/29 210/20		
	4	418	Split s	,	Ш		230/21		
	4	247		-	П		4/3		
,	4	227		-	П		6/5		
	Site	Lab No.	No. of field samples	comprising lab sample	Cycle No.	Molluscs: musscls	clams	horse	chitons

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

	1	6 327	-	E						- 1/-			
	-	326	-							1/-			
	2	328	mples	П					0.8/-				
Angoon	2	325	Split samples	П					0.57-				
	2	231	1	11		:		0.57-					
	_	324	-	II		1/0.1							
	-	232	-	ш		-/9'0							
1	_												
	2	86	,	-									0.1 /-
	3	169	-	_								5/2	
	3	401	-	E							0.5/-		
	3	345	-	E							2/0.1 0.9/-		
	3	79	-	-							2/0.1		
	4	919	-	E						200 / 19			
	3	615	-							2/0.7			
	Site	Lab No.	No. of field samples	Cycle No.	Mohuses:	mussels	clams	butter	horse	liuleneck	chitons	Urchins	Crabs: Tamer

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.

													A	Angoon		
Site	7	m	m	e	6	က	7	7	7		3	3	3	3	3	3
Lab No.	-	134	139	135	136	153	362	363	364		229	320	230	319	323	321
No. of field samples		Splits	Split samples							L						
comprising lab sample	3	-	-	-	-	3	3	3	2		3	3	3	e	2	E
Cycle No.	I	П	Ш		Ш	=		Е			II	F	Ш	Ш		I
Colmon.																
pink	0.05 / -	÷	-/-	-/-	-1-						2/-	2/-				
							1471	15/1	10 / 2				, ,	`	,	
								170	7/61				- / 7	- / +	- / 7	
chinook												· i - W				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.

									1	Angoon		-
Site	7	7	7	7	na	. na	9	3	3	9	е	
Lab No.	448	449	450	451	526	527	229	320	230	319	323	
No. of field samples												
comprising lab sample	2	3	3	2	na	na	3	3	3	3	2	
Cycle No.	Ш	III	III	Ш	na	na	=	III	Ħ	II	II	Ц
Salmon:												
pink						-	2/-	2/-				
coho	3/0.1	3/0.1 5/0.2	3/-	3/-					2/-	4/-	2/-	
chinook	-											
smoked salmon	١				20000/	21000 / 1800					<u> </u>	

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	noo
Site	4	9	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	-	3		2
Cycle No.	I	II	I	I	-			II
Halibut	- <i>f</i> -	-/-				0.4 / -	٠	
Pacific cod			-/-					-/9:0
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		Ī	
Site	-	-	8	ۍ	'n	'n	9	'n	_	_	7	2		_	-
Lab No.	43	99	1111	112	113	307	308	309	232	324	231	325	328	326	327
No. of field samples	Split samples	amples										Split samples	nples		
comprising lab sample		2	-		_	1	-	1	-	_	-	1	1	-	-
Cycle No.	_	1	II	Ш	Ш	Ш	Ш	E	=	Ш	II	П	П	П	
Molluscs:	: :														
mussels	·/·	-/-	3/0.2	3/0.1	3/0.1 3/0.3 0.8/-	0.8/-	1/-	-/6'0	0.6/- 1/0.1	1/0.1					
clams															
butter											-/50				
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	2	<u> </u>	-	,	2	2		-	
Lab No.	120	357		232	324	231	325	328	326	327
No. of field samples			<u> </u>				Split samples	ples		
comprising lab sample	ganin):	-		1	1	_		1	1	-
Cycle No.	Н	Ш		=	Ш	=	II	Ш	Ш	11
Molluscs:										
mussels				-/9.0	1/0.1					
clams										
Dutter						- /c.0				
horse							0.5/-	-/8'0		
chitons	-/-	1/-	<u>-</u>						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.

										An	Angoon		
Site		7	_	~	∞	00	00	 3	3	3	3	7	
Lab No.	281	3	29	91	504	505	206	229	320	230	310	333	221
No. of field samples		Split sample	umples									75.	351
comprising lab sample	3	į	-	_	-		-	6		~	~	·	"
Cycle No.		_		I		E	E					1	
Salmon:	?		9				(-			
4110	-17	13/0./	13/0.7 12/0.2	-/1	0.3/-	-/8.0	- / 8.0	 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.

		323 321	2 3	ПП		2/-	5/0.1
noc		319 3	3	П		4/- 2	
Angoor	3	230	3	П		2/-	
	3	320	3	11	21-		
	3	229	3	Ш	2/-		
	œ	597	1		0.7 /-		
	∞	596	1	Ш	0.77-		
	∞	595	1	Ш	0.27-		
	∞	594	1	Ш	1/0.1		
	∞	582	3	Ш	0.37-		
	00	581	3	Ш	0.2 / -		
	∞	543	1	Ш	-/-		
	00	207	1	Ш	0.5/-		
	Site	Lab No.	No. of field samples comprising lab sample	Cycle No.	Salmon: pink	coho	chinook

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	noo		
Site	L	9	9	9	9	9		3	3	3	3	3	3
Lab No.	264	282	286	652	653	655	27	229	320	230	319	323	321
No. of field samples	۲	۲	۲	۳	2	_			3	6.0	3	2	3
Cycle No.		F	E			=		1	Ш	Ш	Ш	П	П
pink							7	2/-	2/-				
coho	5									2/-	4/-	2/-	
sockeye	6/0.2	3/-	2/-	6/0.1	37-								
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.

									An	Angoon
Site	2	٥	9	∞	00	9	9		3	3
Lab No.	41	284	708	520	521	ğ	285		228	322
No. of field samples										
comprising lab sample	-	9	1	2	2		2		3	2
Cycle No.	_	Ш	Ш	Ш	Ш	-	П		П	П
Hallbut	-/-	0.37-	0.3/- 0.7/- 0.5/- 0.6/-	0.57-	-/9.0	,			0.4 /-	
Pacific cod			-			0.5/-	0.5/- 0.3/-			-/9.0
· **								7		

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.

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.

				L				Angoon			
Sife		p==0	2		-	-	7	7	2		-
Lab No.	. 81	346	411		232	324	231	325	328	326	327
No. of field samples								Split samples	mples		
comprising lab sample			-		1	1	,	1	,	_	-
Cycle No.	1	Ш	Ш		П	П	Ш	Ш	П	П	П
Molluscs:											
mussels					-/9.0	1/0/1	.5				
clams											
butter							0.5/-				
horse								0.5/-	0.8 / -		
chitons	90.0/9.0	5/0.06 0.9/0.6 0.4/-	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.

							ı				Angoon			
Site		1	e (4 8	4 5	4 6		- 8	- 2	2 5	2	25	2	1 22
No. of field samples	080	Q.	760	3	3	690		767	324	167	Split s	Split samples	370	175
sing lab sample	-	-	_	-	-				-	-	-	-		-
Cycle No.				-		_						F	=	
				•										
								-/9'0	1/0/1					
ciants										0.5/-				
horse											0.5/-	-/8.0		
													1/-	1/-
	17.													
	1										-			
		2/0.1												
-			2/1											
Crabs:					· ·									
SS				0.1/-										
					0.27-								,	
			,			2/-								
				1	1									

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.

192 631 632 633 2 3	L								L			Angoon	noo		
192 631 632 633 229 320 230 319 323 3 2 2 3 3 3 3 2 II II II II II II II 5/0.5 1/- 1/- 1/- 2/- 2/- 4/- 2/-	1 5	2		~	~	5	S	×		m	en E	m	m	m	m
3 2 2 3 3 3 3 3 2 II II II II II II II 5/0.5 1/- 1/- 1/- 2/- 2/- 4/- 2/-	9 175	175	1	161	192	631	632	633		229	320	230	319	323	321
3 2 2 2 3 3 3 3 3 2 2 2 3 3 3 3 3 2 2 3															
5/0.5 1/- 1/- 1/- 2/- 2/- 2/- 2/- 2/- 2/- 2/-	2 3	3	I	2	3	2	2	2		3	3	3	3	2	33
5/0.5 1/- 1/- 1/- 2/- 2/- 2/- 2/- 2/-	1 11	Ш		Ш	Ш	II	Ш	П		=	Ш	Ш	П	Ш	Ш
5/0.5 1/- 1/- 1/- 2/- 2/- 2/- 2/- 2/-			L												
5/0.5 1/- 1/- 1/- 2/- 2/- 2/- 2/- 2/-						•	,	,		,	,				-
4/- 2/-	-/- 1/- 2	1/- 3	77	-/	2/02	-/1	· ·	-/1		-/7	-17	-			
												2/1	4/-	21.	
5/0.1													}	14	
															5/0.
									_						

	1				l		
	3	321	3	П			5/0.1
	3	323	2	Ш		2/-	
noc	3	319	3	Ш		4/-	
Angoon	3	230	3	Ш		2/-	
	3.	320	3	Ш	21-		
	3	229	3	Ш	2/-		
.1							
	5	633	2		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.

									i			Ang	ngoon		
Sic	2	5	5	9	9	9	٥	9	L,	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			2	3	3		3	3	3	3	2	3
Cycle No.	=	=			Ш		III	Ш	LJ ,	Ш	=	Ш	=	Ш	
															·-
pink	1/-	0.97-	1/-							2/-	21-				
coho				9'0/9	-/8.0 9.0/9	2/-	0.6/-	-/9'0				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.

						An	Angoon		
Site		9	9	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.				П		П	Ш	П	Ξ
Salmon:				-					
pink				-/2	-/7				
coho	4/0.2	2/-	5/0.4			2/-	4/-	21-	
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.

							Ans	Angoon
Site	-	3	3	3	3	L	3	3
Lab No.	∞	171	172	510	519		228	322
No. of field samples	,		(,				
CALIFORNIA INC. SALIFOR	*	7	7	7	2		3	2
Cycle No.		=	=	Ш	Ш		П	Ш
Hallbut	-/-	0.2/-	0.2/- 1/0.1	-/-	0.37-	•	0.47-	
Doolffood								
								-/9.0

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.

2 2 395 63 ,											
395 63 434 672 1 1 1 1	4	7	7	_			2	2	2	1	1
		671	214	232		324	231	325	328	326	327
1								Split s	Split samples		
-	1	1	1			-	_	٠,	-		-
Cycle No. III I III I II II	Ш	_	П		H	Е	Ш	Ш	Ш	П	
Molluscs: musscls 0.9/-				-/9'0		1/0.1					
clams							7 9 0				
-1							-/c.u				
horse			· · · · · · · · · · · · · · · · · · ·					0.5 /-	0.8/-		
littleneck		1/-	-/9.0								
chions										-/-	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	<u> </u>	1		2	2	2	1	-
Lab No.	80	410	لـــ	232	324	231	325	328	326	327
No. of field samples							Splits	Split samples		
comprising lab sample	_	1		1	1	1	1	. 1	_	1
Cycle No.	I	Ш		Ш	П	Ш	Ш	Ш	Ш	П
Mollings										
mussels				-/9.0	1/0/1					
•										
ciams						0.57-				
-				***			0.57	7 8 6		
noise							-/ (7)	- / 0.0		
littleneck										
chitons	0.1/- 0.5/-	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.

												An	Angoon		
Site	~	~	'n	S	'n	S	S	7	7	3	3	3	3	3	3
Lab No.	261	288	265	566	287	848	649	501	205	229	320	230	319	323	321
No. of field samples Split samples	Split sa	umples													
comprising lab sample	-	-	3	-	3	2	2	_	_	3	3	3	er.	7	3
Cycle No.		П	Ш	Ш	=	Ш	Ш	Ш	E	=		=		=	
Salmon:	?	3	9	•			9				,	· · · ·			
	-/7	2/- 0.4/- 3/	2/0/5	-/1	-/7	4/0.2 4/0.2 0.3/- 0.3/-	4/0.2	-/50	0.37-	- 77	-/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.

											Ang	Angoon		
Site	7	7	7	7	5	5	5	7	3	3	3	3	3	9
Lab No.	503	579	580	009	651	280	654	525	229	320	230	319	323	321
No. of field samples														
comprising lab sample		3	3	3	1	3	3	2	3	3	3	~	7	3
Cycle No.	E	田	Ш	Ш	Ш	Ш	=	Ш		Ш	Е	F	=	=
Selmon:								-						
pink	03/-	03/- 03/-	- <i>f</i> -	0.3/-					2/-	2/-				
coho											27-	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	9	9	4	3		3
Lab No.	902	509	25	228	- 60	322
No. of field samples comprising lab sample	-	2	2	3		2
Cycle No.	Ш	E	1			=
fallbut	-/8'0	1/-		0.4/-	-/	
Pacific cod						-/9.0
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.

	1	326 327						• • • • • • • • • • • • • • • • • • • •	1/- 1/-
	2	328	Split samples		Ш			0.8 / -	
Angoon	2	325	Splits	·	Ξ			0.5/-	
	7	231			=		0.5/-		
	1	324		-		1/0/1			
	-	232		_	П	0.6/- 1/0.1			
·									
	1	428		_	Ш		1/0.1 0.2/- 0.6/0.3		
	1	413		_	Ш		0.27-		
		199		1	_		1/0.1		
	2	58		1	1	-/-			
	1	57		1	I	-1-			
	Site	Lab No.	No. of field samples	comprising lab sample	Cycle No.				

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.

								l				Angoon			
Sic	7	7	7	7	_	_	2			_	7	2	2	-	1
Lab No.	899	223	415	429	246	613	614		232	324	231	325	328	326	327
No. of field samples												Split sa	Split samples		
comprising lab sample	-	_	_	-	1	-	1		-	1	_	1	-	-	,
Cycle No.	H	Ш	Ш	Ħ	Ш			Ų	Ш		ш	П	Ш	Ш	П
Molluscs: mussels									-/9:0	1/0/1					
													-		
clams butter	03/-	0.5/-	03/-	-/60							0.5/-				
horse						,						0.5/-	0.8 / -		
littleneck	. *** *******				0.6/0.3	0.6/0.3 2/0.4 1/0.1	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.

	Site	Lab No.	No. of field samples	comprising lab sample	Cycle No.	Molluscs:	mussels	clams	butter	horse	cockles	chitons
	2	303		-	Ш						0.8/0.1	
	2	612	Splits	-	Ш						0.8/0.1 0.7/-	
	2	618	Split samples		Ш						05/-	
	2	77		1								1/0.1
	2	343		1								1/0.1
	2	344		1	Ш							1/0.1
	-	232			=		-/9:0					
		324		-	Ш		1/0.1					
	2	231		-	Ш				0.5/-			
Angoon	2	325	Split	1	Ш			-		0.5/-		
	2	328	Split samples	1	Ш					0.8/-		
	-	326		1	Ш							1/-
	-	327		1	ш						C	·/I

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	9	1	1	2	2	7	-	-
Lab No.	397	398	685	62	232	324	231	325	328	326	327
No. of field samples								Split s	Split samples		
comprising lab sample	,,		-		1	1	_	,	_	1	-
Cycle No.	Ħ	Ш		1	Ш	Ш	П	Ш	Ш	Ш	=
Molluscs: mussels					-/9'0	1/0/1					
clams butter							0.5/-		·		
horse		****						0.5/-	0.8/-		
chitons	0.5/-	0.17-									
snails			1/-		-		र ≟ ल			1/-	1/-
Crabs: Dungeness				0.1/-							
					T						

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	EC.		
Sic	4	4	4	-			3	3	3	3	3
Lab No.	263	267	560	2	22	229	320	230	319	323	321
No. of field samples											
comprising lab sample		3	3	2	(r)	-	3	m	3	2	3
Cycle No.	Ε		Ш	I			Ш	П	H	=	=
Imon:											
pink	4/0.4	4/0.4 1/0.1		,	2,	2/-	2/-				
coho			·					2/-	4/-	2/-	
sockeye				-/-							
chinook											5/0.1
						1					

Table A-17. Althiok 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.

									Į				Angoon			
Site	~	ന	7	7	7	ന	က	7		_	_	7	7	7	-	
Lab No.	392	251	62	417	430	301	310	366	2	232	324	231	325	328	326	327
No. of field samples						Split samples	mples			-			Split s	Split samples		
comprising lab sample	-	-	-	1	1	_	1			_	1			1	,	
Cycle No.			Ţ	H	Ш	П	Ш	E		1	Ш	Ш	Ш	Е	П	Ш
Molluscs: mussels	0.37-	0.47-							0.6	0.6/- 1/0.1	/0.1					
clams			•													
butter			-/-	0.4 /-	0.3/-							0.5 / -				
horse									-				0.5/-	-/8.0		
littleneck						0.3/- 0.7/-	0.77-					<u> </u>				
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.

	_	323 321	2 3	п п		2/-	5/0.1
		\dashv					
Angoon	3	319	က	Ξ		4/-	
An	3	230	3	Ξ		21-	
	3	320	3	Ш	2/-		
	3	229	3	Ш	2/-		
	7	190	3	Ш	0.37-		
i	7	174	3	Ш	1/-		
	7	173		Ш	-1-		
	7	168	3	II	0.57-		
	7	167	1	Ш	0.4 /-		
	3	169	,	Ш	3/0.2		
	3	9	2	_	-/-		
	Site	Lab No.	No. of field samples	Cycle No.	Salmon: pink	coho	chinook

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.

							. 1			An	Angoon		
Site	7	7	7	3	3	3		3	3	3	3	3	3
Lab No.	196	646	647	564	276	27.7		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.	П	Ш	Ш	Ш	Ш		<u> </u>	Ш	E	Ш	=		П
								ta v					
nink	027-	09/-	0.87-					27-	2/-				
	}	}											
coho	,			2/-	-/9'0	0.27-				2/-	4/-	2/-	
chinook													5/03

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.

No. of field samples comprising lab sample Cycle No.	3 578 2 III	3 591 111	3 592 2 III	229 II		230 II	3 3 11 11	323 223 11	321 321 II
	0.3/-	0.3/- 3/0.1	2/-	2/-	2/-	2/-	-/4	2/-	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	noc
Site	3	9	œ	œ	9	3		3
Lab No.	170	21	522	523	705	228	∞	322
No. of field samples	60	2	2	2	1	3		2
Cycle No.		_	III	Ш	1			I
Halibut	0.3 / -	-/-	0.4 / - 0.6 / -	-/9'0		0.4 / -	-/	
Yellowfin sole					0.8/-			
Pacific cod								-/9.0

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		2	2	2		1
Lab No.	2	205	506	414		232	324	231	325	328	326	327
No. of field samples									Split s	Split samples		
comprising lab sample	-	1	1	1	لب	-	1			1	_	1
Cycle No.	_	П	Ш	III		=	-	=	Ш	Ш	П	П
Molluscs:												
mussels						-/90	1/0.1					
clams butter	0.9 / 0.4	1/0.2	1/1	1/1				0.5/-				
horse		,							0.5/-	-/8.0		
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.

	1	327			ш							1/-	_
	-	326		_	Ξ							1/-	-
	2	328	Split samples		=					-/8.0			
Angoon	2	325	Split	_	11					0.5/-			
	2	231		_	Ш				0.5 / -				
	,	324		-	Ш		1/0/1						
	-	232		-	Е		-/9'0						
													_
	-	617		1	Ħ						1/1		_
		213		_	Ш	-					2/1		
	7	211		1	П				2/1				
	7	65		7	Ι				2/0.1				
		436		1	Ш				1/1				_
	Site	Lab No.	No. of field samples	comprising lab sample	Cycle No.	Molluscs:	mussels	clams	butter	horse	littleneck	chitons	

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.

	1 1	326 327		1 1 1	Ш						1/- 1/-
	2	328	Split samples	-	Ξ					0.8/-	
Angoon	2	325	Split	1	Ш					0.5/-	
	2	231		1	=				0.5/-		
	-	324		1	Ш		1/0.1				
	-	232		-	Ш		-/9'0				
	2	500		-	Ш						1/-
	2	84	Split samples	_	I						0.4 /-
	2	83	Split	1	1						0.3/-
	1	412		1	Ш						1/-
	-	210		1	Ш						2/-
	1	82		_	1						0.6/- 2/-
	Site	Lab No.	No. of field samples	comprising lab sample	Cycle No.	Molluscs:	mussels	clame	butter	horse	chitons

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.

			١				Angoon			
Site		2	-		1	2	2	2		1
Lab No.	687	889		232	324	231	325	328	326	327
No. of field samples							Split s	Split samples		
comprising lab sample		1			1	-	***	1	_	1
Cycle No.	1	_		Ш	Ш	Ш	Ш	П	П	Ш
Molluscs: mussels				0.6/-	1/0.1					
clams										
butter						0.57-				
horse							0.5/-	0.8/-		
chitons									1/-	1/-
snails	0.8 / -	-/6.0								
		-	-	•	_	_	_	_	_	-

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. Angeon = reference site.

	S 102	101	4 491	4 342	1 232	22	1 324	2 231	2 325	2 328	1 326	327
No. of field samples comprising lab sample	_	-		-		·	-	,	Split 1	Split samples	,	-
cle No.	-	1	Ш	11			=	Ш	Ш	П	11	
			-		0.6	0.6/-	1/0/1					
								0.5/-				
									0.5/-	0.8/-		
					<u></u>			1			1/-	1/-
	0.1/-						·		,	į		
		0.1/-	0.77-			 						
				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.

												Angoor	DOO		
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	-		·	c	c	,	6	-	~	 ۳	~	~	~	·	۳
Cycle No.	-				, 11	-		-	E	 , 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	S	2	2	3	3
Lab No.	39	486	202	710	228	322
No. of field samples						
comprising lab sample	-		-	,	3	7
Cycle No.		Ш	1	_		=
- III	,	, 00				
	-/-	-/7"			0.4 / -	
selfe cod						-/9'0
rish lord			0.6/- 0.4/-	0.47-		

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.

						i				Angoon			
Site	1	1	1	1	_	_	_		2	2	2	_	_
Lab No.	45	115	116	337	338		232	324	231	325	328	326	327
No. of field samples										Split s	Split samples		
comprising lab sample	2	1	-				_	_	1	_	-	-	1
Cycle No.	-	Ш				·	=	Ш		Ш	Ш	П	Ш
Molluscs:													
mussels	·/·	4/0.4	1/-	1/-	2/-		-/9.0	0.6/- 1/0.1	-				
clams													
butter									-/50				
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	_	4	4	4	4		_		2	2	2	1	
Lab No.	339	46	117	118	119	232	324	4	231	325	328	326	327
No. of field samples										Split samples	umples		
comprising lab sample	,	-		_	_	_				-	1	1	
Cycle No.	Ш	-		ш	Ш				11	П	=	Ш	
folluscs:													
mussels	1/-	2/0.2	5/12	4/9	2/3	0.6/-	- 1/0.1	0.1					
clams						- '''			7 20				
Dillio									- / (?)				
horse										0.5/-	-/8.0		
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	_		_	-	-	4		1	1	2	2	2	_	
Lab No.	340	302	75	121	359	683		232	324	231	325	328	326	327
No. of field samples											Split s	Split samples		
comprising lab sample			_	-	-	-		1	-	1	-	1	1	-
Cycle No.	11	ш	1	Ш	Ш	_		Ш	П	П	Ш	Ш	Ш	Ш
Molluscs:								067.	1/01					
THE SCIENCE OF THE SC								200						
clams														
butter							***			0.57-				
horse											0.57-	-/8.0		
liuleneck	20/9													
cockles		3/10											-	
chitons			0.7/-	0.27-	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.

	3	321		က	Ш					5/0.1		
	3	323		7	П			2/-				
	3	319		3	П			4/-				
Angoon	3	230		3	П			2/ -				
	3	320		3	П		2/-					
	3	229		3	П		2/-					
	1	95		2	I					-	0.6/-	
	2	268		2	П				0.2/- 0.7/-			
	1	20		2	1				0.27-			
	1	562		3	Ш			0.5/- 0.5/-				
	1	561		2	Ш			0.5/-				
		7		2	I	,	-/-					
	Site	Lab No.	No. of field samples	comprising lab sample	Cycle No.	Salmon:	pink	coho	sockeye	chinook	Dolly Varden	

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.

2	2	2	-	2		1	2		-	1	2	2	2	1	-
Lab No.	59	245	393	394	224	78	400		232	324	231	325	328	326	327
No. of field samples												Splits	Split samples		,
a lab sample		-	1	1	1		-		-	-	-				-
Cycle No.			Ш	Ш		-	E				F				
	-/-	0.47-	0.3 /-	0.3 /-				i	0.6/- 1/0.1	1/0.1					
butter					0.37-						0.5/-				
horse									-			0.5/-	0.8 / -		
						0.2 /-	÷-							-/-	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.

	-	5 327		_	11							- /		 - 1/-
	1	326		1	Ш				_					 1/-
	2	328	Split samples		II								-/8.0	
Angoon	2	325	Split	1	II								0.5/-	
	2	231			II						0.5/-			
	7	324		1	11			0.6/- 1/0.1						
	1	232		-	Ш		,	-/9.0						
1														
	-	358		_	Ш									 2/-
	-	361			III						2/0.4			
		356			III			0.7/-						
	-	355		1	Ш			1/-	•					
	Site	Lab No.	No. of field samples	comprising lab sample	Cycle No.	Mollinger	Monesos	mussels		clams	butter		horse	chitons

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.	П	Ш	II	II	Ш	Ш	II	Ш
almon:								
pink	2/-	2/-						
coho			27-	4/-	2/-			
chinook						5/0.1		
laibut							0.4 / -	
acific cod								-/9:0

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		-	2	2	2	1	-
Lab No.	232	324	231	325	328	326	327
No. of field samples				Split s	Split samples		
comprising lab sample			,	1	1	-	_
Cycle No.	Ш	Ш	II	Ш	Ш	Ξ	
Molluscs: mussels	-/9:0	0.6/- 1/0.1					
clams			0.5/-				
horse				0.57-	-/8.0		
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.

	Willam.															
	Vinage:	KODS	KODS	KODS	KODS	KODS	KODY	. ← Ko	<- Kodiak ->	KODA	YOUR	YOU'S	3007	3003	900	300
	Cycle:		=	=	=	=	=							COON	SCION I	KOUN E
•	D&M no.:	214	214	219	506	206	207	207	210	222	\$ E	E S	11 V	100	1007	110
	-	>Split samples<	mples<	ì	215	217	208	208	213	218	Spilit s	Split samples	Split &	ASplir camples	498 498	498 mples/
ACs	I sh no .	, 19	104	187	216	180		samples<			9					\cardin
				101	100	107	070	627	670	030	488	489	2	492	539	240
naphthalene		4	æ	æ	æ	ø	ø	⋖	œ	æ	æ	cq	eş	ď	ď	œ
CI-naphthalcnes		7	SO.	က	7	9.0	4	6.0	0.5	,	•	٠	•	•	•	1 1
C2-naphthalenes		7	9	9	-	•	90	0.7	•	6.0	•	•		•	•	
C3-naphthaicnes		o	9	9	_	0.5	90	0.5	•	0.7	•	٠	٠	٠	•	
C4-naphinalches		0.0	0.1	0.5	•	•	0.3	•	•	•	•	•	•	•	٠	•
acchaphinylene		0.1	•	•	•	•	•	•	•	•	•	•	•	•	•	•
acenaphibene		# :	o,	9	4	0.7	0	e	•	S	•		•	•	•	•
nuorene		15	10	7	m	-	12	en	•	S	•	•		•	•	•
CI-fluorenes		m	7	7	0.3	0.3	4	0.5	•	0.5	•	•	•	•	•	•
C2-Illuorenes		•	•	•	•	•	•	•	•	•	•	•	•	٠	•	
C3-fluorenes		•	•	•	٠	•	•	•	•	•	•	•	•	0.3	•	•
phenanthrene		37	75	8	10	e	ଛ	12	4	17	0.7	0.5	-	0.7	00	۳
C1-phenanthrenes/anthracenes		m	-	7	0.2	•	6	0.4	•	0.3	•		, ,	; '	.	י נ
C2-phenanthrenes/anthracenes		•	•	•	•	•	•	•	•	•	•	•	,•	•	•	•
C3-phenanthrenes/anthracenes		•	•	•	•	•	•	•	٠,	•		•	٠	•	•	•
C4-phonanthrenes/anthracenes		٠,		• ,	•	•	•	•	•	•	•	•	•	•	•	•
arbanzounophene		'n.	4 (m ·	-	0.5	Y)		0.2	5	•	•	•	•	•	5.1
C. diberrottionhones		-	9.0	-	•	•		٠	•	•	•	•	.*	•	•	•
C3 dibenzolti obenes		•	•	•	•	•	• ;	•	•	•	•	•	•		•	•
			•	•	•	•	•	•	•	•	•	•	•	•	•	•
Sum of LACs		110	72	25	22	9	3	22	4	32	0.7	0.5	-	-	6.0	64)
		;	(1		,)
Huoraninene		17	90	v)	7	0.2	10	e	0.2	S	. 1	•	•	•	•	
C1-fluoranthenes/fixmes		C.3	•.	•		•		•	•	•	•	•	•	•	•	•
henzialanthracene		• .	•	•	•	•	•	1	•		•	•	•	•	•	•
chrosone		٠ 5	•	•	•	•	•	•	•		•	•	•	•	•	٠
Cl. chrosenes/benz[s]snthracenes		5	•	•	•	•	•	•	•	• -	•	•	•	•		1
C2-chrysenes/henz/alanthracenes		•	•	•		•	•	•		•	•	•	•	•	•	•
C3-chrysenes/henz/alanthracenes		•	•	•	•	•			•		•	•	•	•		•
C4-chryspace/benz[a]anthryspace		•	•	•	•	•	•	•		•	•	•	•	•	•	•
benzolhilliozanthene		•	•	•	•	•	•	•	•	•	,	•	•	•		•
henzoficifilioranthene		•				•	•	•		•	•	•	•	•	•	•
herzofa humana		•	•	•	•	•	•	•		•	• .	•	•	•	•	•
induction 2 columns		•	•	•		•	•	•	•		•	•	•	•	•	•
Atheres of Plants			•	•	•	•	•		•	,	•	•	•	•		•
woodela, manufaction		•	•	•			•	•	•		•	•	•		•	•
vaizolgin perytare		•		•		•	•	•	•	•	•		•	٠	,	•
Sum of HACs		12	90	ĸ	7	0.2	10	e	0.2	ĸ	•	•	•		•	•
sample Weight grams:		\$ 10	\$ 25	8	411	V V	5	603		Č		8	1	:	,	
			1	3	11.0	3	50.0	2.07	2.17	5.30	5.38	5.33	5.35	5.40	5.04	5.34

41.7

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

	Village:								C. Chenega Ray .>	voa Rav	1							
	Site: Cycle:	CHES	CHE3 (CHES	CHEA C	CHEA CI	CHEA CE	CHEA CH	CHEA CHEA	なこ語	EZ CHEZ	Z CHEA	CHE4	CHEA	₹	Ð		CHE4
	D& Mno.:	142	145	143	462	\$	٠.	4 2 = 4	43.		446 447	. 4	4	4	451	₹ 9	461	463
ACs		Ē	147	5 5	K		pics											
	Lab no:	137	138	152	452	453	456	454 4	455 4	465 4	466 467	7 468	469	470	471	472	473	474
naphthalene		•	ď	a	ď	đ	ď	•		đ	e	•	,	•	•	,		,
C1-naphthalenes		0.4	, m	, '		. .	0.7	0.2	• •	s •	d ·	. ·	- T	76 ·	rat (at '	rd ·	es ·
C2-naphthalenes		٠	m	•					•		,			•		•	٠	•
C3-naphthalenes		•	7	•									•	•	•	•	•	•
C4-naphthalenes		•	•	•	•	,	0	90			•			•	•	•	•	•
acenaphthylene		•	•	•	•			•	•			•		•	•	•	•	٠
acenaphthene		•	•	•	•	•		0						•	•	0	•	٠
fluorene		•		•	٠			•			•	,	•		٠	•	•	•
C1-fluorenes		•	-	•				•	•	•		•	•	•	•	•	•	٠
C2-fluorenes		•	٠	•	•	•		•					•	•	•	1	•	•
C3-fluorenes		•	•	9	•	•	•						•	•	•	•		
phenanthrene		0.5	٧,	•	0.3	7	7	6.0	7.2		4		•	•	90		· (*	٠ -
C1-phenanthrenes/anthracenes			_	•		, •	, ,	•		,	: '		•	' '	3	1	1	-
C2-phenanthrenes/anthracenes		•	, ,	•		•	•	•						' '		•	•	•
C3-phenanthrenes/anthracenes		٠	•	9		•				•					•	•	•	ð
C4-phenanthrenes/anthracenes		•	•	•	•	•							•	•	•	•	•	•
dibenzothionhene		•	(*		•	•				, ,				•	•	•	•	•
C1-dibenzothionhenes		•	۰ -					, (, ,	,			•	•	•	•	•	•
C2-dibenzothiophenes			. •	•	•	•							•	•	•	•	•	
C3-dibenzothionhenes			•		,	•						•		•	•	•	•	•
4								1	,	,			•	•	•	•	•	•
Sum of LACs		6.0	8		0.3	7	. 7	=	1.2	•	4		•	•	9.0	•	6	-
moranical		•	•	•	•								'	•	•	•	•	•
Cl. Successibles to trease		•	•	•	•								•	•	•	•	٠	•
Nenz (a) anthrocene		•	•	•	•				•	•	ě		•	•	•	•	•	•
charge and accept		•	•	•	•	•		•	• ,				•	1	•		•	•
Ci chavenes henz (a) ant bracenes		•		•	•		•						1	•	•	•	•	•
C charge here a leathern		•	•	•		4	•		•				•	•	•	•	•	•
Cating serve of the serven of a serven of the serven of th		•	•	•		•	•						•	•	•	•		
Carling states were a managed as		•	•	•									•	•	•	•	•	•
herzelkienenetene		•	•	•		•	•		•			•	•	•	•	•	•	
penzolojimojaninene		•			r		•	•					•	1	•	٠		
penzolk junoraninene	-	•	•	•		•		•					•	•	•	•	•	•
benzola pyrene		•		•	,				,	,			ŧ	•	•	•	•	•
indexiol 1,2,3-calpyrene		•	•		•							•	•	•	•	•	•	•
dibenz[a,h]anthracene		•	٠	ŧ	•						•	•	•	•	•	•	•	•
penzolgm]perylene		•	•			•		•					•	•	•	•	1	•
Sum of HACs		•	•	•	•		•						•	•	•	•	,	•
commission wait			9	į		•	;											
salible weight, granis.		2.07	3.38	4.4/	5.01	.42 5.	4	5.08 4.93	93 5.29	9 5.08	8 5.01	5.04	5.52	2.67	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:	\ \ \ C	<- Chenega Bay ->	3ay ->						×	<- Old Harbor -:								
^	Site:		CHEA		OHA2 C	OHA2 OHA2		OHA2 OHA2	-)HA2 (OHA2 OHA2 OHA2			OHA2 O	OHA2 O	OHA2 III		OHA2 O	OHA2
	Cycle:	465	₹ 1 24	# 4	117	326	327	328	333	331	617	919	622	623	624	625 E	626 E	627	628
(}	467				į	328	334	332									
ACE	Lab no.:	483	484	593	=	262	269	230	279	650	541	544	545	546	555	556	557	558	559
namhthalene		4	4	4	æ	ø	•	ø	ø	æ	œ	rei	æ	æ	œ	æ	. 65	ď	ď
C1-naphthalenes		,	٠ ،	0.3	١,	0.5	-	0.4	0.3	-	, ,	•	1 1	, ,	1		•		,
C2-naphthalenes		•	1	٠	•	•	•	•	•	0.1	•	•	٠	•	٠	•	•	•	•
C3-naphthalenes		٠	•	•	•	•	•	•	•	•	•	•	•	•	•		•	•	•
C4-naphthalenes		\ '	•	٥	•	•	•	•	•	•		,	•	,	•		•	٠	٠
acenaphthylene		•	•	٠	•	٠	,	•	٠	•	٠	•	•	,	٠	•	1	•	•
acenaphthene		•	•	•	•	•	•	•	•	1	•	•	•		•	•	•		•
fluorene		٠	•	•	•	•	•	•	•	0.2	•	•	•	•	•	•	•	•	•
C1-fluorenes		•	•	•	•	•	٠	•	•	•	,	•	•	•	•	•		•	•
C2-fluorenes		•	٠	•	•	٠	•	•	•	•	•	•	•		•	•	•	•	•
C3-fluorenes		•	•	•	•	•	•	•	•	•	•	•	•		•		٠	•	٠
phenanthrene		0.3	0.8	0.4	•	9.0	-	-	0.8	e	•	•	•	•	•		•		•
C1-phenanthrenes/authracenes		•	•	•	•	•	•	•	•	•	•	•	•	•	•		1	٠	•
C2-phenanthrenes/anthracenes		4	•	•	•	•		•	•	•	•	•	•		•		•	•	•
C3-phenanthrenes/anthracenes		•	•	•	•	•	•	•	•	•	•	•	,	•	•	•	•		•
C4-phenanthrenes/anthracenes		•	•	•	•	•	•	•	•	٠.	•	•		•	•		,		•
dibenzothiophene		•	•	•	•	•	•	•	•	0.2	٠	•	•				•		•
C1-dibenzothiophenes		•	0	•	•	•	• .	•	•	•	•		•		•		•		•
C2-dibenzothiophenes		•	•	•	•	•	•	•	•	•	•	•	•				•		•
C3-dibenzothiophenes		•	•	•	٠	•	•	•		•	•	•	•	•	•	•	•		٠
Sum of LACs		0.3	9.0	0.7	0	-	7	-	-	4	•		•	•	•	•	•	•	•
,										•									
fluoranthene		.•	•	٠	•	•		•	•	0.3	•	•	•	•	•	•	•		•
pyrace C. G. Constitution Linear		•	•	• 1		• •	•	• •	• (• •			• 1	• 1		• •	• •	, ,
hens a southernesses		• •		, ,		, ,		•	•		•	•	•		•	, ,	•	•	•
chrosepe		•	•	•	•		•	•	•	•	•	,	•		•	•	•	,	•
C1-chryscnes/benz[a]antitracenes		0	•	•		•	•	•	•	•	•	•		•	•	•	•	•	•
C2-chrysenes/benz[a]anthracenes		٠	•	٠	•	,	•	•	•	•	•		•	•	•	•	•	•	•
C3-chrysenes/benz[a]anthracenes		•	•		•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
C4-chrysenes/benz[a]anthracenes		•	•	•	•	•	•	•	•	•	٠		•		•		•		•
benzo[b]fluoranthene		•	•		•	•	•	•	•	•	•	٠	•				•		•
benzo[k]fluoranthene		•	•	•	•	•	•	٠	•	•	•	•	,	•			•		•
benzo[a]pyrene		•	•	•	•		•	•	•		•	•	•	•	•		•		•
indeno[1,2,3-cd]pyrene		•	•	•	•	•	•	•	•	•	•	1	•	1					1
dibenz[a,h]anthracene		•	•	•	•	•	•	•	•	•	•	•	,		,		1		•
benzo[ghi]perylene		•	•	•	•		•	•	•	ı		•	•	ı	•	,	•		•
Sum of HACs		•	•	•	•	•	0.1	•	•	0.3	•	•	•	•	•		•	•	•
cample wright orang.		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
and the state of t																- 1		Ì	

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

		- Individual of																	
	Village:	\ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \	Old Harbor ->		2.43	, m	<- Tatitlek ->						s - La	-			'		
	Suc.	7 1	J		7141	- 				1 E	LABO L	LAB/ L/	LAB/ LAB/		· .		<u> </u>		LABS
	C) 4.6.	100	1 2	= 5		= 5	= 5	# 72 E	= 5	= 5	= 8								= ;
	D & M IIO.:	910	670	620	* *	155 155	133	55	701	151	\$?? ?	9 9 1	107 107		55 55 55 55 55 55 55 55 55 55 55 55 55	592	597 5	598	28
ACs		;			(((\ 1			191	301	?	pur saun	\care					
	Lab no.:	573	598	599	-	134	139	135	136	153	281	10	3	29	504	505	506 5	507	543
naphthalene		ø	q	œ	ď	a	α	•	æ	a	a	ď	đ	d	đ	•	•		۰
C1-naphthalenes		, ,	٠ '		, '	٠,	. '	, '	٠,		0.4	s •	s '	d ,	d '	đ ·	d '	d (d 1
C2-naphthalenes		•	•	٠	•	•	•	•		,									,
C3-naphthalenes		•	•	•	•	٠	٠				•				•				•
C4-naphthalenes		•	4	٠	•	٠		•	ı	•	6			•					, ,
acenaphthylene		•	•	•	•	•		•	•			•	,		•				
acenaphthene		-	•	1	•	•	•	•	•	•	•		-	0.1					
fluorene		•	•	٠	•	,	•				1		-	0.3				•	•
C1-fluorencs		•	•	•	•						1		, ,					,	•
C2-fluorencs		٠	•	•	٠			•	•	•		•							•
C3-fluorenes		•	•	٠		•	•			•	•					•	,		•
phenanthrene		•	0.7	0.2	0.05	•		0	•		7	~	11	12	0.3	8.0	9.8	5.	•
C1-phenanthrenes/anthracenes		•	•	•	•	•	0			•				•		•	,	, ,	•
C2-phenanthrenes/anthracenes		•	•	•	•	•	•			•				,				,	•
C3-phenanthrenes/anthracenes			•	•	•	•	•					,	•	,	•	•			•
C4-phenanthrenes/anthracenes		•	•	•	ŧ	•	•	•			ı.	,			•				•
dibenzothiophene		•	•		•	•							•	•	,		•	,	•
C1-dibenzothiophenes		•	•	•	•	•	•	0	•	٠	•								1
C2-dibenzothiophenes		•	•	•						•									•
C3-dipenzounophenes		•	•	•	•		•								,				•
Sum of LACs		•	0.2	0.3	0.05		•		•	•	7	1	13	12	0.3	8.0	89.	0.5	•
fluoranthene		•	,	,	,	,							_						
DVIENC		•	•	•	• •						• 1		5	7.0	•	•			
C1-fluoranthenes/pyrenes		•	•	•	٠		•				•					, ,			
benz[a]anthracene		٠	٠	•		•			•	•		,	,	,					
chrysene		٠	•	•	•				•		•							,	
C1-chrysenes/benz[a]anthracenes		•	•	•	•		•	0	,						,	,			,
C2-chrysenes/benz[a]anthracenes		•		•	•		•		•				•	,		,	•		ı
C3-chrysches/benz[a]anthracenes		•	•	•				•			,		•		,				•
C4-critysches/benz[a]animacenes		•	•	•	•			•		•	٠								
penzolo jiliorantiene		•	•	•	•		•			•					1				,
bear of Junear	-	•	•		•						•					,			
indepo[1.2.3.cd]byrene		•			•	•		•						•	•				
disease a lanthacene		•	•		•	•		•				•							•
henzofohilnervlene	-		, ,	ı (•				ı							
ourselle all bor years			•	,	,	•	•												ı
Sum of HACs		•		•	•		٠					•	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	4.62 3	3.47 3	3.00	4 01	9C 5 UV 5	26.3	26	4	ć
					Charles and the charles		Section of the sectio	4											77

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

LAB8 LAB III III 593 600 602 600 581 589 602 0.3 0.2 0.3 0.2 0.3 0.3 0.3 5.34 5.33		Village																	
Cycle: 11 - 11 - 11 - 11 - 11 - 11 - 11 - 11		Site:	A De		Larsen							ľ	Ouzink	1				-	
D& & Markon D& & Markon		Cycle:				-	LAB8						UZS O					_	Akhiok
14 100 559 5600 560		D& M no.:	591	595	265	\$	3	# 76 5	- 5	= ;	= ;	=							H4 AK
14 15 15 15 15 15 15 15	Ċ		593	9		}	3	Ž,	7 5	2 2	563	258	265	272	274				
All Their Corp. All Their			602	603					Š	3 6	8	259	271	273	275				
Infrarence and A		Lab no.:	281	582	88	595	596	597	0	175	101	30 52	631	000	. ((7)
mitmeenes 0.2 0.3 0.3 0.3 0.3 0.3 0.3 0.3 0.3 0.3 0.3	naphthalene		•	,									150	750	633	1	-		ı
1	C1-naphthalenes		4	ed	aş	4	æ	76	•	æ	æ	æ	d	¢	,				
Minacenes	C2-naphthalenes		•			•	0.2	0.2	•	0.2	8.0	0.3	, ,	d 1	4	rej.	ব্য	æ	æ
office contacts of the contact of th	C3-naphthalenes		•			,	•	•	•		0.3	0.3							1 0
0.009 0.01 0.04 0.05	C4-naphthalenes		•		•		•	•	•			, ,	, ,	•					,
of the control of the	acenaphthylene		•		60.0		٠	•	•	•			,	•					
O O O O O O O O O O	acenarhthene		•	•			•	•	•				•	•	•				
oly 0.2 0.3 0.9 0.2 0.5 0.5 1 2 4 1 1 1 0.9 1 3 minocense sintracense sintrace	fluorene		•		•	•	•		•		,	,							
### Size Size Size Size Size Size Size Size	Ci-fluorence		•	•		•					٠.	٠,		•				0	2
of the correct of the	C2-fluorence		•	•	•	•					- -	4.0							
02 03 09 02 05 05 1 2 4 1 1 1 09 1 3 Althrecones attracenes antitracenes antitracenes antitracenes antitracenes B. 2 0.3 1 0.2 0.7 0.7 1 3 5 1 1 1 1 0.9 1 4 S. 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 5.12 5.11 5.16 5.12 5.11 5.16 5.12 5.11 5.16 5.12 5.11 5.16 5.12 5.11 5.16 5.12 5.11 5.16 5.12 5.11 5.16 5.12 5.11 5.16 5.12 5.11 5.16 5.12 5.11 5.16 5.12 5.11 5.16 5.12 5.11 5.16 5.12 5.11 5.16 5.12 5.11 5.16 5.12 5.11 5.16 5.12 5.11 5.12 5.11 5.16 5.12 5.11 5.16 5.12 5.11 5.16 5.12 5.11 5.16 5.12 5.11 5.16 5.12 5.11 5.16 5.12 5.11 5.16 5.12 5.11 5.16 5.12 5.11 5.16 5.12 5.11 5.16 5.12 5.11 5.16 5.12 5.11 5.16 5.12 5.11 5.10 5.12 5.11 5.12 5.12	Carried Carried		٠		•	•				•								,	•
of the contents of the content	C3-Illustrates		•		,	,		•	•										
athracense attracense attracense arthracense arthracen	pochadurene		0.5	0.3	00	٠ د	' ¥	' '		. ,	•		•						
Authracenes 42	CI-phenanthrenes/anthracenes			•	3	7	o O	C.		-	7	4	_	-	_	-	٠ و	٠.	٠,
authracenes 0.2 0.3 1 0.2 0.7 0.7 1 3 5 1 1 1 1 0.9 1 4 enes anthracenes an	C2-phenanthrenes/anthracenes			, ,	•	1		•	•		•	•				٠	ÿ		~
### 0.2 0.2 0.2 0.2 0.2 0.2 0.2 0.2 0.2 0.2	C3-phonanthrenes/anthracenes		•	•	•										,	•			
0.2 0.3 1 0.2 0.7 0.7 1 3 5 1 1 1 0.9 1 4 Entes antitracenes antitra	C4-phenanthrenes/anthracenes				•			•			•								,
0.2 0.3 1 0.2 0.7 0.7 1 3 5 1 1 1 10.9 1 4 entes antitracenes antitr	dibenzothiophene		,		•						•				•	•			
entes 0.2 0.3 1 0.2 0.7 0.7 1 3 5 1 1 1 1 0.9 1 4 antitracenes antit	C1-dibenzothiophenes		•			•		•		,	0.2	0.2							
### 0.2 0.3 1 0.2 0.7 0.7 1 3 \$ 1 1 1 1 0.9 1 4 ##################################	C2-dibenzothiophenes		•	•					•	•									
0.2 0.3 1 0.2 0.7 0.7 1 3 5 1 1 1 1 0.9 1 4 anthracenes authracenes sultracenes sultracenes anthracenes anthracen	C3-dibenzothiophenes		,	•									,		•				•
enes anthracenes a	•			•							•			,					
enes anthracenes a	Sum of LACs			,	•									•					
anthracenes anthra			7.0	ر. د.ک	_			0.7		_	m	w	,	_		•	,		
authracenes authra	fluoranthene		,									ļ	•	•	-	j -	, ,	4	_
anthracenes anthra	pyrene		١ ،	•	7.				•			1.5							
anthracenes anthra	C1-fluoranthenes/pyrenes		, ,	•					•				,			•		0.4	0.1
anitracenes antitracenes antitracenes artitracenes artitr	benz[a]anthracene			,	•										,			•	•
anthracenes anthra	chrysene			•		•							`1					•	•
authracenes authracenes authracenes c c 6. 7.34 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 5.24 5.34	C1-chrysenes/benzfalanthracenes		,					•										•	•
anthracenes anthracenes solution to the control of	C2-chrysenes/benz[a]anthracenes						•					,	,	, ,				•	•
s.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 5.24 5.34	C3-chrysenes/benz[a]anthracenes		,				1											'	•
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	C4-chrysenes/benz[a]anthracenes													, ,				•	•
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	benzo[b]fluoranthene		,	•												•		,	•
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 5.24 5.34	benzo[k]fluoranthene		•															•	•
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	benzo[a]pyrene			•										,			•	•	•
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	indeno[1,2,3-cd]pyrene						,						t i				•	1	•
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	dibenz[a,h]anthracene		ı													•	•	•	•
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	benzofghilpervlene																•	•	٠
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	A														,		•	•	•
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	Sum of HACs			,						ı							٠	•	•
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 5.23 5.23				•						•	, 0	1 C						•	
5.23 4.72 5.21 4.73 5.03 5.04 5.11 5.16 5.13 5.03 5.73	sample weight, grams:	λ,												•		•	•	5 .4	0.1
																	\$ 03	5 22	07.3

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

						l								-					
	Village: Site:	CHIS	CHIIS	CHIS	CHIS	CHIS	Chinak ->CHIS CHIS		CHILL	CHI17 C	CHI7 C	сніл сніл	II7 CHI7		 Pil.3 Pi	- Port Lions -> PIL3 PIL7	ons > PTL.7 PTL.7	PIL7	7
	Cycle:		=		Ħ		=	=					III	Ħ			11111		
	D & M no.:		338	339	346	340	344	352	209	202	202				69 2	234 2	242 2		241
Č		>Split samples	mples.	343		341	342	349				501	508 5	506	20		ة <u>به</u>	287	
	Lab no.:	261	288	365	566	287	648	649	501	502	503			90	6	69	167		173
ambib alone		•	đ	t	•		•	•	•		,	٠				,			,
C1-naphthalenes			0.1	0.5	0.5	90	8.0	0.7	• •	d ·	d i	d '	d '	d '	, i	0.4	2.0	0	d '
C2-naphthalenes		•	•	0.1	•	•	0.1	0.1	,	•		,				20.0	, ! '	٠ :	•
C3-naphthalcnes		٠	•	0.1		•	0.1	0.1			,			,			,		•
C4-naphthalenes		•	0	•	•	•		•	•	•		٠	•	,			,		•
acenaphthylene		•	•	•	•	•	•	•	•			•		4	,				
acenaphthene		•	ı	6	•	•		•	•	•	٠	•	,			•			•
fluorene		٠	٠	0.2	•	•	0.1	0.2	•		•	•).2			
C1-fluorenes			•	0.1	•	ŧ	0.2	0.2		•	•						•		•
C2-fluorenes		•	•	•	•	•		•			•	•	•						•
C3-fluorenes		٠			•	•	,	1	,			•							•
phenanthrene		9.0	0.3	7	9.0	-	7	7	0.3	0.3	0.3	0.3		.3		7	0.2	4	
C1-phonanthrenes/anthracenes		•	b	•	•				•				•	,	,				
C2-phenanthrenes/anthracenes		•	0	•	•	•	•		•	٠						•			
C3-phenanthrenes/anthracenes		•	•	•	•	ŧ	•		,					•					ð
C4-phonanthrones/anthracenes	in Su-	•	•	5	•	٠	•	8		•	ı			•	1		•		,
dibenzothiophene		•	0	0.1		•	0.2	0.2			ŧ		•						•
C1-dibenzothiophenes		•	•	•	•	•	•	•											,
C2-dibenzothiophenes	·	•	ı	1	9	•	9	,	•	0				,				,	
C3-dibenzothiophenes		•	•	•	•			0	•								,		
Sum of LACs	**************************************	7	0.4	60	100	7	4	*	0.3	0.3	0.3	0.3		.3		6	0.4	Ŋ	
fluctanthene		•	•	0	•		0.2	0,0	•							03	,	ı	•
pyrene		•	,	,	•	•	,	;	•	•	•				,	<u>,</u> '			
C1-fluoranthenes/pyrenes			•	٠	٠					•		•	,		,		,		
benz[a]anthracene		•	•	•	•				•	•									•
chrysene		•		٠	٠	•		•			•	1	,	,					
C1-chrysenes/benz[a]anthracenes	-	•	1	٠	•	•			•	•	•	,	•					,	
C2-chrysenes/benz[a]anthracenes	-	•	•	•	•	•				•									•
C3-chrysenes/benz[a]anthracenes		•		•	•		•		•	•	•	,	,			ı			
C4-chrysenes/benz[a]anthracenes		•	•	•	•		•	•		•							,		
benzo[b]fluoranthene		•	•	•				,		•			•			•			•
benzo[k]fluoranthene		•	•	•						•	•	•			,				•
benzola Jpyrene		•	•	•	•		•				•	,	,						
indeno[1,2,3-cd]pyrene		•	•	•							,	•	1				,		,
dibenz[a,h]aninracene		•	•	•				,		•				,					
penzolgnijperylene		•	٠	,	•	,					•								
Sum of HACs		•	•	0.2	•		0.2	0.2	•							0.2			•
sample weight, grams:		8.09	5.43	5.37	4.91	5.01	5.00	5.27	5.38	5.23	5.31 5	5.17 5.	5.11 5.36		3.06 5.	5.56 5.21	21 5.82	5	35
												-	-						}

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

	Village															
	Site:	PII 7	7 TIM	C- Port Lions -> Dry 7 pry 3	- Suor	-			c- Port C	<- Port Graham/ English Bay	English	Bay ->		Kartuk	-Angoon	1
	Cycle:	=	=		"	מבי	5		PTG3	PTG3	PTG3	PTG3	PTG3	KARI	AGN3	AGN3
	D & M no.:	243	240	246	230	288	31	1361	= 5	= ;	=	1		_		
24		284	244	247	285	2 2	7	2	871	127	8	134	480	84	187	180
		280	245	248		}				671	33	131	479	83	188	961
	Lab no.:	174	8	38	646	647	2	133	148	154	155	152	485	ŧ	189	185
naphthalene		•									227	130	23/	-	229	320
C1-naphthalenes		# C	res	a j	a	æ	æ	æ	æ	æ	æ	ď	đ	,		
C2-naphthalenes		7.5	•	•	0.5	0.3	•	•	٠	•	•	, '	s '	4	nd "	a
C3-naphthalcnes		•	•	•	٠	•	•	•	•	•	•		ı.	•	- 0	6.0
C4-naphthalenes		•	•	•	•	•	٠	•	•	٠	٠ ,	•	•	•	0.05	•
acenaphthylene		•		ı	•	•	•	•	•		,	•	•	•	•	•
accounthere		•	•	•	•	•		•	•		•	•	•		•	•
fluorene		•	•	•	•	,	•	•	•	' '	•	•	•	•	٠	•
C1-fluorence		•	•	•	,	•	•	•		•	•	•	•	•	•	•
C2-fillownes		•	•	•		•		•	,	•	•	•	•	•	•	•
C3-fliomenae		•	•	•	•	١	•		•		•	•	1	•	•	•
appropriate the second		•	•	•		•		,					•	•	•	•
Prenaminene C1		-	0.3	0.2	0.4	0 \$	• ,	٠.				•	•	•	•	•
C1-phonanthrenes/anthracenes		ı	•		;	3				•	•	•	•	•	,	-
C2-phenanthrenes/anthracenes		•	•	•		•		•			•		•			
C3-phenanthrenes/anthracenes		•	•		•		•			•	,		•			
C4-phenanthrenes/anthracenes		•		•		•				•	•	•	,	,	٠ ،	•
dibenzothiophene			,	•		•		٠	•			•	•	,	•	•
C1-dibenzothiophenes				•	ø	•			•			•	•		•	•
C2-dibenzothiophenes			•	1	•								•		•	
C3-dibenzothiophenes						•			•			•	•			•
		,							•	•				•	•	•
Sum of LACs		-	, C	0,0	•	•								1		
		•	3	7.0	Š	8 .0		-	•				•	•	7	·
fluoranthene		•	,												4	4
pyrene		•								1		•				,
C1-fluoranthenes/pyrenes		•		•	,	,				•			•	,		,
benz[a]anthracene			,	,	•	•				,	•		•	•		•
chrysene			۱ ا	•									•		٠	•
C1-chrysenes/benz[a]anthracenes			1									•	,		•	
C2-chrysenes/benz[a]anthracenes		, ,	•					•	•							
C3-chrysenes/benz[a]anthracenes		, ,	•									,				
C4-chrysenes/benz[a]anthracenes													,	٠ .	•	•
benzo[b]fluoranthene		٠ ،	•	•					•	•		,		, ,		
benzo[k]fluoranthene			•	•		•				,						
benzo[a]pyrene			•							,			,		•	
indeno[1,2,3-cd]pyrene		•	•													
dibenz[a,h]anthracene					•								•	1	,	
benzo[ghi]perylene									•	•		٠.	. ,	•		
		•							,				•			•
Sum of HACs		,									ı	,	,			
-		•		•					•	•						
sample weight, grams:	5	5.24 5.	5.14 5.5	.51 5.01	5 05	15 3.20	2 00		•					ı	•	•
								4.03	3 4.41	4.46	16 4.87		5.40 3.4	3.43 5.	5.58 5.37	37

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

	Village			ľ				l								
	Site:	TATY	TATY	- Tatitlek ->	itlek •	tale 4 de		_			<- Ouz	<- Ouzinkie ->				
	Cycle:) E	E) H	TAT/	TAT7	TAT7	9Zno	9Zno	9Zno	9Zno	9Zno	9Zno	9Zno	9Zno
	D& Mno:	434	# CP	3 5	= 97	≣ ;	≣ ;	≣ ;				H	Ħ	III	Ш	Ħ
		437	42,4	3 5	7	431	430	474	50	455	202	361	456	200	360	454
ACs		430	97.	764	#	433	200	429			452	362	457	203	453	459
	Lab no.:	362	363	364	448	£ 64 6 64	427	157	670			363	458	;		
									070	346	203	2/4	2/2	000	910	119
naphthalene		•	æ	•	•	•	•	•	•	•	æ	æ	4	a	¢	đ
Ci-naphunaiches		7	7	7	0.3	0.7	0.2	0.2	0.4	•	0.5		, ,		0.7	6 0
C2-naphinalenes		74,	7	e	•	0.2	•	7	•	•	•	•	•	04	3	
C-maphinalenes		7	_	7	٠	0.2	•	٠	•	•	•	•	•	3 6	•	•
C4-naphthalenes		•	•	0.1	•	•	0.2	•	0.7	•	•	•		7, '	• 1	•
avenaphunylene		• .	•	•	•	•	•		•	•	•	•	•	•		•
accarapunene			6.0	-	•	•	•	•	•	•	•	,	•		. ,	•
All Successions		- ;	-	7	•	0.7		•	•	,	•	•	•	03	•	•
CI-Illuoranes		0.3	0.3	0.4	•	•.	•	•	•	•	•	•	, ,	ָרָ י		
CZ-Illioraics		•	•	•	•	•	•		•	•		•	•	,	•	•
C-limited		•	•	•	•	•	•	•	0.3	,	•	•	•	, 6	٠ ،	' 70
phenanthrene		*	'n	9	7	۳	7	-	m	9.0	_	9.0	90	3 6	7.0	,
C1-phonamhrones/anthracenes		0.2	0.4	9.0	•	•	•	•	•		, ,	, ,	3 '	4 (-	n
Cprenanteenes/aninteenes		•	•	•	•		•		0.3	•		•	•		•	
C. physiania cacyania accases		•	•	٠	•		•	•	0.7		•	•	•		٠ ،	• •
diberration of the		٠.	٠,	•	•	•	•	•	•	•	•	,	•	•		• 1
Chairman Line		- ;	7	2	0.4	-	0.3		•	٠	•	•	•	0.3		, ,
C. diberzehiorhene		Ö	0.09	0.7	•	•	•	•	•	•		•	٠	,	. •	,
C3-dibenzothionbenes		•	•				1	•	0.4	•	•	•	•	•	•	•
		0	•	•	•		•		•	•	•	٠	•	•	•	•
Sum of LACs		7	15	19	6	v	e	64	¥	œ	ŗ	70	•	•	•	, (
)	•	•	•	ę ė	4	9.0	9.	4	7	'n
fluoranthene		- ;	-	7	0.1	0.2	•	•	•	•		,	•	0.0		Š
pyrane C1 5		0.1		0.3					9.0	•	•	•	,	3		Š
ben-fallenshandes/pyrenes		•	•	•						•	•		•	•		•
chrysens		•									,	•	•	•	•	
CI-chrysmes/henzialanthracmes		•				•	•	•	•	•	•	•		٠	•	
C2-chrysmes/henz[a]amhracmas		•	•				•			•	•		•			
C3-chrysenes/henz(a)anthracenes		•	•	•	•	•			•	•		•	•	•		•
C4-chrysenes/benz/alanthracenes			•		•	•		·		•			•	•		
benzo bifluoranthene				•		,					•	•			•	
benzolkifluoranthene			•	•	•			•				•		•		
benzo(a)pyrene		• •		•			•		,			•	٠			> '
indeno[1,2,3-cd]pyrene			٠.	•	•		•	•	•				•		,	•
dibenz[a,h]anthracene					•						1	•		,	,	,
benzo[ghi]perylene		•	•	, ,			•	•			•	•		•	•	
				,	•	•				٠			,		,	,
Sum of HACs		1	=	7	0.1	0.2			9.0				•	6.0		
sample weight, grams:		4.74	5.28	5.25	4 90	4 33	8	:	,					4		*
								1	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.

	Village														
	Sire.	Detre a		<- Port Lions ->	-ions ->		٩	Port Ces Cent	2		l				
		FILS	FIL3	PTL3	PTL3	PIT	PIN 2		Ne.Day	× ×	<- Karluk ->	Akhiok	. An	C. Angoon	
	Cycle				=	} E	3	Z 63	PTG3	KARI	KARI	AKH4	A CND	^ 100 v	i
	D& M no.:	212	574	57.3	1 OC.	= 5	≡ ,	-	III	III	Ξ			AGN3	AGN3
(677		011	2/0	220	523	30	481	222	111	III	=	=	I
ACs ·		9	176	275	577	522	580	2	100	215	374	381	181	177	102
	1			276			}		794	373	375	382	182	170	
	170 no.:	×	576	577	8778	201	000	;	483		376	383	101	0/1	761
narhthalass		!				77	27.72	60-93	60-538	60-561	60.562	3	104		
Cleanbalt		•	•	•	•					ı		2002	067-70	90-319	60-323
		0.8	000	•	•	-	-	~	•	a	•				
C2-naphthalenes		•	9	•	•	8 .0	9.0	0.5		•	• •	ব্য	•	æ	es
C3-naphthalenes		,		•	•	0.1	•			•	0.7	•	-	7	-
C4-naphthalenes		•	•	•		•	•				•		0.2	0.7	0
acenaphthylene		•		•	•	•	,	,	•		•		•	2	1
acenaphthene		6	•		•		,		•	•	•	,		5	,
fliction		•	•	•		•		•		•			•		,
CI-Green		•	•			•	•	•						•	•
CI-IIIOIGE		•		•				•	•				•		
CZ-iluorenes			•	•	•	•		,	, ,	•	•	•	,	0.1	•
C3-fluorenes		•	•	•	•				•	•	•				,
phenanthrene		• ,		٠		•		,	•			,			
C1-phenanthrenes/amhracemen			9.0	0.2	0.3	·	٠.	' !			•			•	
C2-Dhenanthrone And		•		•	,	4	-	0.7		0.5	0.3		٠ -	٠,	•
C. phone:				,	•	•		•	•		•		-	-	-
Cash and a state of the state o			•		•					•	,				•
Threathness and access		•		•											•
anocazothiophene			•	•			•			•			•		•
C1-dibenzothiophenes		•				0.1	•						•		•
C2-dibenzothiophenes		•	•		•		•		•				•		
C3-dibenzothiophenes		•	•	•	•	•	•	,	•					,	l 1
		9					•	•				,	•	,	•
Sum of LACs		•					,		•		•	•			
		~	9.0	0.2	0.3	C	·							ı	
fluoranthene							4	-		0.5	0.5		2	4	c
pyrene		•		1		10							ı	•	7
C1-fluoranthenes/pyrenes			•								•			,	
benz[a]anthracene		•				•	•						,	,	
chrysene							•								
CI-chrysenes/henzfalanshass											•				
C2-chrysenes/henz[a]amin		•)				•					
C3-chrysenes/henz[a]andu accines						•				•		,			
C4-chrysenes/henz[a]andti accines										,	,				•
benzofbifuoranthene		•			,					•			,	•	
benzofkifinoranthana					•	,							,		
benzofahvrene															
indeno[123-cd]nyrama		•			,										
dibenzía hlanthracena					, ,					,		٠ ،			,
henzolahilmanitan														,	
مسحوف ألحاء كالطاق															,
Sumofuto				,									,	,	
		•			•							,			,
Sample weight orams:					T:0 -	-									
· · · · · · · · · · · · · · · · · · ·	8	5.26 5.45	5 5.49	5.10	0 5.35	5 5.03	4 99	71.5	4						
										5.15	5 5.17	7 5.09	5.54	4.85	

		L'Adding		·	<- Larsen Bay ->			Chiniak	Akhiok	^ *	<- Karluk ->
	Site:	KODS	LAB6	LAB6	LAB6	LAB6	LAB6	CHI5	AKHI	KARI	KARI
	Cycle:	=		=	=	=	=	=	-	-	=
	D & M no.:	211	596	298	308	307	295	347	16	98	280
			297	8	311	308	900		92	87	281
ACs			302	306	303	305					
	Lab no.:	18	264	282	786	652	653	651	2	20	268
arafadadaaa		•	•	•	•	•	. •	•	•	•	•
		• 6	8 (•	• 6	• (• 6	1	•	•	•
CI-naphthalenes		Q. (7	9	0.7	7	C.	0.0	•	•	0.3
C2-naphthalenes		0.0	0.7	<u>.</u>	•	0.5	•	•	•	•	•
C3-naphthalenes		-	0.1	•	•	0.0	•	•	•	•	•
C4-naphthalenes		•	•	•	•	4	•	•	•	0.7	•
cenaphthylene		٠	•	•	٠	e	•	•	•	•	'
cenaphthene		0.8	•	٠	•	٠	•	•	٠	•	•
horene		2	0.8	0.3	0.2	0.5	•		•	•	•
CI-fluorence		70	•	•		0.2	•	•	•	•	•
C)-fliorenes		; '	•	•	٠	•	•	•	•	•	•
Ca-fluorence						•	•		•		'
2-study cases		• •	٠ ,	٠,	-	٠,	٠, ر	, ,	•	•	· 3
poenanintene		• ;	7 .	7	-	7	7	ò	•	•	Ď.
CI-phenanthrenes/anthracenes				•	•	•	•	•	•	•	•
C2-phenanthrenes/anthracenes		•	b	٠	•	ŧ	•	•	•	•	•
C3-phenanthrenes/anthracenes		•	•	•	•	•	•	•	•	•	•
C4-phenanthrenes/authracenes		•	•	•	•	•	•	•	•	•	•
dibenzothiophene		-	0.7	0.	0.1	9.0	0.2	•	•	•	•
C1-dibenzothiophenes		•	•	•	0	•	•	•	•	•	•
C2-dibenzothiophenes		•	•	•	•	•	•	•	•	•	•
C3-dibenzothiophenes	<i>J</i> 4	•	•	•	•	•	0	•	•	•	•
Sum of LACs		=	49	В	7	•	e	-	•	0.2	0.7
fluoranthene		0.5	0.7	٠	•	0.1	•	•	'	,	'
ovrene			٠	•	•	•	•	•	•	•	,
C1-fluoranthenes/pyrenes		•	•	٠	•		٠	•	٠	•	•
benz[a]anthracene		•	•	٠	٠	•	•	•	•	•	•
chrysene		•	•	•	•	٠	٠	•	•	٠	•
C1-chrysenes/benz[a]anthracenes		٠	٠	٠	٠	•	٠	•	٠	•	'
22-chrysenes/benz[a]anthracenes	•	•	•	. •	•	1	•	•	•	•	•
3-chrysenes/benz[a]anthracenes	no	•	٠	•	•	•	•	•	•	•	•
24-chrysenes/benz[a]anthracenes		6	•	•	•	•	•	•	•	•	•
senzo[b]fluoranthene	-	ŧ	•	1	•	•	•	•	•	•	•
xenzo[k]fluoranthene		•	•	•	•	•	٠	•	•	•	•
benzo[a]pyrene		•	•	٠	•	•	•	•	•	٠	•
indeno[1,2,3-cd]pyrene			•	•	•	•	•	•	,	1	'
dibenz[a,h]anthracene		•	•	•	٠	•	•	•	•	•	•
oenzo[ghi]perylene	-	•	ę	•		•	•	•	•	•	•
C + 124 + C		4	•			4					

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

									-				
	Fish:	Ÿ.	Chum ÷		+	Chinook		티	<u>۸</u>	1.4	<- Smoked salmon ->	- walmon	dele v
	Village:	Larsen Bay		<-Chimisk →		Angoon	Nodiaki	Nation	<-Old Harbor->	18rbor->	-	181-7	<- I at ILLEK ->
	Site:	3	CHIS	CHIS	CHIC	AGN3	KODS	KAK-	OHA2	OHA	OHA	IVI	IVI
	Cycle	310	350	141	≣ 5	101	44	- 12	111	rids/	Spin sampicar		
	D St. M. INC.		355	336	S 10	<u> </u>	8 %	3	:				
ACs	1,1	337	353	354	303	183	3	90	202	241	744	¥0 \$	527
	Lab no.:	600	007	624	273	371	*	2	60/	14.7	74.4	250	776
naphthalene		•	•	•	**	•	•	æ	•	450	210	1200	1200
CI-naphthalenes		0.3	-	0.3	. 1	7	4.0	0.2	0.7	320	400	9	950
C2-naphthalenes		•	9.0	•		8.0	0.07	•	į	410	530	930	1500
C3-naphthalenes		•	0.3	•	•	0.08	•	•	•	510	610	270	1400
C4-naphthalenes		•	•		,	•	•	•	•	380	370	650	1200
acenaphthylene		•	•		•	•	•	•	,	580	640	3000	3400
acenaphthene		•	•	•	•	•	•	•	•	22	5	280	280
fluorene		•	9.0	•	•	0.3	•	•	•	410	450	008	2100
C1-fluorenes		•	•		•	•	•	•	•	340	380	25	000
C2-fluorenes		•	•	,	•	•	•		į	740	08/	1700	1400
C3-fluorenes		• ,	• ,	1 1	• •	• 4	' 1	• •	• 1	210	061	780	130
phenanthrene			7	0.5	0.4	7	0.7	0	0.7	1800	0081	2100	4600
C1-phenanthrenes/anthracenes		•	0.07	•	•	•	•	•	•	260	019	1800	1400
C2-phenanthrenes/anthracenes		,	•	•	•	•	•	•	į	230	250	710	3/0
C3-phenanthranes/anthracenes		•	•	,	•	•	•	•	٠	8	2	220	011
C4-phenanthrenes/anthracenes		•	•	•	•	•	ı	•	•	5	7	4	6.0 6.0
dibenzothiophene		•	0.3	•	•	•	•	•	1	14	4	44	36
C1-dibenzothiophenes		•	•	•	•	•	•	•	•		5	27 5	9:
C2-dibenzothiophenes		•		•	•	•	•	•	•	0 0	2 *	2 •	= '
C3-dibenzothiophenes		•			•	•	•	•	•	0.3	•	d	า
Sum of LACs			45	8.0	0.4	\$	1	9.0	-	7100	7800	20000	21000
fluoranthene			0.2	•	•	0.1	•	٠	•	280	310	1400	820
pyrene		•		•	•	•	r	•	1	200	210	0001	36
C1-fluoranthenes/pyrenes		•		•	•	•	•	•	1	5	93	440	ន្ត
benz[a]anthracene		•	•	•	•	•	•	•	•	5 5	4 3	. .	32
chrysene		•	•	•	•	•	•	•	•	5 7 °	57	₹ ′	£3 4
CI -chrysenes/benz[a]anthracenes		•	•	•	•	•		1	•	0	= -		
C2-cnrysenes/benz[a]anurracenes		•	•	•	•	•		•		•	•	3 6	. c
CA character of a leather care		•	•	• 1		, ,	, ,		1		•	} '	} '
bear-fall countrate			, ,			•	•			9	7	91	12
henzolk filmomathene			. 1	•		•	•	•	•	9	. 9	21	19
henzolalnymne		•	•	,	•	•	•	•	•	7	9	20	17
indeno[123-cdlovrene		•	•	,	•	•	•	•	•	m	4	6	90
dibenz[a,h]anthracene		•	•		•	•	•	•	•	0.2	9.0	•	•
benzo[ghi]perylene		•	•	•	•	٠	•	•	•	33	m	00	7
Sum of HACs		•	0.2	•	•	0.1	•	•	•	650	700	3000	1800
								. 1	,		1	,	;
sample weight, grams:		2.08	5.23	5.10	5.26	5.17	5.28	5.24	5.29	4.83	5.23	5.09	2.19

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

Number Change C	1.00							ŀ											
Section Sect		Village:	<- Kodi			บี v	enega B		٠ د	Md Harb		_			•	arsen B			
Cycle Cycle D. A. Mon. 49 220 49 19 11 11 11 11 11 11		Site:	KOD2				HES C	-	HE2 O	HAI 0				_		LAB6 1			LAB8
Doc Miles Application Doc Miles Do		Cycle	-				П	=		_						=	I	_	
halteners 10		D.A. M. no.	40	200	907	· <u>o</u>	92	171	472	120	323	322	27	148	5	292	251	909	607
Application			\$	221		<u> </u>	1 2	70	473		324		28	149	•	293		909	809
Lab Dot: 4 199 588 28 130 131 445 440 283 747 77 132 41 284 788 580	Š		2	i		2	:		474		325		ł			294			
0.1 0.3 0.3 0.3 0.3 0.3 0.3 0.3 0.0 0.0 0.0		Lab no.:	4	193	808	28	130	131	485	9	283	707	27	132	41	284	708	520	521
01 03											:								
0.1 0.3	aphthalene		•	•	•	4	•	•	~	•	4	•	a	**	•	æ	•	•	4
0.2 0.6 0.5 . 0.9 0.5 0.2 0.5	1-naphthalenes	····	•	0.1	0.3	•	•	٠	•	•	0.3	0.3	•	•	•	0.1	0.2	0.7	0.7
0.2 0.6 0.5	2-naphthalenes		٠	•	•	•	•	•	•	•	. 1	•	•	•	•	٠	•	,	•
0.2 0.6 0.5 . 0.9 0.5 0.2 0.5 0.5 0.9 0.5 0.2 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5	3-naphthalenes		•	•	b	•	•	•	•	•	•	٠	•	٠	٠	٠	•	•	•
0.2 0.6 0.5 . 0.9 0.5 0.2 0.5 0.5	4-naphthalenes		•	•	•	•	,	•	•	•	•	•	•	٠	٠	•	•	•	•
0.2 0.6 0.5 0.9 0.5 0.2 0.5 0.2 0.5 0.2 0.5 0.2 0.5 0.2 0.5 0.3 0.5 0.4 0.9 0.5 0.5 0.5 0.5	constitutions	war-	•	٠	٠	•	•		•	•	•	•	•	•	•	٠	•	•	•
0.2 0.6 0.3 . 0.9 0.5 0.2 0.5 0.2 0.5	Company Series		•		1	,	,	•	1 -								. 1		
0.2 0.6 0.3 . 0.9 0.5 0.2 0.5 0.2 0.5 0.2 0.5 0.2 0.5 0.2 0.5 0.3 0.9 0.5 0.3 0.9 0.5 0.3 0.7 0.3 0.9 0.3 0.7 0.3 0.9 0.4 0.5 0.3 0.7 0.3 0.7 0.3 0.7 0.3 0.7 0.3 0.7 0.3 0.7 0.3 0.7	compouncie		•	•	•	•	•		•	•	•	•	•	•	•	•	,	•	•
0.2 0.6 0.5 . 0.9 0.5 0.2 0.5 0.2 0.5 0.2 0.5 0.2 0.5 0.2 0.5 0.3 0.9 0.5 0.3 0.7 0.3 0.7 0.3 0.7 0.3 0.7 0.3 0.7 0.3 0.7 0.3 0.7 0.3 0.7 0.3 0.7	norene		•	•	•	•		•			•	٠		•	•	•	•	•	•
0.2 0.6 0.3 . 0.9 0.5 0.2 0.5 0.3 0.7 0.3 0.7 0.3 0.7 0.3 0.7 0.3 0.7 0.3 0.7	1-fluorenes		•	•	•	1	•	•	•	•	•	•	•	•	•	•	٠	٠	•
0.2 0.6 0.3 . 0.9 0.5 0.2 0.5 0.5 0.2 0.5 0.5 0.9 0.5 0.2 0.5 0.5 0.2 0.5 0.5 0.2 0.5 0.2 0.5	2-fluorenes		٠	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
6.2 0.6 0.5 . 0.9 0.5 0.2 0.5 0.5 0.2 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5	3-fluorenes		•		•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
9.3 0.9	consultations		•	0.2	9.0	•	•	٠	0.5	•	6.0	0.5	•		•	0.2	0.5	0.3	0.4
6.3 6.7 6.8 6.8 6.9 6.9 6.5 6.7 6.8 6.7 6.8 6.8 6.8 6.8 6.8 6.8 6.8 6.8 6.8 6.8	I obensuithenes/southracenes		•		•	•	•	•		•		•	•	•	•	•	•	•	•
663 664 665 665 665 665 665 665 665 665 665	Opensorhrenes/sorhrenes		•	•		•		•	•	•	•	•	•	•	•	•	•	•	1
8.5	ohen enthrenses/smthmorenses		,	٠	1	•	. •	٠.	•	•	•	•	•	•	•	•	•	•	•
6.3 0.9	- president circa/anthracence		•	•	•		•	•	•	•	•	•	•	•			•	•	•
polyments polyments polyments explyyrenes explyyrenes explyyrenes explying antimecenes explaint antimecenes explai	Principal term of the second s		,										1	•	•	•	•	,	•
phenois card all antimecens corz all antimecens correct co	Air and the second		•	•		,	,	,			, ,					• •		•	. '
### ### ##############################	1-discussionistics		•	•	•		,	,	,	1	,	,	,					, ,	
### ### ##############################	z-dipenzomiophenes		•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
eatygrenes conz[a]antiracenes co	5-dibenzothiophenes		•	•	•	•	•		•		•		•		•	•	٠	•	1
ea/gyrenes corz[a]anthracenes corz[a]anthracenes corz[a]anthracenes corz[a]anthracenes corz[a]anthracenes corz[a]anthracenes corz[a]anthracenes inthene inthene inthene inthene interior inthene inthene inthene inthene interior inthene			•	6	9	•		•	. 4	•	-	9	•	•	•	0.3	0.7	9	90
eutpyrenes conz[a] anthracenes conz[a] anthracenes conz[a] anthracenes conz[a] anthracenes conz[a] anthracenes conz[a] anthracenes inthene			•	3	•	•	•	,	3	1	•	3	,				;	}	3
eu/pyrenes cenz[a]anthracenes cenz[a]anthrac	oranthene		•	•	•	•	•		•	•	•	٠	•	•	•	٠		•	•
ene ex/pyrenes cental anthracenes cental alanthracenes cental alanthrace	120		•	٠	٠	•		•	1	•	•	•	•	٠	•	•	•	•	•
ene cent algorithm accres cent accres cent accretion accress cent algorithm accress cent accress cen	-fluoranthenes/ovrenes		•	•	9	•	•	•	•	•	•	٠	•	•	•	,		,	٠
### State St	nzíalanthracene		•	•	•	٠,	•	•	•	•	1	٠	•	•	٠	•	•	•	•
enz[a]antiracenes enz[a]antiracenes enz[a]antiracenes inhene inhene inhene 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	Lysene		•	•	•	*	•	٠	•	•	•	•	•	•	•	٠	٠	•	٠
### State St	-chrysenes/benz[a]anthracenes		•	,	٠	. •	•	,	•	•	•	٠	•	١	•	•		4	•
### State St	2-chrysenes/benz[a]anthracenes		•	٠	•	•	1	•	•	•	1	•	•	•	•	1	•	•	•
## State Sta	-chrysenes/benz[a]anthracenes		•	•	•	•		•	•	•	•	٠	•	٠	•		•	•	•
nthene nithcre	-chrysenes/benzía lanthracenes		٠	•	•	•	•	•	•	٠	•	•	•	•		· • • • • • • • • • • • • • • • • • • •	٠	•	. •
## stants: 1.5	nzolbifluoranthene		٠	•	•	•	•	•	•	•	•		•	•	•	•	•	1	•
Jipyrene	nzolk Muoranthene		٠	•	•	•	1	•		•		•		•	•	•	•	•	•
lancene lene 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	sizoja jironi amanan	t					,	,	,	,		•	٠	٠	•	•	•	•	•
Jayrene tracene lene state 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	nzola įpyrene		•	•	•	•	•	,	,	1		,	,	ı	1	,		١.	'
lene lene 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	denol 1, 2, 3-cd jpyrene		•	•	•	•	•		•	•	•	•	•	•	•	Ć	•	•	•
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	benz[a,h]anthracene		•	•	•	•		•	•	• *	•	•	r	•	•	1	•	•	•
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	mzo[ghi]perylene		• ,	•	•		•		•	•	•			•	•	•	•	•	•
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	ım of HACs		•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
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																			
	mple weight, grams:		3.22	5.26	5.38	4.14	2.08	205	2.36	4.78	4.70	5.15	3.85	4.99	4.46	5.13	5.15	5.23	5.42

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

	N. P. 10							-						- 14	
	VIIIABC:	0.0	<- Ouz	<- Ouzinkie ->	0173	- 2210		- * - X	TATA 3	^ Pr	<- Pt. Lions ->		Pt. Gra./ Eng. Bay		Angoon
	<u>د</u>	-	=	=		3 =	=		: :	3 -	2 5	21.5	7107	3 :	YCN3
	D& M no:	8	366	776	3	¥ ¥	337	£13	33,4	76	111	# 70 3	ج -	107	= }
		%	36.	277	3 2	3 2	100	212	9 5	2 %	790	704	57	484	2 5
AC.		3	3	i	3	Ř		217	238	9	202	280			130
	Lab no.:	•	171	172	510	519	706	\$00	170	21	522	523	39	486	228
nardeth allera		•		,	ı										
		•	1	•	•	•	•	4 (a .	4	a	ed .	a	•	æ ,
C. narshihalenee		•	9.0	9	•	•	9	7.0	- -	•	•	•	•	•	0.7
Construction Construction		•	•	•	•	•	•	•	•	•	•	•	•	•	•
C-impuratence		•	•	•	•	•	•	•	•	•	•	•	•	•	•
			•	•	•	•	•	•	•	•	•	•	•	•	٠
acenaphinyiene		•	•	•	•	•	•	•	•	•	•	•	•	•	•
acenaphthene		•	•	•	•	•	•	•	•	•	•	•	•	•	•
fluorene		٠	•	•	•	•	•	•	•	•	•	•	•	•	•
C1-fluorenes		•	•	•	•	•	•	•	•	•	•	•	•	•	•
C2-fluorenes		•	•	•	•	•	•	•	٠	٠	•	•	•	•	٠
C3-fluorenes		•	•	•	•	•	•	0.5	•	•	•	1	•	•	•
phenanthrene		•	0.1	0.5	•	0.3	4.0	9.0	0.2	•	0.4	0.0	•	0.2	0.0
CI-phenanthrenes/anthracenes		•	•	•	٠	•	٠.	•	•	•	'	; '	•	,	, '
C2-phenanthrenes/anthracenes		•	•	•	•	•	•	•	•	•	•	•	•	•	•
C3-phenanthrenes/anthracenes		•	•	٠	•	•	•	•	•		٠	•	•	1 4	
C4-phenanthrenes/anthracenes		•	•	•	•	•		•			•	•			•
dibenzothiophene		•	•	•	•	•	٠	•	•	•	•	•	•	' '	, ,
C1-dibenzothiophenes		•	•	•	•	•	•	•	•	•	•	•	•	• •	, ,
C2-dibenzothiophenes	•.	٠	•		•	•		•	•	•	•	•	•	•	•
C3-dibenzothiophenes			•	•	٠	•	•	•	•	•	•	•	٠	•	•
	-														
Sum of LACs		•	0.2	-	•	0.3	8.0	-	0.3	•	4.0	9.0	•	0.2	0.4
- Constitution of the Cons						•									
number of the second		•	1	7.	•	•	•	•	•,	•	•		•	•	•
Ci diversity and the second		e	•	•	•	•	•	•	•	•	•	•	•	•	•
bear follow the companies		•	•	•	•	•	•	•	•	•	•	•	•	•	•
observe a parameter access		•	•	9	•	•	•	•	•	•		•	•	•	•
Cl. of the second secon		•	•	•			•	•	•	•	1	•	•	•	•
C1-cnry senes/ocaz(a) anum acenes		•	•	•	•	•	•	•	•	•	•	1	•	•	•
C2-cinyscies/ocaz[a]anuitacenes		•	•	•	•	•		•		•	•	·	•	•	•
C. chrysches/ocaz[a]animacches		•		•	•	• ′		•	•	•	1	•		•	•
C+-cmysches/ocaz[a]anumaccases		•	•	•	•		•		•	•	•	•	•	•	•
benzol bilinoranthene		•		•	•	•	•		•	•	•	•	•	•	•
benzo[k]Huoranthene		•	•	•	•	•	•	•	•	•	•	•	•	•	٠
benzo[a]pyrene		•	•	•	•		•	٠	•	١,	•	•	•	•	٠
indeno[1,2,3-cd]pyrene		1	•			•	٠	,	•		٠	•	1	٠	•
dibenz[a,h]anthracene		•	•	•	•	•	•	•	•	•	•	•	•	•	•
benzo[ghi]perylene		•	•	•	•	•	•	•	•	•	•	•	,	•	•
Sum of HACs		•	•	10	,	,	,								
		•	•	÷.	•	•	•		•	•	•	•			•
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.

	Ninea.			D		a rio	NAME AND	The state la		Town Day	\ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \
	Site	CHE2	CHEZ CHI	CHE	CHES	OHAI	Seepes	TAT4	LAB6	LAB6	AGN3
	Cycle: D & M no.:	014	II 99	11 S	日12	1 108	E31	1 025	I 105	249	195 1195
ACs		015 013				113		026		250	198
	Lab no.:	23	149	151	487	26	524	22	704	285	322
nachthalene		4	•	44	•	•	æ	æ		æ	æ
CI-naphthalenes		•	•	•	•	'	· •	. •	0.2	0.1	0.2
C2-naphthalenes		•	•		•	•	•	•	•	•	•
C3-naphthalenes		6	D		•	•	•	•	•	•	•
C4-naphthalenes		•	•	•	•	•	•	,	•	•	•
acenaphthylene		•	,	•	•	•	•	•	•	•	•
acenaphthene			•		•	•	•	•	•	•	•
Illuorene		•	•	•	•	•	•	•	•	•	•
CInoranes		• •	• •	• •	• •		• t		, ,	•	
C3-fluorenes		•	•	0		•	•	•	•	•	•
phenanthrene		•		•	0.3	,	0.7	,	0.3	0.5	0.4
C1-phenanthrenes/anthracenes		•		1	•	•		•	•	•	•
C2-phenanthrenes/anthracenes		•	,	•	•	٠	•	•	•	1	•
C3-phenanthrenes/anthracenes		•	•	•	•	•	•	•	•	í	•
C4-phenanthrenes/anthracenes		•	•	•,	•	•	•	•	•	•	•
dibenzothiophene		•	•	•	•	•	•		•	•	•
C1-dibenzomiophenes		9 1	0 1	• 1	•		•	•*	•	•	•
C3-dihenzothiophenes			, ,								
Sum of LACs		•	•	•	3	•	0.7	•	0.5	0.3	9.0
fluoranthene		•	٠		•	•	•	•	•	•	•
pyrene	***************************************	•	•	•	•		٠	•	•	•	•
C1-fluoranthenes/pyrenes		•	•	•	0	•	•	•	•	•	•
benz[a]anthracene		•	•	•	•	•	•	•	•	•	•
chrysene		•	•	•	•	•	•	•	•	•	•
CI-chrysenes/benz/ajanthracenes		•	•	•	•	•	•	•	•	•	•
Ca-throenes/henzislanihmenes						• •	6 0				
C4-chrysenes/benz[a]anthracenes		•	•	. •	•	•	•	•	•	•	•
benzo[b]fluoranthene		•	4	•	•	•	•	•	•	•	,
benzo[k]fluoranthene			•	ı	•	•		•	•	•	•
benzolalpyrene			•	•	٠	•	•	•	•	•	•
indeno[1,2,3-cd]pyrene		•	•	•	•	•	•	•	1	•	1
dibenz[a,h]anthracene		•	•	•	•	•	•	•	•	•	•
benzolghiperylene		•	•	4	•	•	•	•	4	₽ J	•
Sum of HACs		√ •	\ \	•				•		\ \frac{1}{2}	•
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.

	Fish:										
	Village:	Kodiak	۲	<- Chenege Bou	<- Kockfish ->				<- Irish Lord ->	rd ->	Yf. Sole
	Site:	KODI	CHE	CHE	CHE2	TAT3	TAT4	Chiniak P	CHIMIAK Port Graham English Bay	nglish Bay	Pt. Lions
	Cycle: D&M m:	1 CV	I 710	II 97.	п!	-		I	107 1	707. 1	21. 51.
ACs		\$	017	<u>80</u>	167	000	800	044 045	020	024	074
	Lab no.:	24	42	150	157	701	202	36	906	Ċ	
naphthalene		•	•					67	60/	01/	705
C1-naphthalenes		• '	* '	•	•	۹)	•	æ	æ	•	, eq
C2-naphthalenes		•	•			4.0	0.3	•	0.5	0.2	0.4
C3-naphthalenes		•	•	•	•		• 1	•	,	•	•
C4-napotnaienes		•	•	•	•	•	٠.	•	•	•	•
accomply tene		•	•	•	•	•	•	, ,	•	•	•
Chorne		•	,		١.	•	•	' '	₹ I	•	•
CI-fluorenes		•	•	•	,	•	•	•		•	•
C2-fluorenes		•	•	•	•		•	•		•	•
C3-fluorenes		•		•		•	•	•	•		•
Dhenanthrene		•	•		,		•	•		• •	•
C1-ohenanthrenes/anihracenes		•		•	•	0.7	0.3	•	0.4	0.0	' *
C2-phenanthrenes/anthracenes		•	•	•	•	•	•	,	- '	4 '	5
C3-phenanthrenes/anthracenes		•	•	•	•	•	•	•	٠	•	
C4-phenanthrenes/anthracenes		•	•			1	•		•		•
dibenzothiophene		4	•		•	•	•	•	•	•	• (
C1-dibenzothiophenes		• 1	•	•	•	•	•	•	•	•	, ,
C2-dibenzothiophenes		• (•	•	•	•	•		1	•	•
C3-dibenzothiophenes			•	•		•		,	,	•	•
		,	•	•	•	•	•	•	•	•	•
Sum of LACs		•	•	•		-	è				
				1	•	-	0.0	•	9.0	0.4	8.0
fluoranthene		•	•		•	,					
pyrene		,	•	,	•	, ,	•	•	•	•	•
C1-International pyrenes		•		•	•	•				•	•
character daminacene		•			•			• •	•		•
Cl. charges and confedence		•	•			•	•	, ,	•	•	
C)-chrysenes/henz[a]animacenes		•	•	•		•	•) (•	•
Cachivence henzielenthmanne		í	•		ı			•	, ,		•
C4-chrysenes/henzialanthracenes		•		•	•		•	,		•	•
benzofblilnoranthene					•	•			•	• 1	•
benzolk ifluoranthene		•	•	•	•	•		•	,		• •
benzofaltwrene		•	•	•	•	•			•	, ,	•
indeno[123-cdhymene			•	•	•			•	,		
dibenzia hlanthracene				•	•	•	•	٠,	•		,
benzofghilperylene		•	•		•	•	• :	•	. 1	• •) - i
		•	•	٠			,	1	,	1	
Sum of HACs		•	•	•	•	•	•				
ternale weight were		į					•			•	•
with wight, grains.		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.

	Village:	V	<-Windy Bay	V-> K	Kodisk		2	2												
	Site: Cycle:	WNB1	WNB1 WNB1	<u> </u>		CHE! CF	CHEI CH	E E	HO II	EI PTGI	H PTG4	PTG1	<-Port (PTG1	<-Port Graham/English Bay-> PTG1 PTG4 PTG4 PTG4	Fraham/English Bay-> PTG4 PTG4	١.	PTG1	DTG:	L DIVE	ars. B.
	D& M no.:	989	8	491	021	168	1 <u>8</u> =	468 458 4	± 469 470	111 11 12 020 07 07 020	_ E	II I	II I		= 5				Ħ	I
ACs					_	010								171	77	2	476	477	478	220
	Lab no.:	47	242	243	48	4	114	304 3	305 306	96 45	5 46	711	116	117	110		8			
naphhalene		•	4	•	•											2	2	338	339	9
CI-naphthalenes		, '	91	0.3	• '	. '	,	- V	# 6	~ ·	•	æ	œ	œ	æ	æ	æ	œ	e	q
C2-naphthalenes		0.3	120	-	4				0.2	n -		- 0.3	0.	0.5	0.3	0.09	0.7	0.7	0.5	
C3-naphthalenes		\$	340	14	. 4	0.5				- -		•	•	•	•	1	•	•		•
C4-naphinalenes		34	260	4	85	-	1 4	1 (*)	٠.	- e				•	•	•	•	•	. •	•
accampanylene		•	0.07	•		. •		, ,	,	1		٠.	•	•	•	•		•	1	•
fluorene fluorene		•	0.5	•	•		, ,						•	•		•	•	•	•	
CI-fluorence		• ;	14	0.4		•).S C	0.2 0.	.1 0.3				•	' -	•	•	•	•	•	•
C2-fluorenes		2 3	œ	7		0.2	_	-	1 0.9	. ~		•	•	- -	•	•	1		,	
C3-fluormes		= 6	9	54		6	4	4	3		• •		•		•	•	•			•
phenanthrene		% :	<u>8</u>			0.2 0	0 4.	9.0	2 0.7		•	' '	• (• :	i	•				
C1-phenanthrenes/anthracmes		29	77.	φ,	3		_	S.	4	,	7	***	00	' च	٠ ،	٠,	٠, ٢	' 6	٠,	٠,
C2-phenanthrenes/anthracenes		3 5	8					9	9 7	_	'		} '	0) c	7		œ.	0.7	-
C3-phenanthrenes/anthracenes		3 5	3700			25	2	22 23	3 15		•	•	•	200	3 -			ı	1	•
C4-phenanthrenes/anthracenes		<u> </u>	000	200	֓֞֞֜֞֜֞֜֞֜֓֓֓֞֜֜֜֟֓֓֓֓֓֓֓֓֓֓֓֓֡֓֜֜֜֜֓֓֓֡֓֜֜֡֓֡֡֓֜֜֜֡֡֡֓֡֓֡֡֡֡֓֜֜֡֡֡֡֡֜֜֝֡֡֡֡֡֡֡֡	_		22 22	3 14		•	•	•	,	; ·		• •	,		•
dibenzothiophene		3 =	5 5	3 •	n :	e e	4,	<u>.</u>	9		•	•	•		•	•	, ,	•		
C1-dibenzothiophenes		: 2	420	4 6	* 8		- 0	m :	7	•	•	1	٠	0.1	•					
C2-dibenzothiophenes		210	2300			2 9	•	*	2	•	•	•	٠	•	•		•		•	
C3-dibenzothiophenes		780	3500		230	2 12	3 2	5 4 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5	2 2 2	•	•	,	*	,	٠			• •	, ,	· -
							2	กั		•	•	1	•	•	•	•		•	•	90.0
Sum of LACs		3300	16000 2	2400 15	1500 220	091 03	0 200	061	36	•		•	•	ų	•	•	,			
fluoranthene		;	,								•	•	-	n	•	7	_	7	_	-
pyrene		20	47	90 t	57	٠ د ده	9		9 1	•	0.07	0.4	,	v	4	·				(
C1-fluoranthenes/pyrenes		, 04	96.0	- 9	3:	7	en -	8	د	•	0.1	•	٠	0 0	,	1 2				0.3
benz[a]anthracene		3 2	3 =	3 °	14	4		(A)	_	٠	•	•	•	•	, ,	} '		•		
chrysene		110	380	7 52	9 9	oi Ì	. c		6.0	•	- 1	•	•	0.5	0.1		•			
C1-chrysenes/benz[a]anthracenes		160		2 2		. ·		o -	7 0	•	•	•	•	7	7	0.3				٠,
C2-chrysenes/benz[a]anthracenes		89		9		,	· -	-	9.0	,•	•	•	•			•				
C3-chrysenes/benz[a]anthracenes		0.2		52				• •	ָרָהָי מיני	•	•	•	•	,		•		•		
hersoft in the sense of a janine sense			28	S						•	•	•					•			
benzoft-liftnomerken		90			5 0.1	7	-	1 2	-	• •	• •		•	٠.		' (
Denzola Junoraminene		•		_	37		0.3	3 0.7	03		F i	•				0.2		•	,	,
indeno[123-cd]norman			7	7	•	•	- 0.09			• •			•	0.0	0.1					
dibenzie blanchmann						•	•		; '	•	,	•	•							,
henzolohilnerolene			S	0.5	•		•	•	•	•		•	•		•				ı	
consolibri y totte				6	,		•		٠	•	• •	• •			•	•				,
Sum of HACs												,				•				ť
		~ }	2500	550 160	9 9	77	77	79	15	•	0.2	0.4	•	12	•	6			·	<u> </u>
sample weight, grams:	•	4.58	4.93 5.	5.19 5.31	1 5.05	4.61	4.83	5.19	4 40	4 78	473	6								}
							i						3.11	5.45	5.17 5.	5.33 5.30	30 5.13	3 5.35		5.09

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

		TATI TATI TATS TATS 1	TATI	LAL	T CIW	IAISI	TAIS T	IAIS	AISO	TATS OHAS OUZS		Ω E E	CHIZKAR		KAR2 KAR2	22 KAR2		AKH2 AKH3		KASI KASI	ACM1 ACM1	NO.
		1 00	1 00	II 951	П 157	II 158	# 02	# 451	⊞ 75	1 119			040 040		II 1 278 36	III III 368		150			בו בו	H I
ACs	D & M no.:	26 ×	002 002 >duplicate<																2		2	<u>:</u>
	Lab no.:	8	8		=======================================	13	307	308	88	8	395	57	58	59 2	245 393	3 394	392	251	355	356	232	324
naphthalene		•	•	•		•	đ	•	•	. (,											
CI-naphthalenes		'	• '	0.2	0.2	0.2	0.2	• 4.0	0.1		0.7	ng '	og '	a, '	8 8 0.2 0.1	e -	es i	8 C	# C	æ (e (æ ç
C2-naphthalenes		1	•	•	٠	•	•		•				•					7.0	5	0.0	0.0	5
C3-naphthalenes		•	•	•		•	•	. •		•	•	,			, ,		, .		•	•	•	•
C4-naphthalenes		•	•	•	٠	•	•	, •						,					•		٠	
acenaphthylene		•	•	9	90	90				,	•								•	•	•	
Acenarhihene		•	•	9	9	2	•	•	١.				•			•		•	•	•	•	٠
Supreme .		•	٠	•				•	•			1						•	•		٠	•
O D		•	•	•	٠	•		1	•	•		•	•			•		•	٠	•	1	·
CI-illuorenes		•	•	•	•	•	•	•	•				•		•			•	•	. 1	•	
CZ-filluorenes		•	٠	•	•	•	•	•	•			,				,			•	,		
C3-fluorenes		•	•	٠	•	•	•	,				•				7.		•				•
phenanthrene		•	•	7	7	7	9.0	0.7	9.0	, .4	0.7			,	00 00	7 03	0.3		0		٠,	, ,
C1-phenanthrenes/anthracenes		•	٠	•		٠		•	- 4		•	•	,	,					9	†	2	5
C2-phenanthrenes/anthracenes		i		•	•	•	•	•			٠,							•	•	•	•	•
C3-phenanthrenes/anthracenes		٠	•	•	•		•	٠.	•		٠.			, ,	•			•	•	•	•	
C4-phenanthrenes/anthracenes		•	٠	!	,	4	•			•	,			١, ١	. ,			•	•	•	•	34
dibenzothiophene		•	•		•		,	,	•			, ,						•	•	•	1	
C1-dibenzothiophenes		•	•	•	•	•		•		•		, ,		. ,				•	•	•	•	
C2-dibenzothiophenes		•	٠		, •	. 1		•	•			j.		, ,			•	٠	•	•	•	•
C3-dibenzothiophenes		•	•	•	•	•	•			•	, ,	>					•	•		1	•	•
																			•	•	•	•
Sum of LACs		•	•	.	m	.e	8.0	-	6.0		0.9		•	. 0.4	4 0.3	3 0.3	0.3	0.4	-	0.7	9.0	-
fluoranthene		•	•	0.3	5	0.3	,															
pyrene		•	•	, '	; '	; '	, ,	, ,		•							9	•	•	•	•	0.
C1-fluoranthenes/ovrenes		٠,	•	,				,	•			•					•	•	•	٠	•	
benzi alanthracene		•					1		•	•	,						•	•	•	•	•	•
chrysene					,	•	•	•	•								•	•	•	•	•	•
CI chrysenes/henz/alanihracenes		1	,	•	•	•	•	•			•						•	•	•	•	•	•
O-chrysneshenzfalenthmones		•	•	•	•		•		•		,			,			•	٠	٠	•	•	•
Ca charamer Accompanies to the control	,	•	•	•					• ,								1	•	•	•	٠	'
California American					•												•	,	٠	•	•	•
Carting School of Amunacenes		•	·	r	•	•		•							•			,	٠		•	٠
		•	•	•			•										•	١	•	•	•	'
Delizo[k]illioraminene		•	•					•								•	•	•	٠	•	•	
cenzolajpyrene		•		•			•	•			,					'	•	•	•	•	•	•
denol 1,2,3-cd pyrene		•					•	•	•								.1		, 1	٠,	•	•
dibenz[a,h]anthracene		•	•		•		•			•		,		,			•	•	•	اير		' '
penzolghi]perylene		•		•				,•	•	,							•	•	•	٠		•
Sum of HACs		•		0 2	-	~																
		1	•			2		•	•		•						•	•	•	٠	•	0.1
and a second second		,		, ,			!															

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

	27-11						i									
	Vullage:	Kodiak	Chen	Chenega Bay					0.9	<- Old Harbor ->	^				-	
	Suc.	NOD E	CHE.	CHES.	OHA3	OHA3		OHA3	OHA3	OHA4	IA4	OHA4	OHA4	OHAA) MV	AGNO
	D& Mno.	# V	7 .	7 6	- :	= :	п	Ħ								7 I
	- THE TOTAL OF THE	COP .	110	710	0	318	319	614	613	320	114	321	8	9	019	176
ACs													dnp<	>duplicate<)
	ab no:	212	664	\$90	699	225	226	431	432	227	029	247	418	410	433	331
naphthalene		•	•	•										112	222	177
CI-naphthalenes		• -	0.7	• ?	- C	= 6	4 (4	4	•	4	æ	4	æ	•	•
C2-naphthalenes		- 7) c	3	0.0	0.5	0.2	0.3	•	0.2	0.1	0.4	0.2	0.4	0.4	0.2
C3-naphthalenes		74	3	, 60	•	•	•	•	•	•	•	•	7	e	6.0	
C4-naphthalenes		\$	7 0	5 6	•	•	•	•	•	٠	•	•	79	33	2	•
acenaphthylene		3 3	Š	9	•	•	•		*	•	•	•	23	2	2 :	• •
acenaphthene		8 8	•	•	•	•	•	•	•	•	•	•	} '	,	7	
fluorene			•	•	•	٠	•	•	٠	•	•	•	•		•	•
Cl-fluorence		7	•	•	•	•	•	•	•	•	•	•		٠ -	٠ ،	•
C)-financies		9	•	0.1	•	•	•	•	•	٠		•	9 6	- :	50	
C-inordies		78	0.1	•	•	,	•	٠		1		•	7	= :		•
Co-imorenes		œ	8.0	0.5	•	•	•			•	•	٠	>	6	7	•
pocoanthrene		91	٣	7	-	00	90	-	, 5	٠,	٠,	٠,	•	-	m	•
CI-phenanthrenes/anthracenes		32	1	(4)) °	5	-	5	7	m •	7	91	61	13	0.3
C2-phenanthrenes/anthracenes		45	9	4		3 -	•	•	•	7	-	-	37	\$	36	
C3-phenanthrenes/anthracenes		22		-	•	- -	•	•	•	 	0.3	0.4	32	4	4	
C4-phenanthrenes/anthracenes		1 9		Š		•	•		•	•	•	•	8	13	15	•
dibenzothiophene		*	٠,	٠ ﴿	•	•		•	•	•	•		•	0.05	: '	
C1-dibenzothioohenes		٠ ز	- (7.0	•	•	•	•	•	•			•	· (*	٠ ٦	
C2-dibenzothiophenes		8 =	7 6	, S	•			•	•	0.3	•	0.2	23	2	٠ ١	•
C3-dibenzothiophenes		7 6	•	٠.	•	•			•	0.3	0.1	0.1	33	47	25	
		3	•		•		•	•	•	13		•	01	2	2	•
Sum of LACs		410	23	1	•	•	1							!	}	,
			'n	2	7	~	0.7	-	63	•	4	4	230	330	210	2
fluoranthene		11	"	c	70	t										3
pyrene		7 7	- r	4 -	9) c	0.3	o. o		en .	S	7	12	15	10	
C1-fluoranthenes/pyrenes		. ⊿	• '	-	• .	5		0.7	•	7	7	, -	œ	01	7	
benz[a]anthracene		80	•	• •	•	•		•		•			0.3	7	-	•
chrysene		er.	90	03			•			0.1		•		0.4	0.5	
C1-chrysenes/benz[a]anthracenes		00	;	5	•					0.2	0.1	0.1	0.5	-	_	
C2-chrysenes/benz[a]anthracenes		•		•	,	•	•							•		
C3-chrysenes/benz[a]anthracenes		•		•			•							•		
C4-chrysenes/benz[a]anthracenes				•		•	•	•	•				•	1.		
benzo[b]fluoranthene		0.7	•			,	•	•		•		ı.	•	•		,
benzo[k]fluoranthene		0.5	•	•			•	ı						0.2	0.5	•
benzo[a]pyrene		0					•							•	0.2	
indeno[1,2,3-cd]pyrene		•		,	•	•				٠				,		
dibenz[a,h]anthracene		•	٠ ،	•	•	•								•		
benzo[ghi]perylene			1 1	•			•	•	•						•	
			•		•									1		
Sum of HACs		20	S	3	9.0	9.0	0.3	_		¥	r	,	7	6	;	
							}	•	1	מ	•	า	77	Ž)	70	
sumple weight, grams:		5.11	5.07	5.02	5.03 5	5.07 5	5.04 5	5.26 5	5.31 5	5.20	5.05	5.52	200	\$ 65	£ 30	8
																5

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

6.1 673 416 435 682 249 250 260 68 434 672 207 62 417 430 6.2 673 416 435 682 249 250 260 68 434 672 207 62 417 430 6.3 673 416 435 682 249 250 260 68 434 672 207 62 417 430 6.4 673 673 673 673 673 673 673 673 673 673		Village:	1 401	IABI	□	- Larsen Bay - A D3	↑ 1 v 10 v	1 4 10 2	tav 1	2110	<- Ouzinkie ->	nkie ->	72110	÷ 21.24	<- Akhiok	- ^-	Karluk
Applies			8 7	288 E 88	188 188	1 000	315	316	314	039		062	11 12 253		AAATA III 377	378	11 279
## 8	ACs	Lab no.:	673	416	435	682	249	250	260	8	434	672	207	62	417	430	224
### Accreted the control of the cont	narhthalene		•	•	•		٠	•	٠	٠	•		a	•	*	•	
## Secretary Control of the control	C1-naphthalenes		0.3	, t	0.3	0.9	0.3	0.5	0.7	, '	0.2	0.2	0.4	, '	'	0.1	0.1
## Second	C2-naphthalenes		•	•	•	•	•	•	•	•	•	•	•	•	٠	٠	٠
Secretaria Sec	G-naphthalenes		•	•	٠	•	•	•	•	•	•	•	•	٠	•	•	•
## Secretary of the control of the c	C4-naphthalenes		•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
1 0.8 2 0.7 1 0.8 2 0.7 2 1 0.4 0.2	scenaphthylene		•	•	•	•	• .	•	•	•	•	•	•	•	•	•	•
## State of the contents of th	acenaphmene		•	٠	•	•	ı	٠	•	•	•	•	•	•	•	٠	•
Advances thruscenes th	CI-fluorenes									• •						' '	• •
## Secretarian 2	C2-fluorenes		• •	•	•	•		•	•	•	•		• •	• •	•	•	•
## Accress 1	C3-fluorenes		•	•	•	•	٠	•	•	,	•	ť	•	•	•	•	•
## disperses 0.3	phenanthrene		7	0.5	0.7	-	-	8.0	7	•	0.7	7	-	•	0.4	0.2	0.5
Accesses Accesses Accesses Accesses Accesses Accesses Accesses Barrier Barri	C1-phenanthrenes/anthracenes		0.3		•	•	7	•	9.0	•	•		0.7	•		•	•
## 1	C2-phenanthrenes/anthracenes		0.3	1	•	•	0.5	•	0.3	•	•	7	0.4	•	•	•	١
### 1	C3-phenanthrenes/anthracenes		•	•	•	•	٠	4	٠	•	•	0.3	•	•	•	•	٠
### and the contents of the co	C4 phenanthrenes/anthracenes		•	• ,	•	•	•	•	•	•	•	•	•	•	•	•	•
## 1 4 0.9 7 3 0.4 0.3 1 0.1 0.7 0.2 0.7	dibenzothiophene		•	•	•	•	•	•	•	•	•	· 5	. 5	•	•		•
3 0.5 1 2 4 1 4 0.9 7 3 0.4 0.3 thracenes thracenes thracenes th	C dibenzoniconenes		• •	• •	• •	• 1	. 5	• •	• •	• (• •	- -	5	•	•	• ,	•
### 1 4 . 0.9 7 3 . 0.4 0.3 ### 1 0.1 0.7 0.2 0.7	C3-dibenzothiophenes						, ,	• •		•		0.4	• •				٠,٠
### 1 4 . 0.9 7 3 . 0.4 0.3 1																	
thracenes thrace	Sum of LACs		60	0.5	vot 1	7	•	-	•	•	0.9	7	e	•	0.4	0.3	0.3
thracenes thracenes thracenes 1	fluoranthene			•	•	0.1	0.7	0.2	0.7	•	•	-	0.5	•	•		•
thracenes thrace	pyrene		0.3	•	•	. •	0.1	•	0.1	•	•	0.5	•	•	•	٠	•
thracenes thrace	Cl-fluoranthenes/pyrenes		•	٠	•	•	•	•	•	•	•	•	•	•	•	•	•
thracenes thrace	benz[a]anthracene		•	•	•	•	•	•	•	•	•	•	•	•	•	٠	•
thracenes thrace	chrysene		•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
thracenes thracenes 1	Ci-chrysenes/benz[a]anniacenes		• •	• •	• •	•	• •	. ,		• •	٠, '	• ,			• •	• (• •
thracenes 1	C3-chrysenes/benz/alanthracenes		•	•	•	•	٠	•	•	•	•	•	٠	•	•	•	•
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	C4-chrysenes/benz[a]anthracenes		٠	•	•	•	•	•	٠	•	•	٠	•	٠	٠	•	•
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	benzo[b]fluoranthene		•	•	•	•	•	٠	•	•	•	•	•	•	٠	•	•
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	benzo[k]fluoranthene		•	•	•	•	•	٠	٠	•	•	•	•	•	•	•	•
1	benzo[a]pyrene		•	٠	•	•	• .	•	•	•	٠	•	•	•	•	•	
1 0.1 0.8 0.2 0.8 . 2 0.5 . 5.08 5.17 5.38 5.01 5.38 5.02 5.16 5.31 5.28 5.02 5.84 5.20			•	•	•	•		•	•	•	•	•	•	•]	•	1	1
1 0.1 0.8 0.2 0.8 2 0.5 0.5 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			•	•	•	•	•	•	•	•	•	•	•	•	٠	•	•
1 - - 0.1 0.8 0.2 0.8 - 2 0.5 -	benzo[ghi]perylene	-	•	•	•	•	•	•	•	•	• .	1	ı	•	•	•	•
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	Sum of HACs		-	•	•	0.1	9.0	0.2	9.0	•	•	7	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.

	W.							i								
	Site:	CHII	CHI		<- Chiniak > II CHI2	CHII2	CHI2		1	i Lia	· Pr	Lions ->				Kasitsna
	Cycle: D & M no.:	1 053	E32	€33	8	П	1 89	# E	1 1 2 E	1 = 6	rilli II			77	PT1.2 II	KAS1 III
ACs								3	3	677	067	914		8	232	489
	Lab no.:	199	413	428	899	223	415	429	2	205	506	414	436	¥		176
naphthalene		•	•	•	•	•							200	3	717	20
CI-naphthalenes		0.5	•	0.1	. '	• '	• '	0.6	a '	4 0	4 C	a	et C	4	es C	as (
C3-paphihalenes		•	•	•	•	•	•	•	•	} '	ָי י	٠.	, ,	• 1	0.3	0.4
C4-naphthalenes		•	•	•	•	•	•	•	•		•	•	• •	• (•	•
acenaphthylene		• 1	•	•		•	•	•		•		•	•		• •	
acenaphthene		• •	• •	•		•	•	•	•	•		•	•	•		
fluorene			• •	• 1	•		•	•		•	•	•		•	•	
CI-fluorenes		•	•	•		• 1	•	•	•	•	•	•	•	•	•	•
C2-fluorenes	-	•	•	•	•		•	•	•	•	•		•	•	•	٠
C3-fluorenes		0.1	•	•		•	٠,		•	•		٠.		•	•	•
phenanhrene		9.0	0.2	0.5	0.3	0.5	0.3	0.3	0 0	. 0	۰	٠.	٠.	٠,	• ,	•
C-phenalthreneyantracenes		•	•	•		•	•	•	; '	; '	0.07	- •		7	7 5	T
C3-phenanthrenes/authrocnes			•	•	•		•	•	•		,				3	0.0
C4-phenanthrenes/anthracenes		ė i	•	•	•			•	•	•		•	•	•		†
dibenzothiophene				• 1	ř	•	•	•		•				•		
C1-dibenzothiophenes		•				•	•					,		•	•	•
C2-dibenzothiophenes		•				• •	• •	• ;		,		•	•	•	•	•
C3-dibenzothiophenes			•	•					•		•		•		•	•
Sum of LAC.		,	,					,	•						•	•
		-	0.2	9.0	0.3	0.5	0.3	6.0	6.0	-	=	-	-	7	7	2
fluoranthene		0.1	. •	0.3	•	•	,			6		,		ı	•	•
Pyrene C1 6:00-01		•	•						4. ,	7.0		-		0.1	- ;	0.3
benzialanthrome		•		•		•	•		•	• •			•		0.2	0.0
chrysene		٠.	•	•			•	•	•	•	•		•	, ,		
C1-chrysenes/benz[a]anthracenes		•	, ,	•	•	•	•			•	,		•			•
C2-chrysenes/benz[a]anthracenes		•	•	, ,		• ;		•	•					•	•	,
C3-chrysenes/benz[a]anthracenes		•		•		•			w, e							•
bern fill file and the file for the file file file file file file file fil		•	•		•		•		•				,			•
benzolk filmoranthene						•			,	٠.	٠,	• 1				•
benzolalovnene			•		•						•		• •			•
indeno[1,2,3-cd]pyrene		•				•	•			•	•					
dibenz[a,h]anthracene		٠, ٠	• •		•										· •	٠.
benzo[ghi]perylene		•											•		•	•
			,	•	•	•		•	•	•		•		•		•
Sum of HACs		0.1	•	0.3		•		•	0.4	0.2	-	-	-	1	-	
sample weight, grams:		5.08	5.98	5.26 5	5.07 5.	5.06	5.53	5.26	5.28	9	2 613					•
													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.

				0	ОНАЗ ОНА4	OHA4	OUZZ O	0.17	EE		CHI2	AKH3 A	AKH3	PTI 1 P	-	
	SILC:	WNB2	KODS	-		-	1		;	3)			111	ZIE	5
	Cycle: D& M no.:	038	49 E	495	E15	■ 119	090	II 252	II 227	634 E	E39	11 358	1I 358	п 231	E 519	II 137
ACs												Zdmb×	>duplicate<			
	Lab no.:	999	437	447	615	919	1/9	214	246	613	614	301	310	213	617	340
narchthalene		•	ď	•	•	•	. •	•	. •	•	æ	•	ď	•	•	đ
Ci-naphthalenes		0.7	0.9	, '	0.5	0.2	0.3	0.2	0.2	0.1	0.3	• '	0.5	0.2	0.2	0.0
C2-naphthalenes		0.8	7	٠	٠	6.0	•		•	•	1	•	•			0.1
C3-naphthalenes		7	14	4	•	17	٠	•	٠	•	٠	•	٠	•	•	0.2
C4-naphthalenes		13	22	9,	•	91	•	•	٠	•	•	•	•	•	•	•
acenaphthylene		•	٠	•	•	•	۰	•	•	٠	1	٠	•	٠	•	•
acenaphthene		•	•	٠	٠	٠	•	•	•	•	٠	٠	٠	•	•	•
fluorene		0.2	-	•	•	9.4	•	٠	•	•	•	:	•	٠	•	0.1
CI-fluorenes		4	9	٣	•	90	•	•	•	•	•	•	•	•	•	0.0
C2-fluorenes		19	82	9	•	0	•	•	•	•	•	•	•	٠	•	•
C3-fluorenes		9	S	7	0.4	en en	•	•	•	-	0.3	•			•	•
phenanthrene		7	90	4	-	15	0.7	0.4	4.0	0.8	0.5	0.3	0.5	-	-	S
Cl-phenanthrenes/anthracenes		43	78	7	٠	34		•	•	•	•	•	٠	0.3	•	9
C2-phenanthrenes/anthracenes		130	4	22	•	32	•	•	•	•	•	•	•	0.3	•	e
C3-phenanthrenes/anthracenes	•	180	2	œ	•	0	•	•	•	•	•	•	1	. •	•	e.
C4-phenanthrenes/anthracenes		45	0.0	•	٠		•	•	•	•	•	•	•	•	•	•
dibenzothiophene	44	₩.	4	7	•	90	•	•	•	•	•	•		•	•	0.4
CI-dibenzothiophenes	-	12	11	3	•	21	•	•	•	•	•		•	•	•	
C2-dibenzothiophenes		120	‡ ;	54	•	** :	•	•	•	•	•	•	•	•	.•	0.0
C-dipenzonnopuenes		37	ร์ เ	<u>C</u>	•	2	•	•	•	•		•	•	•	•	•
Sum of LACs		830	270	120	7	200	,	9.0	9.0	7	-	0.3	0.7	7	-	70
		•	;	1	1				,							
fluoranthene		*	R =	51	0.7	= '		• ,	0.3	0.4	0.1	•	•	- :	6.0	Φ.
Pyredie ClAnoramheneshumenes		r (c	= 5	0	• (· ·	• •	• 1	• :	•	•	•	•	-	.	7 00
henzialamhracene		6	0.2	;	•	} '	•	•	•	•		, ,		• •	•	3 6
chrysene	10	24	7	0.8	•	0.3	•	•	•	•	•	•	•	•	•	90
C1-chrysenes/benz[a]anthracenes		32	•,	•	•	•	•	•	•	•	•		•	.•	1	•
C2-chrysenes/benz[a]anthracenes		32	•	•	•	٠	•	•	•	•	•	•	•	•	٠	1
C3-chrysenes/benz[a]anthracenes			•	•	•	•	•,	•	•	٠	•	٠	٠	•	•	•
C4-chrysenes/benz[a]anthracenes		•	•	•		•	4	•	•	•	٠	•	•			•
benzo[b]fluoranthene		7	0.2	•	•	•	•	•	•	•			•	•	•	•
benzo[k]fluoranthene	· .	•	•	1	•	•	•	•	•	•	•	•	•	•	,	•
benzo[a]pyrene		•	•	•	٠	•	•	•	•	•	•	•	٠		•	•
indeno[1,2,3-cd]pyrene		•	•	•	•	•	•	•	•	•	1	•	•	1	٠,	•
dibenz[a,h]anthracene		•	.*	•	:*	•	•	•	y. •	•	•		•	•	٠	•
benzo[ghi]perylene	5.	0.1		i .	1 -	•	•	• 1	•	•		•	•	•	• .	•
Sum of HACs		130	87	77	0.7	10		•	0.3	0.4	0.1	•	•	-	•	•
		,	1		•	1		1			1		1	1	1	,
sample weight, grams:		2.00	5.35	2.62	5.34	5.24	5.03	5.30	4. 56.	5.33	5.15	5.35	2.07	5.37	5.26	2.05

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

	47-81		Chinish			Horse Clam	
	- ecelli		1		1000		
	Site:	CHIO	V- Canada V-	Cini	FC/EB	<- Angoon ->	
÷	Cycle:	П		# E	5=	AGN2	AGN2
	D& Mno.:	224		638	136	175	175
ACs			^	>duplicate<		>duplicate<	
	Lab no.:	60-303	60-612	819-09	60-302	325	328
naphthalene		•	•	•	•	,	
CI-naphthalenes		0.2	. *	0.1	0.2	0.2	0.4
C2-naphthalenes		•	•	•	•		. '
C. naphunalenes		•	•	•	•		•
C+-naphuaienes		•	•	•		•	٠
accomplished			•	•	•	•	٠
Accompanience Annual		ı	•	•	•	•	٠
Claffinguman		•	•	•	٠	•	•
C1-Inormes		•		•	•	•	•
C3-fluores		•	' 6	•	•		•
phenanthene		' '	0.0	• •	•	•	1
C1-phenanthranes/anthracense		0.0	6.0	0.4	m	0.3	0.4
C2-phenanthrenes/anthracenes		9 1	•	•	•	•	•
C3-phenanthrenes/anthracenes		•	•	•	•	•	•
C4-phenanthrenes/anthracenes		• •		•	•	•	•
dibenzothiophene		, ,		• 1	•	•	•
CI-dibenzothiophenes	-	•				• 1	•
C2-dibenzothiophenes		•	•	•	•	•	
C3-dibenzothiophenes		•	•	•	٠	•	٠
Sum of LACs		80	0.7	9	,	3.0	•
		}	•	3	ז	2	5.0
fluoranthene		0.1	٠		S	,	•
pyrene C: 6			•		en	•	•
C.Ifluoranthenes/pyrenes		•	•	•	•	•	•
chargens		•	•	•	0.5	•	•
CI-chrysenes/henzfalanthracener		•	,	•		•	•
C2-chrysenes/henzialanthracenes		•	•	٠	•	•	•
C3-chrysenes/benz[a]anthracenes		•	• •	•	•	•	•
C4-chrysenes/benz[a]anthracenes		•		• •	•	•	•
benzo[b]fluoranthene			•	•	, 0	• 1	•
benzo[k]fluoranthene		٠	•	•	; '	, ,	• •
cenzo[a]pyrene		1		•	•	•	•
ndeno[1,2,3-cd]pyrene		•	•	•	•	•	•
dibenz[a,h]anthracene		•	•	•	30 ²	•	•
oenzolgnijperyiene				•	•	•	•
Sum of HACs		0.1	•	•	10	•	•
sample weight, grams:		5.42	5.26	\$ 40	. 203	6 3 3	173
		!	2	ì	9	3.32	5

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

	-																	
	Village:	Windy Bay	Bay		Γ	old.	. ~	H	공	H	Lau	ڃا	^	Ouzinkie	F	Akhiok	Karluk	¥
	Site:	WNB1 WNB1	WNB1			OHA3 C			TATS 1		LABI	LABI		OUZ2			KARI	KAR2
	Cycle: D&M no:	35	#92	204	4 93	- 6	317	E 5	159	423	78	313	= 0% = 0%	- 5	≣ 8	3.5 E 02.5	- 6	320
ACs		}	1						ì	1	2		}	5			3	2
	Lab no.:	76	360	208	396	22	345	401	120	357	8	346	411	80	410	399	78	400
nachthalene		đ	æ	•	, et	•	•	4	a	q	æ	•	ce	a	α	a	a	a
C1-naphthalenes		0.4	9.0	m	-	0.5	0.3	•	, ,	8.0	0.2	0.2	, '	٠ '	0	40	; [, '
C2-naphthalenes		0.0	0.2	4	0.3	•		•		'	,		•	٠	, '	; '	;	•
C3-naphthalenes		•	e	14	-	•	•	•	•	•	•	•	•	•	•	٠	,	1
C4-naphthalenes		0.02	43	27) green	1	•	•	•	٠	•	•	•	•	•	•	•	•
acenaphthylene		•	•	•	•	•	•	•	•	•	•	•	•	•	•	٠	•	•
acenaphthene		•	•	7	•	•	•	•	•	٠	,	•	•	•		•	•	•
fluorene		•	0.7	E	0.3	•	•	•	•	•	١	•	•	•	•	•	•	•
C1-fluorence		0.03	4	O N	ຕ	٠		0	•	•	•	•	•	•	٠	•	•	•
C2-fluorencs		7	86	45	7	•	•	•		•		•	•	٠	•	•	•	٠
C3-fluorenes	-	•	11	12	e	٠	•	•	•	•	•	•	•	•	•	•	•	٠
phenanthrene		7	S	14	13	6.0	9.0	0.5	•	0.4	0.4	0.7	0.4	0.1	0.3	0.7	0.1	٠
C1-phenanthrenes/anthracenes		-	38	30	34	0.05	•	٠	•	٠	•	•	•		•	٠	•	•
C2-phenanthrenes/anthracenes		7	380	71	14	→	٠	•	٠	٠	•	•	•	•		•	•	•
C3-phenanthrenes/anthracenes		e	1000	19	4	.g. •-	•	٠	•	•		,	•	1	٠	•	•	•
C4-phenanthrenes/arithracenes		0.4	310	7	•	. •	•	•	•	•	•	•	•	•	٠		•	•
dibenzothiophene		0.3	٣	m	0.5	b	•	•	•	•	•	•	. •	,	,	•	•	+0
C1-dibenzothiophenes		0.1	23	9	_	•	•	٠	•	•	•	•	•	•	•	•	٠	•
C2-dibenzothiophenes		0.7	280		m	. 1	•	•	•	•	•	•	•	•	•	•	•	•
C3-dibenzothiophenes		0.0	1400	0	4	•	i	•		•		•	•	•	٠	•	•	•
Sum of LACs		13	4000	230	3	7	0.9	50	•	-	9.0	6.0	4.0	0.1	0.5	-	0.3	•
fluctionalbone		9	Ξ		1	9 00	,		,		900	•						
		5	; ;	7 0	- [-	3 5	•			•	9 5	÷ c	•	•	•	•	•	•
C1-fluoranthenes/hyrenes		90	220	•	۲ -	3 '	•	•		, ,	50.0	7.	• •	I 14		•		•
benzfalanthracene		,		, e	5	•		•	•	•	•	•		, ,	, ,		,	
chrysene			220	4	~	•	•	•	•	•	•	•	•	•			, ,	1 1
C1-chrysenes/benzfalanthracenes		9.0	370	•	•		•		•	•	•	•	•		•	•	•	•
C2-chrysenes/benzfalanthracenes		-	400	,	•		•	•	•	•	•		•				٠ ،	
C3-chrysenes/benzfalanthracenes		0.02	230	•	•	•	•		•	•	•	,	•	•	', 1	•	•	•
C4-chrysenes/benz[a]anthracenes		•	270	٠	•	•	٠	•	•	•	•	•	•	•	•	٠	٠	•
benzo[b]fluoranthene		•	41	0.8	•	•		•	•	•	•	•	•	•	•	•	•	•
benzo[k]fluoranthene		٠	æ	0.5	•	•	•	•	•	1	•		•	•	٠	•	•	•
benzo[a]pyrene		•	9	0.1	•	•		•		•		•	,	•	٠	٠	•	•
indepol 123-cd byrene		•	۲.	•	•	•	•	•		٠	٠	•	,	•		. 1		
dibenz[a,h]anthracene		•	, 1 4	•	•	•		•		•	•			•		, ,		
benzo[ghi]perylene		٠	19	•	•	•	1	•	•	•	•	,	•	٠,	ì	•	٠	٠
				!	,													
Sum of HACs	-	m	1800	27	දි	0.1	• ,-^	• .	•	•	90.0	9.0	•	•	•	•	•	•
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 40	4 00	× 18	20	613
												,	}	<u>`</u>	\\.	;	5	1

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

	Village:		1	Chinish														
	Sile: Cycle:	CHIZ	CHIZ	CHI2	Ü	CHIZ	PILI	THE STATE OF	Port Lions ->PTL1 PTL2	ions ->	PIL2	PIL2	Pr. G	Pt. Gra./Eng. 1 TG1 PTG1	Bay	Kasits.	Angoon	uo
	D& M no.:	43.	225	223	635	₹ 9	_ 2	228	111 518	- 89	T 89	733		= 2	E			E SON
ACs										>duplicate<	cale	3	77	5 71	47	486	163	172
	Lab no.:	7	343	344	397	398	82	210	412	83	80	209	75	121	360	360	Č	
naphthalene		•	a	•	•	,								171	ξ.	Š	326	327
C1-naphthalenes		0.2	0.3	0.6	rs '	ed '	a C	es -	a 7	a :	at '	es (ed ;	æ	æ	æ	જ	es.
C2-naphinalenes		•	•	•		•	• •		* '	- -		0.7	0.3	•	0.4	8.0	9.0	0.8
C4-naphthalenes		•	•	•	•	•	•	٠	•		. ,	• 1	•	•	•	•	0.07	
Acenaphthylene		•	•	•	•	•	•	٠	•	•	•	,	•	•		•	•	•
acenaphthene		•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
fluorene		• 1	,	•	•	•	•	•	•	•	•	•	•		• 1	•	•	•
C1-fluorenes		•			•	•	•	•	•	٠	•	•	•	•	• •	•	•	•
C2-fluorenes		• •	•	•	•	•	•	•	•	•	•	٠	•		• (•	•
C3-fluorenes		•	•	•		•	•	٠	•	•	•	•	•	, ,	•	•	•	•
phenanthrene		٠.	' t	• ,	• 1	•	•	•	•		•	•		,	•	•	•	•
C1-phenanthrenes/arithracenes		-	0.7	9.0	0.5	0.1	0.4	0.7	0.7	0.2	0.3	90	0.4	٠, د	, ,	, ,	' 8	• (
C2-phenanthrenes/anthracenes			•	•	•	•	•	•	•	•		;	Š	7.0	2.0). O	0.7	9.0
C3-phenanthrenes/anthrecenes		•	•	•	•	•	•		•	٠			•	•	•		•	•
C4-phenanthrenes/anthraomes		•	•	•		•	•	•	•	,		•	• •	•		•	•	•
dibenzothiophene		•	•	8		•	4			•	•	•	•	•	•	•	•	•
C1-dibenzothiophenes		•	•				•	•	1	•	,	,	•	• •	•		•	
C2-dibenzothiophenes		•	1	•			•	•	•	•	•	•	,		• (•
C3-dibenzothiophenes		۱ ۱	•	•		,	•		•				,	•	' '	• 1	•	•
			•	•			•	•	•			•				' '	, ,	• 1
Sum of LACs		-	-	=	0.5	0.1	y U	·	-	,	,	,	!				ı	•
				ŀ	} .	5	9	4	-	6.3	6 .	-	0.7	0.2	0.7	~	-	-
nuoraninene			80.0	60.0		•	•	•	•									
C1-fluoranthenes/nomenes		0.0 4			•	٠		•				, ,		•				•
benzfalanthracene		•			•	•	•			•		,			•			•
chrysene					,						•	,		, ,		1		
C1-chryscnes/benz[a]anthracenes				•				•				,			, ,			
C2-chrysenes/benz[a]anthracenes		, ,	• (•						•	,		•	•		•	•
C3-chrysenes/benz[a]anthracenes				, ,	1 -		1						•	•	•	•		' '
C4-chrysenes/benz[a]anthracenes		•		•	,	• •	•			,		,	,	•			•	
benzo[b]fluoranthene			•	•		٠,								•	. •	,		
benzolk ithoranthene			•					• 1	•							•	•	
benzola pyrene						•	1 - 1	• 1		,				,				•
indeno[1,2,3-cd]pyrene				•	•	,			•		•		•	•	•	•		
and an intracence		•	,					, ,							•		,	
penzo[gn]perylene		•					·, •	1 •	• (•			•	1				
Sum of UAC.								,									•	
		0.1	0.1	0.1				•			•	,						
sample weight, grams:	•	¥ 01									ı	•						
	1		0.50	5.57	5.41	5.31 5.	5.03 5	5.03 5	5.18 5.	5.10 5	5.42 5.	5.33 5.	5.19 5.	5.12 5	5.09	5.50 5	5 28 5	5 30
																		4

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

Windy Bay Crimiak WNB1 CHI2 I I I I I I I I I		Mollusc:		Ÿ	<- Snails ->				Immete
Site: WNB1 Cycle: 1 D & M no.: 37		Village:	Windy Bay		<- Port Lions ->		Port Graham	<- Larsen Bav ->	av ->
D& M no. 37		Site:	WNBI	CHIZ	PTL1	711.2	PTG4	LAB4	LABI
Lab no. 684		D& M no.:	37	36	65	19	7 %	101	95
nes		Tab no:	684	¥84	789	889	60	. 707	Š
nes				600	000	000	003	080	060
nes	cne		aş	•	#8	, 4	•	α	đ
nes hes hes hes hes hes hes hes hes hes h	thalenes		-	9.0	0.3	0.5	-	20	900
nes	thalenes		•	•	;	'	• •	;	0.0
nes nes/arabracenes enes/arabracenes enes/arabracenes enes/arabracenes enes/arabracenes enes/arabracenes ophenes ophen	thalenes		•	•	•		•	•	•
nes/anthracenes enes/anthracenes enes/anthracenes enes/anthracenes enes/anthracenes enes/anthracenes ophenes ophenes ophenes ophenes enes/pyrenes cene benz[a]anthracenes benz[a]anthracenes benz[a]anthracenes enthene enthen	thalenes			•	. (•	•	•	•
cnes/authracenes cnes/authracenes cnes/authracenes cnes/authracenes cnes/pyrenes ophenes ophen	hylene		•	•	•	•	•	•	•
encs/anthracenes encs/anthracenes encs/anthracenes encs/anthracenes encs/anthracenes ophenes o	hene		•	•	•	•	1	•	•
cnes/authracenes cnes/authracenes cnes/authracenes cnes/authracenes cnes/authracenes ophenes o			•	•	•	•	•	•	•
enes/authracenes enes/authracenes enes/authracenes enes/authracenes enes/authracenes ene ophenes ophenes ophenes ophenes ene ene ene ene ene dipyrene enthene			1	•	•	•	•	,	•
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enex/anthracenes enex/anthracenes enex/anthracenes enex/anthracenes enex/anthracenes ophenes ophenes ophenes ophenes enex/pyrenes beruz[a]anthracenes beruz[a]anthracenes beruz[a]anthracenes ene en inthene en inthene en inthene en inthene en inthene en intene en inthene en in	cnes		16	•	•	•	•	•	•
cnes/authracenes cnes/authracenes cnes/authracenes cnes/authracenes cnes/pyrenes ophenes ones/pyrenes on ophenes on ophenes op	enes		13	•	•		•	•	,
enes/authracenes enes/authracenes enes/authracenes enes/authracenes enes/authracenes ophenes o	rene		9	9.0	0.5	0.4	,	` œ	, 0
ches/anthracenes cres/anthracenes cres/anthracenes cres/prenes ophenes	anthrenes/anthracenes		11	•	! *	; '	1 -	2	5
cnes/authracenes cries/authracenes cries/authracenes ophenes crie crie crie dalauthracenes outhene	anthrenes/anthracenes		8	•	•	•	•	1 1	•
ene (anthracenes ene (aphenes ophenes ophenes ophenes ophenes ophenes ene ene (anthracenes benz[a]anthracenes benz[a]anthracenes enthene enthe	anthrenes/anthracenes		170	•	•	•	•		•
cne ophenes ophenes ophenes ophenes ophenes che	unthrenes/anthracenes		9	•	•	•	٠,	• •	•
ophenes ophenes ophenes ophenes cene benz[a]antiracenes benz[a]antiracenes benz[a]antiracenes nithene nithene e d]pyrene inacene	riophene		0.06	•	•	٠	•		•
ophenes ophenes ophenes cene benz[a]amimacenes benz[a]amimacenes benz[a]amimacenes nithene nithene olipyrene inacene	zothiophenes		2	•	•	•	•	• •	
ophenes nes/pyrenes cene benz[a]anthracenes benz[a]anthracenes benz[a]anthracenes nithene nithene in of pyrene in accene	zothiophenes		54	•	•	•	•	•	•
nes/pyrenes zene benz[a]arutrracenes benz[a]arutrracenes benz[a]arutrracenes nithene nithene e d]pyrene irracene	zothiophenes		210	• •	,	•	•	•	•
nes/pyrenes cene cene benz[a]anthracenes benz[a]anthracenes benz[a]anthracenes nutiene nutiene e dipyrene dipyrene									
hes/pyrenes cone benz[a]anthracenes benz[a]anthracenes benz[a]anthracenes nithene nithene dipyrene hracene	ACs.		620	~	9.0	0.9	en .	1	7
nes/pyrenes zene benz[a]anthracenes benz[a]anthracenes benz[a]anthracenes nutiene nutiene e dipyrene ivacene	ane		-	•	•	•	9.0	•	0
nes/pyrenes cene benz[a]anthracenes benz[a]anthracenes benz[a]anthracenes nutiene nutiene e dipyrene uracene			7	•	ı	•	0.2	•	; '
benz[a]anitracenes benz[a]anitracenes benz[a]anitracenes benz[a]anitracenes nitrene nitrene e dipyrene ivacene	inthenes/pyrenes		13	•	•	•	•	•	•
benz[a]anthracenes benz[a]anthracenes benz[a]anthracenes onthene inthene classification of the control of the c	uthracene		0.5	•	•	٠	•		•
benz[a]anthracenes benz[a]anthracenes benz[a]anthracenes onthene inthene c dipyrene hracene dipyrene idene			39	•	•	•	0.07	•	•
benz[a]anthracenes benz[a]anthracenes onthene inthene dipyrene uracene dipyrene ilene	enes/benz[a]anthracenes		54	•	•	•	•	•	•
berz[a]anthracenes orthere inthene of pyrene inacene idpyrene idene idene	encs/benz[a]anthracenes		38	•	•	•	•		•
benz[a]anihracenes nithene nithene e d]pyrene nracene ilene	mes/benz[a]anthracenes		10	•	•		•	,	•
nithene nithene e dipyrene nracene diene	mes/benz[a]anthracenes		0.0	•	•	•	•	•	•
nthene e d]pyrene tracene ilene	luoranthene		5	•	•	•	•		•
d Jpyrene tracene dene	luoranthene		•	•	•		•	•	•
d pyrene macene dene	yrane		•	•	•	•	•	•	•
nacene ilene	2,3-cd/pyrene		•	•	٠	•	,	,	•
lane.	Janthracene		•		•	•	•		•
	Iperylene		0.1	•	•			•	•
	ACs		160		•	•	9	,	-
		•					ì	•	1.0

5.03

5.08

5.00

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

Village:	KODS	ungeness -> Larsen Bay	Chiniak CHI3	Port Lions PTLS	Old Harbor 1	- Tanner -> Larsen Bay -P	<pre>c-Port Lions-> PTL4</pre>	7 2 2	arsen Bay Pon Lions LAB4 PTL	t Lions
Nullage:	KODS	Larsen Bay	Chiniak CHI3		Old Harbor	arse	<-Port Lions-: PTL4	PHZ 1	arsen Bay Por LAB4	1 Lions
Cycle:					ところ		F11.4	F11.4	LAB4	F11.4
Dig Mino: 52 212 State Dig Mino: 52 212 State		LAB4		-		ו	-	Ш	_	Ξ
Lab no. 96 341	52	103	55	73	115	38	71	581	102	235
Lab no. 96 341					911	100	72			
ess	96 341	8	97	102	86	100	101	491	689	342
bes bes bes bes bes bes bes condition anex/anthracenes anex/anthracenes anex/anthracenes benz[a]anthracenes	ed ed	ø	a a	4	4	ď	ď	a	æ	ď
bess bess cs cs cs cs cs cs cs cs cs	0.1 0.2	'		•	0.08	0.1	, '	, '	8.0	, -
bess bess cess nes/anthracenes nres/anthracenes nres/anthracenes nres/anthracenes cre ophenes	•	•	•	•	•	•	,		•	•
benz[a]anthracenes benz[a]anthracenes cene ophenes o	• 0.08	•	•	•	•	•	•	•	•	•
nes/anthracenes nes/anthracenes nes/anthracenes nes/anthracenes nes/anthracenes ophenes ophene		•	•		•	,	•	•	•	•
nes/anthracenes nes/anthracenes nes/anthracenes nes/anthracenes ene ophenes op		•	•	•	•	•	•	•	•	' '
nes/anthracenes nes/anthracenes nes/anthracenes nes/anthracenes ene ophenes op	• •	•	a 1	•	•	•	1		•	0.0
nes/anthracenes nes/anthracenes nes/anthracenes nes/anthracenes cne ophenes op		• •	• •	• •	• •	, ,			• •	7.0
nes/anitracenes nes/anitracenes nes/anitracenes nes/anitracenes ene ophenes op		•	•	•	•	•	,	•	•	•
nes/anitracenes nes/anitracenes nes/anitracenes nes/anitracenes ene ophenes op		•	•	•	•	٠	•	0.3	•	•
nes/anthracenes nes/anthracenes nes/anthracenes anes/anthracenes che ophenes ophenes ophenes ophenes che ophenes ophen	0.09 0.3	0.08	0.1	0.09	0.05	0.1	0.07	0.4	0.9	-
nes/antmacenes anes/antmacenes anes/antmacenes applenes ophenes ophenes ophenes ophenes es/pyrenes es/pyrenes benz[a]antmacenes benz[a]antmacenes anthene anth		•	•	•	•	•		•	•	•
nes/authracenes nes/authracenes ophenes ophenes ophenes ophenes ophenes ophenes es/pyrenes cene benz[a]authracenes benz[a]authracenes ohniene nithene authene inthene i		•	•	•	•	•	•	•	•	•
cene ophenes ophenes ophenes ophenes ophenes conceptors conceptors and anothracenes openz [a] anothracenes openz [• •	•	4 (•	•	•		•	•	•
ophenes ophenes ophenes ches/pyrenes es/pyrenes enc benz[a]anthracenes benz[a]anthracenes chenz[a]anthracenes chenz[a]anthrace		•	• •	• •	• •			• (4 (• :
ophenes ophenes ophenes nes/pyrenes ene benz[a]anthracenes benz[a]anthracenes oraz[a]anthracenes	•	•	•	•	•	•	•	•		, ,
ophenes os/pyrenes es/pyrenes ene benz[a]anthracenes benz[a]anthracenes christalanthracenes inhene nuhene racene		•	•	•	•	•	•		•	•
best [a] antiracenes benz [a] antiracenes benz [a] antiracenes benz [a] antiracenes benz [a] antiracenes nithene c c d) pyrene uaccene		•	1.	•	•	•	•	•		•
fluorarithene pyrene C1-fluorarithenes/pyrenes berz[a]anitracene chrysene C1-chrysenes/benz[a]anitracenes C2-chrysenes/benz[a]anitracenes C3-chrysenes/benz[a]anitracenes C4-chrysenes/benz[a]anitracenes benzo[b]fluorarithene benzo[k]fluorarithene benzo[k]fluorarithene benzo[k]fluorarithene benzo[k]fluorarithene benzo[s]apyrene dibenz[a,3-cd]pyrene dibenz[a,h]anitracene	0.7 0.6	0.1	0.1	0.1	0.1	0.2	0.1	0.7	7	es
puroranizate Pyrene C1-fluoranthenes/pyrenes beruz[a]anitracene C1-chrysenes/beruz[a]anitracenes C2-chrysenes/beruz[a]anitracenes C3-chrysenes/beruz[a]anitracenes C4-chrysenes/beruz[a]anitracenes beruzo[k]fluoranithene beruzo[k]fluoranithene beruzo[k]fluoranithene beruzo[k]nutracenes diberuz[a]anitracenes beruzo[k]nutracenes beruzo[k]nutracenes beruzo[k]nutracene										
berz[a]anthracene chrysenes/pyrenes chrysenes/berz[a]anthracenes C1-chrysenes/berz[a]anthracenes C2-chrysenes/berz[a]anthracenes C3-chrysenes/berz[a]anthracenes C4-chrysenes/berz[a]anthracenes berzo[b]fluoranthene berzo[k]fluoranthene indero[1,2,3-cd]pyrene diberz[a,h]anthracene		•	•	•	•	•	•	•	r	•
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 indeno[1,2,3-cd]pyrene dibenz[a,h]anthracene		• •		• •		• •	, ,			
chrysene C1-chryscnes/benz[a]anthracenes C2-chryscnes/benz[a]anthracenes C3-chryscnes/benz[a]anthracenes C4-chryscnes/benz[a]anthracenes benzo[b]fluoranthene benzo[s]pyrene indeno[1,2,3-cd]pyrene dibenz[a,h]anthracene		•	•	•	•	•			,	•
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 indeno[1,2,3-cd]pyrene dibenz[a,h]anthracene		•	•	•	•	•	,	•	•	•
C2-chrysches/benz[a]anthracenes C3-chrysches/benz[a]anthracenes C4-chrysches/benz[a]anthracenes benzo[b]fluoranthene benzo[a]pyrene indeno[1,2,3-cd]pyrene dibenz[a,h]anthracene		•	•	•	•	,	•	•		•
Cycling series for the farming control of the	•	•	•	•	•	•		•	•	•
benzo[b]Iluoranthene benzo[k]Iluoranthene benzo[a]pyrene indeno[1,2,3-cd]pyrene dibenz[a,h]anthracene benzo[ghi]perylene	• •	• •		• •		, ,	t 1	• •		•
benzo[k]fluoranthene benzo[a]pyrene indeno[1,2,3-cd]pyrene dibenz[a,h]anthracene benzo[ghi]perylene		•	٠	•	•	,		•	•	
benzo[a]pyrene indeno[1,2,3-cd]pyrene dibenz[a,h]anthracene benzo[ghi]perylene		•	•	•	•	•	•	•	•	•
indeno[1,2,3-cd]pyrene dibenz[a,h]anthracene benzo[ghi]perylene	ŧ	•	•	•	•	•	,	•	,	•
diberz[a,h]anltracene benzo[ghi]perylene	•	•	•	•	•	ı	•	•	•	1
period girl pery icane	•	•	•	•	•	•	,	•	,	•
		•	•	•	•	•	•	•		r
Sum of HACs	•	•	٠	•	•	•		•	•	•
sample weight, grams: 5.13 5.38 5.		5.18	5.25	4.91	\$ 95	5.11	5.53	5 53	200	5 31
								7	3	7

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

ACC		Village:	Old Harbor	Larsen Bay
D&M no.: 113 D&M	÷.	Site:	OHA3	LAB3
tes to the following the follo		D& Mro.:	113	8
es e	AGs	Lab no.:	691	692
es e				
nes/anthracenes nes/anthracenes nes/anthracenes nes/anthracenes nes/anthracenes nes/anthracenes ophenes ophene	naphthalene		es C	es 8
ses ses ses ses ses ses ses ses	C1-taphinatanes		7 6	7.
res/anthracenes nes/anthracenes nes/anthracenes nes/anthracenes nes/anthracenes ophenes ophene	Carambalana		0.0	4
nes/anthracenes nes/anthracenes nes/anthracenes nes/anthracenes nes/anthracenes nes/anthracenes nes/anthracenes ophenes ophene	C4-nanhthal-nes		• '	8 1
nes/anthracenes nes/anthracenes nes/anthracenes nes/anthracenes ophenes ophene	account the land		•	•
nes/anthracenes nes/anthracenes nes/anthracenes nes/anthracenes ophenes ophene	accomply to a		•	•
nes/anthracenes nes/anthracenes nes/anthracenes nes/anthracenes ophenes ophene	Stronge Stronge		b	•
nes/anthracenes nes/anthracenes nes/anthracenes nes/anthracenes nes/anthracenes ophenes ophene	C1-findence			•
2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2	(2) fluorence		•	•
nes/anthracenes nes/anthracenes nes/anthracenes nes/anthracenes nes/anthracenes nes/anthracenes ophenes ophene				•
nes/anthracenes nes/anthracenes nes/anthracenes nes/anthracenes ophenes ophene	C3-Imortage		• (•
nes/anthracenes nes/anthracenes nes/anthracenes nes/anthracenes ophenes ophene	phenanthrene		7	-
nes/anthracenes nes/anthracenes nes/anthracenes ophenes ophene	C1-phenanthrenes/arithracenes		6.0	•
nes/anthracenes nes/anthracenes ophenes ophenes ophenes ophenes ophenes ophenes ophenes ophenes ophenes nes/pyrenes ene ophenes ophene	C2-phenanthrenes/anthracenes		0.2	•
nes/anthracenes ene ophenes ophenes ophenes ophenes cs/pyrenes cene benz[a]anthracenes benz[a]anthracenes obenz[a]anthracenes	C3-phenanthrenes/anthracenes			•
ophenes ophenes ophenes ophenes cophenes cophene	C4-obenanthrenes/anthracenes			•
ophenes ophenes ophenes	dibenzothiophene			
ophenes ophenes ophenes series cene cene cene cene cene cene cene ce	C1-dibenzothiophenes		•	
poplenes sexpyrenes cene beruz[a]anthracenes beruz[a]anthracenes beruz[a]anthracenes beruz[a]anthracenes conthene dipyrene dipy	C2-dibenzothiophenes		•	•
sexpyrencs cene cent[a]anthracenes cent[a]anthracen	C3-dibenzothiophenes		9	•
nes/pyrenes cene cene cene cene cene cene control cont	Sum of LACs		4	•
nes/pyrenes cene cene cene benz[a]anthracenes benz[a]anthracenes cenz[a]anthracenes centlene inthene dipyrene fracene inacene 12				\$
nes/pyrencs cene berz[a]anthracenes berz[a]anthracenes berz[a]anthracenes orthene nithene d]pyrene tracene dayrene dipyrene tracene	fluoranthene		0.0	0.8
benz[a]anthracenes benz[a]anthracenes benz[a]anthracenes benz[a]anthracenes orthene inthene of jpyrene tracene	pyrane		0.8	0.3
benz[a]anthracenes benz[a]anthracenes benz[a]anthracenes benz[a]anthracenes anthene inthene a d]pyrene tracene	C1-fluoranthenes/pyrenes		•	•
benz[a]anthracenes benz[a]anthracenes benz[a]anthracenes benz[a]anthracenes anthene anthene alpyrene tracene	benz[a]anthracene		•	•
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benz[a]anthracenes benz[a]anthracenes benz[a]anthracenes anthene inthene a d]pyrene tracene	C1-chrysenes/benz[a]anthracenes		•	•
benz[a]anthracenes benz[a]anthracenes anthene inthene e d]pyrene tracene	C2-chrysenes/benz[a]anthracenes		•	•
benz[a]anthracenes inthene e d]pyrene inacene	C3-chrysenes/benz[a]anthracenes		•	•
nthene nthene e e dipyrene fracene	C4-chrysenes/benz[a]anthracenes		•	•
benzo[k]fluoranthene benzo[a]pyrene indeno[1,2,3-cd]pyrene dibenz[a,h]anthracene benzo[ghi]perylene Sum of HACs	benzo[b]fluoranthene		0.3	•
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dibenz[a,h]anthracene benzo[ghi]perylene Sum of HACs	indeno[1,2,3-cd]pyrene		•	•
benzolghilperylene Sum of HACs 2 1	dibenz[a,h]anthracene			•
Sum of HACs 2	benzo[ghi]perylene		•	•
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	Sein of fiacs		7	-

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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
	70	70	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.

December	ACs	Lab no.:	32	50	89	8	<u>8</u>	123	141	159	171	861	216	234	253	272	290	312	348	403
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confundamental confun	C3-naphthalenes		•		•	,	•	•	•	•	•	•	1		•	•	ı	•	•	•
oce/anthracenes nes/anthracenes nes/anthracene	C4-naphthalenes		•	•	•	•	•	•	•	•	r	•	•		•	•	1	•		1
eca/anthracenes eca/anthracenes eca/anthracenes eca/anthracenes eca/anthracenes eca/anthracenes eca/anthracenes phenes phenes phenes phenes phenes aca/pyrenes era/a janthracenes era/a	acenaphthylene		•	•	•	•	•	•	•		•	•		,	•	•	,	1	,	1
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test/anthracenes test/anthracenes test/anthracenes test/anthracenes test/anthracenes test/anthracenes test/anthracenes the test/anthracenes the test/anthracenes the test/anthracenes test/anthra	C1-fluorenes		•	ı	•	•		•	1	•	•	•	•	•	•	•	•	ı		
nes/anthracenes 0.02 0.1 0.08 nes/anthracenes 0.02 0.1 0.08 nes/anthracenes 0.0 0.0 0.0 nes/anthracenes 0.0 0.0 0.0 phenes 0.0 0.0 0.0 0.0 phenes 0.0 0.0 0.0 0.0 0.0 nenz(a) janthracenes 0.0 <th>C2-fluorencs</th> <th></th> <th>•</th> <th>•</th> <th></th> <th>,</th> <th>•</th> <th>٠</th> <th>•</th> <th>•</th> <th>•</th> <th>•</th> <th>•</th> <th>•</th> <th></th> <th>•</th> <th>•</th> <th>•</th> <th>•</th> <th>ŧ</th>	C2-fluorencs		•	•		,	•	٠	•	•	•	•	•	•		•	•	•	•	ŧ
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phenes phenes phenes ca/pyrenes encar[a]anthracenes encar[a]anthra	C1-dibenzothiophenes		•	•	•	•	•	•	٠	٠	٠	•	•	•	•	1	•	•	•	•
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benzo[a]pyrene indeno[1,23-cd]pyrene dibenz[a,h]anthracene benzo[ghi]perylene Sum of HACs	benzofklittoranthene		•		•	,	•	•	•	•	•	1	•	1	•		•	•	. •	•
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Sum of HACs	benzo[ghi]perylene	_	•	•	•	٠	•	•		•	•	1	•	1	•	•	•	1	١,	•
Sum of HACs																				
	Sum of HACs		•	•	4	•	•	•	•	•	•	•	•		•	•	•	•	•	•

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

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nanhthalene						2		7	2	× 2	200	584	209	620	639	657	675	694	7
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C2-naphthalenes		,	•	•	•	•	•		0.1		7 6		-	7		7	7	m	
C3-naphthalenes		•	•	•	•	•	,	٠	•		3				•	•		0.3	Ó
C4-naphthalenes		•		•	•	•	•	•	•						•	•	•	•	
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C2-fluorenes		,	•		•			•	•	•	•			,				•	
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phenenthan		•					0.2	,			•				•			•	
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C2-phenanthrenes/anthracenes			•	•	•			•	•	•	•	,	,					C.	0
C3-phenanthrenes/anthrecesses			•	•		•	,		•	•			•		•	•			_
C4-phenanthranes/ant		•	•	•			•	0.2	2	ı	•	•	•		,			ı	•
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CI-dibenzothiophenes		•	•		,	•		• .	•	•				•				ı	•
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C3-dibenzothiophenes						•	•	•			•	,						•	'
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pyrene			•		8		•	.•	•	•									
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benzialanthracene						9			,				ı						1
Christine										,	•	•				•		,	•
Ol shareness A		•					,		•			•			•	•			
Selics/ocn2[a janthracenes							1	•				•	,		,		,		•
C2-chrysenes/benz[a]anthracenes							•						•				,		•
C3-chrysenes/benz[a]anthracenes				,							,					,	•	٠,	•
C4-chrysenes/benzialanthracenes									•	•									•
benzofbliluoranthene								,	٠.										1
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henzofaloumane													,						•
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Athernal Line Calpyrene	•							,											
moenzla, njanthracene	•					ı	•						,					1	1
penzolghi jperyiene	•									,									ı
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	,																		