

Lower Duwamish Waterway Group

Port of Seattle / City of Seattle / King County / The Boeing Company

Lower Duwamish Waterway Remedial Investigation

FISH AND CRAB DATA REPORT ADDENDUM: PCB CONGENER DATA, MS/MSD ANALYSES, AND DDT CONFIRMATION FINAL

For submittal to

The US Environmental Protection Agency
Region 10
Seattle, WA

The Washington State Department of Ecology
Northwest Regional Office
Bellevue, WA

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Acronyms

Acronym	Definition
ACG	analytical concentration goal
Ecology	Washington Department of Ecology
EPA	US Environmental Protection Agency
GC/ECD	gas chromatography/electron capture detection
GC/MS	gas chromatography/mass spectrometry
LCS	laboratory control sample
LDW	Lower Duwamish Waterway
MS/MSD	matrix spike/matrix spike duplicate
PAH	polycyclic aromatic hydrocarbon
PCB	polychlorinated biphenyl
QA	quality assurance
QAPP	Quality Assurance Project Plan
QC	quality control
RI	remedial investigation
RL	reporting limit
SDG	sample delivery group
SRM	standard reference material
SVOC	semivolatile organic compound
TEF	toxic equivalence factor
TEQ	toxic equivalent
Windward	Windward Environmental LLC
WHO	World Health Organization
ww	wet weight

1.0 Introduction

This data report is an addendum to the *Lower Duwamish Waterway Remedial Investigation data report: fish and crab tissue collection and chemical analyses* (Windward 2005). It provides the results of the following additional chemical analyses of archived tissue samples collected as part of the Lower Duwamish Waterway (LDW) Phase 2 Remedial Investigation (RI):

- ◆ Analysis of a subset of the fish and crab tissue samples for individual polychlorinated biphenyl (PCB) congeners, as specified in the fish and crab tissue quality assurance project plan (QAPP; Windward 2004)
- ◆ Analysis of matrix spike/matrix spike duplicate (MS/MSD) samples as quality control (QC) samples for the tissue data set
- ◆ Confirmation of DDT compounds in a subset of tissue samples with high PCB concentrations and high reported DDT concentrations to assess the extent to which the reported DDT concentrations may reflect PCB congener interference in the pesticide analysis

This report is organized into sections addressing sample selection and laboratory analyses, chemical analysis results, and references. The text is supported by the following appendices:

- ◆ Appendix A – PCB congener data
- ◆ Appendix B – MS/MSD results and corrective action memo
- ◆ Appendix C – data management
- ◆ Appendix D – data validation report
- ◆ Appendix E – laboratory Form 1s
- ◆ Appendix F – graphical representation of PCB congener data

2.0 Sample Selection and Laboratory Analyses

The following sections present the sample selection and laboratory analyses for the PCB congener analyses, the MS/MSD analyses, and the DDT confirmation analyses.

2.1 PCB CONGENER ANALYSES

All tissue samples collected in 2004 as part of Phase 2 sampling were analyzed for PCBs (as Aroclors). In addition, a subset of the fish and crab tissue samples were selected for analysis of all 209 PCB congeners following EPA Method 1668A (EPA 1999) as specified in the QAPP (Windward 2004). The selection of which fish and crab samples were analyzed for PCB congeners was made in consultation with the US Environmental Protection Agency (EPA) and the Washington Department of Ecology

(Ecology). The composite samples were selected to cover the range of total PCB concentrations (based on the sum of detected Aroclors), to represent the different mixes of Aroclors in these samples, and to provide spatial coverage of samples throughout the LDW. Two samples of each tissue type were selected per sampling area for whole body fish samples, except in area T4 where one English sole and one starry flounder each were selected. All fish fillet samples were selected. For crab samples, two edible meat and one hepatopancreas samples were selected in each sampling area except T4 where only sample was available of each.

Figure 1 shows the fish and crab sampling areas; Table 2-1 lists the types and numbers of samples selected for congener analysis.

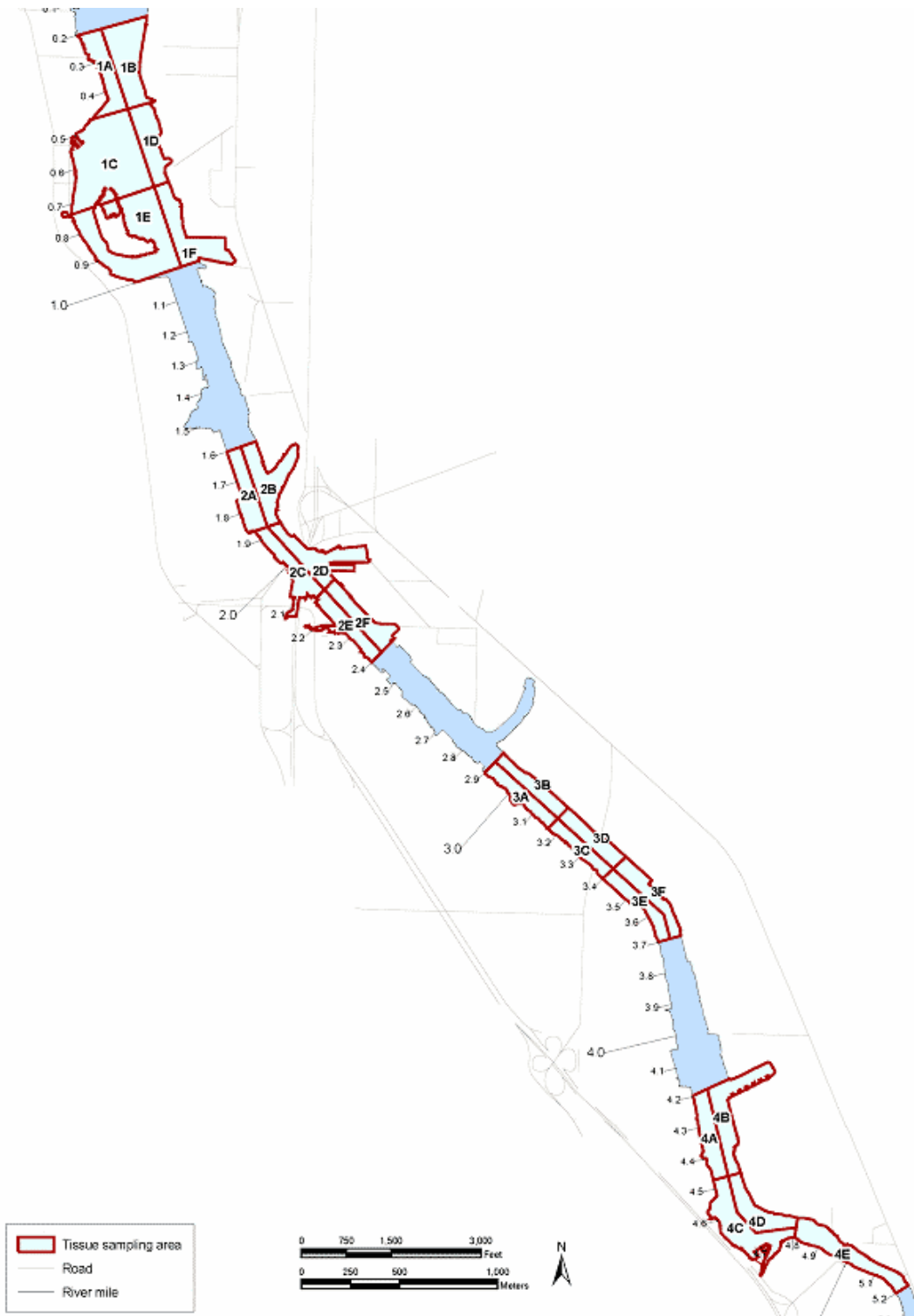


Figure 2-1. LDW fish and crab tissue collection areas

Table 2-1. Numbers of samples selected for PCB congener analysis

SPECIES	FILLET SAMPLES	WHOLE-BODY SAMPLES	OTHER SAMPLES
English sole	7	7	–
Starry flounder	1	1	–
Pile perch	1	–	–
Striped perch	1	–	–
Shiner surfperch	–	9	–
Pacific staghorn sculpin	–	8	–
Crab hepatopancreas	–	–	4
Crab edible meat	–	–	7
Total	10	25	11

2.2 MATRIX SPIKE/MATRIX SPIKE DUPLICATE SAMPLES

The analytical laboratory mistakenly believed they did not have sufficient fish and crab tissue to run MS/MSD samples for organic analyses for three sample delivery groups (SDGs)¹. As documented in the *Corrective Action for Duwamish Fish and Crab Chemical Analyses* memo dated April 22, 2005 (see Attachment B-1 for a copy of this memo), the laboratory corrected this oversight by conducting MS/MSD analyses using archived tissue samples. The results of the MS/MSD analyses will be compared to the project QC criteria. If the MS/MSD, SRM, and laboratory control sample (LCS) results are consistent with the QC criteria, then it is unlikely that the tissue data were influenced by matrix effects. If, however, the MS/MSD results indicate potential matrix effects, then greater uncertainty is associated with the results. The tissue dataset will not be revalidated based on the MS/MSD results because functional guidelines state that no action is taken on MS/MSD data alone.

The original number of samples submitted with each SDG is presented in Table 2-2. MS/MSD samples were required to be run at a frequency of one per SDG or 20 samples, whichever was higher. Two sets of MS/MSD samples were required for SDGs K2409445 and K2409809, and three sets of MS/MSD samples were required for SDG K2409451. A total of seven MS/MSD samples were required for all of the analytes except for the PAHs, which required three MS/MSD samples because of the smaller number of samples analyzed for polycyclic aromatic hydrocarbons (PAHs).

¹ Ms/MSD samples were run at the required frequency for metal analyses.

Table 2-2. Numbers of samples in each SDG

SDG	LAB	SVOCs	LOW LEVEL PAHs	PESTICIDES	PCBs	BUTYLINS
K2409445	Columbia	24	na	24	24	24
K2409451	Columbia	53	53	53	53	53
K2409809	Columbia	31	na	31	31	31

na – not analyzed

The samples listed in Table 2-3 were selected for MS/MSD analyses to meet the required frequency for each of three SDGs. Within the groups of samples with sufficient sample mass to run an MS/MSD, samples were selected from as many different matrices as possible to provide the most representative tissue types.

Table 2-3. Samples selected for MS/MSD analysis

SAMPLE ID	TISSUE MATRICES
SDG K2409809	
LDW-T4-M-SF-FL-comp -1	starry flounder, fillet
LDW-T3-M-ES-WB-comp-4	English sole, whole body
LDW-T1-M-DC-EM-comp-1	Dungeness crab, edible meat
SDG K2409445	
LDW-T4-D-PS-WB-comp-1	Pacific staghorn sculpin, whole body
LDW-T4-E-PS-WB-comp-1	Pacific staghorn sculpin, whole body
LDW-T3-E-PS-WB-comp-1	Pacific staghorn sculpin, whole body
LDW-T3-F-PS-WB-comp-1	Pacific staghorn sculpin, whole body
LDW-T1-D-PS-WB-comp-1	Pacific staghorn sculpin, whole body
LDW-T2-A-PS-WB-comp-1	Pacific staghorn sculpin, whole body
LDW-T3-B-PS-WB-comp-1	Pacific staghorn sculpin, whole body
LDW-T4-A-PS-WB-comp-1	Pacific staghorn sculpin, whole body
SDG K2409451	
LDW-T1-M-ES-WB-comp-4	English sole, whole body
LDW-T1-M-ES-WB-comp-5	English sole, whole body
LDW-T1-M-ES-WB-comp-2	English sole, whole body
LDW-T2-M-ES-WB-comp-3	English sole, whole body
LDW-T1-M-ES-WB-comp-3	English sole, whole body
LDW-T4-M-ES-WB-comp-2	English sole, whole body

MS/MSD samples were analyzed for PCBs as Aroclors, organochlorine pesticides, PAHs, semivolatile organic compounds (SVOCs), and butyltins following the methods outlined in the QAPP (Windward 2004).

2.3 DDT CONFIRMATION SAMPLE SELECTION

All detected organochlorine pesticide concentrations in the fish and crab tissue dataset were JN-qualified by the data validators because of interference from PCBs in these

samples, resulting in inflated concentrations of organochlorine pesticides. In order to confirm this qualification, eight samples were selected for DDT confirmation analysis by gas chromatography/mass spectrometry (GC/MS). DDT isomers were selected as the target analytes because they were the only organochlorine pesticide reported as detected at concentrations above the reporting limits (RLs) for the GC/MS analysis. The GC/MS analysis is more selective than the original gas chromatography/electron capture detection (GC/ECD) analysis, and therefore is not subject to the analytical interference by PCB congeners. However, the GC/MS analysis is not as sensitive, and thus tends to have higher RLs.

The samples were selected based on total DDT concentrations greater than 200 µg/kg ww and total PCB concentrations greater than 4,000 µg/kg wet weight (ww) (Table 2-4). The RLs for the GC/MS analysis are higher than those for the original Method 8081A GC/ECD analysis, so only the highest DDT concentrations were above the GC/MS RLs. The samples with the highest PCB concentrations were selected because they represent the samples most likely to be affected by PCB interference in the DDT analysis.

Table 2-4. Selected DDT confirmation samples

SAMPLE	TOTAL DDT CONCENTRATIONS ^a (µg/kg ww)	TOTAL PCB CONCENTRATIONS ^b (µg/kg ww)
LDW-T3-D-SS-WB-comp-1	200 JN	4,000
LDW-T1-M-DC-HP-comp-1	390 JN	4,000
LDW-T2-M-ES-WB-comp-3	280 JN	4,200 J
LDW-T4-M-DC-HP-comp-1	290 JN	5,500
LDW-T3-M-DC-HP-comp-1	440 JN	4,500
LDW-T3-F-SS-WB-comp-1	450 JN	4,900
LDW-T3-E-SS-WB-comp-1	570 JN	8,800
LDW-T2-E-SS-WB-comp-1	1020 JN	18,400 J

^a Total DDT concentration based on sum of detected DDT, DDD, and DDE isomer concentrations

^b Total PCB concentration based on sum of detected PCB Aroclor concentrations

3.0 Results of Chemical Analyses

A summary of the results of the PCB congener analyses conducted on subset of fish and crab tissue samples are presented in Section 3.1. The results of the MS/MSD analyses and the results of the DDT confirmation analysis are presented in Sections 3.2 and 3.3, respectively.

3.1 PCB CONGENER RESULTS

This section presents the results of the coplanar PCB congener analyses for fish (Section 3.1.1) and crab (Section 3.1.2) tissue samples. The results for all 209 PCB congeners analyzed in fish and crab tissue samples are presented in Appendix A. The

coplanar PCB congeners are those congeners for which World Health Organization (WHO) toxic equivalence factors (TEFs) are available (Van den Berg et al. 1998). Coplanar PCB congeners include PCB-077, PCB-081, PCB-105, PCB-114, PCB-118, PCB-123, PCB-126, PCB-156, PCB-157, PCB-167, PCB-169, and PCB-189. In addition, the total PCB concentrations based on the sum of the detected concentrations of all 209 PCB congeners are presented.

In many samples, two or more PCB congeners cannot be separated analytically. In these samples, the congeners coelute and the concentration of the combined congeners is reported as one value. The laboratory responsible for the PCB congener analyses (Axys Analytical Services, Ltd.) has the convention of assigning the concentration of the coeluting congener to the congener with the lowest IUPAC number. For example, PCB-156 and PCB-157 coelute and the concentration is reported as PCB-156. PCB-157 is reported as C156 to indicate that it is a component of a coelution. This convention has been followed in presenting congener data throughout this addendum.

3.1.1 Fish tissue results

All of the coplanar PCB congeners were detected in all of the fish composite tissue samples, except PCB-169, which was not detected in 23 of the 35 fish tissue samples (Table 3-1). All RLs for PCB-169 were above the analytical concentration goal (ACG) of 0.68 ng/kg ww established for fish tissue samples (Appendix D of the QAPP). RLs for PCB-169 ranged from 1.81 to 28 ng/kg ww. Dioxin-like PCB congeners, such as PCB-169, will be evaluated as toxic equivalents (TEQs) in the risk assessments, rather than as individual congeners. However, because TEQs are calculated, rather than quantitated by the laboratory, comparisons of ACGs for individual PCB congeners to RLs are somewhat uncertain. The effect of the PCB-169 RL values on the calculated mammalian TEQ values will be discussed later in this section.

Table 3-1. Detection frequencies and concentration summaries of coplanar PCB congeners in LDW fish fillet and whole-body tissue samples

TISSUE TYPE/ PCB CONGENER	UNIT	DETECTION FREQUENCY	DETECTED CONCENTRATION			REPORTING LIMIT ^a	
			MINIMUM	MAXIMUM	MEAN ^b	MINIMUM	MAXIMUM
English sole fillet							
PCB-077	ng/kg ww	7/7	240	1,030	635	na	na
PCB-081	ng/kg ww	7/7	15.6 J	85.6	46.4	na	na
PCB-105	ng/kg ww	7/7	6,890	19,200	14,200	na	na
PCB-114	ng/kg ww	7/7	450	1,260	930	na	na
PCB-118	ng/kg ww	7/7	23,200	61,100	45,000	na	na
PCB-123	ng/kg ww	7/7	270	1,130	740	na	na
PCB-126	ng/kg ww	7/7	29.2	110	74	na	na
PCB-156	ng/kg ww	7/7	3,130 C	8,750 C	6,350 C	na	na
PCB-157	ng/kg ww	7/7	C156	C156	C156	na	na
PCB-167	ng/kg ww	7/7	1,250	3,600	2,610	na	na

TISSUE TYPE/ PCB CONGENER	UNIT	DETECTION FREQUENCY	DETECTED CONCENTRATION			REPORTING LIMIT ^a	
			MINIMUM	MAXIMUM	MEAN ^b	MINIMUM	MAXIMUM
PCB-169	ng/kg ww	0/7	nd	nd	nd	1.81	20.6
PCB-189	ng/kg ww	7/7	226	511	391	na	na
Pile perch fillet							
PCB-077	ng/kg ww	1/1	142	142	142	na	na
PCB-081	ng/kg ww	1/1	11.2 J	11.2 J	11.2	na	na
PCB-105	ng/kg ww	1/1	3,920	3,920	3,920	na	na
PCB-114	ng/kg ww	1/1	261	261	261	na	na
PCB-118	ng/kg ww	1/1	12,800	12,800	12,800	na	na
PCB-123	ng/kg ww	1/1	209 J	209 J	209	na	na
PCB-126	ng/kg ww	1/1	20.6	20.6	20.6	na	na
PCB-156	ng/kg ww	1/1	1,750 C	1,750 C	1,750 C	na	na
PCB-157	ng/kg ww	1/1	C156	C156	C156	na	na
PCB-167	ng/kg ww	1/1	694	694	694	na	na
PCB-169	ng/kg ww	0/1	nd	nd	nd	8.39	8.39
PCB-189	ng/kg ww	1/1	102	102	102	na	na
Starry flounder fillet							
PCB-077	ng/kg ww	1/1	221	221	221	na	na
PCB-081	ng/kg ww	1/1	16.2 J	16.2 J	16.2	na	na
PCB-105	ng/kg ww	1/1	4,650	4,650	4,650	na	na
PCB-114	ng/kg ww	1/1	370	370	370	na	na
PCB-118	ng/kg ww	1/1	15,300	15,300	15,300	na	na
PCB-123	ng/kg ww	1/1	240	240	240	na	na
PCB-126	ng/kg ww	1/1	21.4	21.4	21.4	na	na
PCB-156	ng/kg ww	1/1	2,000 C	2,000 C	2,000 C	na	na
PCB-157	ng/kg ww	1/1	C156	C156	C156	na	na
PCB-167	ng/kg ww	1/1	859	859	859	na	na
PCB-169	ng/kg ww	1/1	0.916	0.916	0.916	na	na
PCB-189	ng/kg ww	1/1	115	115	115	na	na
Striped perch fillet							
PCB-077	ng/kg ww	1/1	193	193	193	na	na
PCB-081	ng/kg ww	1/1	25.3 J	25.3 J	25.3	na	na
PCB-105	ng/kg ww	1/1	8,730	8,730	8,730	na	na
PCB-114	ng/kg ww	1/1	545	545	545	na	na
PCB-118	ng/kg ww	1/1	28,300	28,300	28,300	na	na
PCB-123	ng/kg ww	1/1	489	489	489	na	na
PCB-126	ng/kg ww	1/1	50.4	50.4	50.4	na	na
PCB-156	ng/kg ww	1/1	3,990 C	3,990 C	3,990 C	na	na
PCB-157	ng/kg ww	1/1	C156	C156	C156	na	na
PCB-167	ng/kg ww	1/1	1,500	1,500	1,500	na	na
PCB-169	ng/kg ww	0/1	nd	nd	nd	28.0	28.0

TISSUE TYPE/ PCB CONGENER	UNIT	DETECTION FREQUENCY	DETECTED CONCENTRATION			REPORTING LIMIT ^a	
			MINIMUM	MAXIMUM	MEAN ^b	MINIMUM	MAXIMUM
PCB-189	ng/kg ww	1/1	291	291	291	na	na
English sole whole-body							
PCB-077	ng/kg ww	7/7	742	2,070	1,200	na	na
PCB-081	ng/kg ww	7/7	41.7	165	87.3	na	na
PCB-105	ng/kg ww	7/7	17,000	43,600	29,500	na	na
PCB-114	ng/kg ww	7/7	1,230	2,960	1,960	na	na
PCB-118	ng/kg ww	7/7	58,200	131,000	93,200	na	na
PCB-123	ng/kg ww	7/7	934	2,430	1,610	na	na
PCB-126	ng/kg ww	7/7	92.1	185	130	na	na
PCB-156	ng/kg ww	7/7	8,850 C	19,200 C	13,500 C	na	na
PCB-157	ng/kg ww	7/7	C156	C156	C156	na	na
PCB-167	ng/kg ww	7/7	3,600	7,700	5,560	na	na
PCB-169	ng/kg ww	4/7	3.17 J	5.04	4.06	2.58	4.80
PCB-189	ng/kg ww	7/7	555	1,170	887	na	na
Pacific staghorn sculpin whole-body							
PCB-077	ng/kg ww	8/8	54.2	490	231	na	na
PCB-081	ng/kg ww	8/8	9.12	23.9 J	15.8	na	na
PCB-105	ng/kg ww	8/8	5,880	19,600	10,400	na	na
PCB-114	ng/kg ww	8/8	413	1,230	710	na	na
PCB-118	ng/kg ww	8/8	19,800	70,400	34,100	na	na
PCB-123	ng/kg ww	8/8	212 J	602	402	na	na
PCB-126	ng/kg ww	8/8	25.9	66.5	48.2	na	na
PCB-156	ng/kg ww	8/8	3,570 C	15,500 C	6,650 C	na	na
PCB-157	ng/kg ww	8/8	C156	C156	C156	na	na
PCB-167	ng/kg ww	8/8	1,050	4,610	2,170	na	na
PCB-169	ng/kg ww	4/8	1.43	4.84	2.51	3.62	25.3
PCB-189	ng/kg ww	8/8	249	1,750	583	na	na
Shiner surfperch whole-body							
PCB-077	ng/kg ww	9/9	568	5,940	1,600	na	na
PCB-081	ng/kg ww	9/9	45.8	187	82.6	na	na
PCB-105	ng/kg ww	9/9	10,800	195,000	41,100	na	na
PCB-114	ng/kg ww	9/9	815	11,400	2,410	na	na
PCB-118	ng/kg ww	9/9	33,800	812,000	153,000	na	na
PCB-123	ng/kg ww	9/9	648	7,750	1,890	na	na
PCB-126	ng/kg ww	9/9	55.3	370 J	157	na	na
PCB-156	ng/kg ww	9/9	5,710 C	108,000 C	25,200 C	na	na
PCB-157	ng/kg ww	9/9	C156	C156	C156	na	na
PCB-167	ng/kg ww	9/9	2,320	34,900	9,970	na	na
PCB-169	ng/kg ww	2/9	6.06	22.4	14.2	1.76	27.1
PCB-189	ng/kg ww	9/9	409	9,590	2,210	na	na

TISSUE TYPE/ PCB CONGENER	UNIT	DETECTION FREQUENCY	DETECTED CONCENTRATION			REPORTING LIMIT ^a	
			MINIMUM	MAXIMUM	MEAN ^b	MINIMUM	MAXIMUM
Starry flounder whole-body							
PCB-077	ng/kg ww	1/1	242	242	242	na	na
PCB-081	ng/kg ww	1/1	21.8 J	21.8 J	21.8	na	na
PCB-105	ng/kg ww	1/1	6,450	6,450	6,450	na	na
PCB-114	ng/kg ww	1/1	509	509	509	na	na
PCB-118	ng/kg ww	1/1	22,700	22,700	22,700	na	na
PCB-123	ng/kg ww	1/1	310	310	310	na	na
PCB-126	ng/kg ww	1/1	30.2	30.2	30.2	na	na
PCB-156	ng/kg ww	1/1	3,280 C	3,280 C	3,280 C	na	na
PCB-157	ng/kg ww	1/1	C156	C156	C156	na	na
PCB-167	ng/kg ww	1/1	1,460	1,460	1,460	na	na
PCB-169	ng/kg ww	1/1	1.24	1.24	1.24	na	na
PCB-189	ng/kg ww	1/1	252	252	252	na	na

^a RL range for non-detect samples only

^b Reported mean concentrations are the average of the detected concentrations only; RLs were not included in calculation of the mean concentration.

na – not applicable

nd – not detected

C156 - PCB-156 and PCB-157 co-elute; the combined concentration is presented as the concentration of PCB-156

Data qualifiers: C–concentration represents coelution; J - estimated concentration

The concentrations of the individual coplanar PCB congener and total PCB concentrations (i.e., the sum of the detected concentrations of all 209 PCB congeners) for all fish tissue samples are presented in Table 3-2. Total PCB concentrations ranged from 192 to 1,269 µg/kg ww in fillet composite samples. Total PCB concentrations ranged from 349.6 to 12,230 µg/kg ww in the whole-body composite samples. The two highest total PCB tissue concentrations were reported for whole-body composite samples of shiner surfperch from sampling area T2E (12,230 µg/kg ww) and T3E (8,010 µg/kg ww) (Table 3-2). Fish tissue plots of total PCB concentrations as the sum of the detected congeners versus the total PCB concentrations as the sum of the detected Aroclors as well as PCB pattern plots are presented in Appendix F.

Table 3-2. Coplanar PCB congener and total PCB congener concentrations in fish tissue samples

SPECIES TISSUE TYPE/ SAMPLE ID	PCB CONGENER CONCENTRATIONS (ng/kg ww)												TOTAL CONGENER CONCENTRATION (µg/kg ww) ^a
	PCB-077	PCB-081	PCB-105	PCB-114	PCB-118	PCB-123	PCB-126	PCB-156	PCB-157	PCB-167	PCB-169	PCB-189	
English sole fillet													
LDW-T1-M-ES-FL-comp-1	830	65.3	18,600	1,160	52,300	786	102	7,740 C	C156	3,210	3.76 U	511	1,119 J
LDW-T1-M-ES-FL-comp-2	656	46.7	13,200	772	37,800	800	71	5,470 C	C156	2,210	2.34 U	371	857 J
LDW-T2-M-ES-FL-comp-1	696	51.4	19,000	1,260	61,000	1,130	97.2	8,210 C	C156	3,430	3.05 U	458	1,269 J
LDW-T2-M-ES-FL-comp-2	1,030	85.6	19,200	1,230	61,100	1,080	110	8,750 C	C156	3,600	6.43 U	456	1,265 J
LDW-T3-M-ES-FL-comp-1	283	17.8 J	8,200	611	29,900	452	32.9	4,270 C	C156	1,780	20.6 U	309	641 J
LDW-T3-M-ES-FL-comp-2	703	42.3	14,200	1,040	48,500	677	73.3	6,880 C	C156	2,820	1.81 U	408	1,025 J
LDW-T4-M-ES-FL-comp-1	240	15.6 J	6,890	450	23,200	270	29.2	3,130 C	C156	1,250	14.9 U	226	510 J
Pile perch fillet													
LDW-M-M-PP-FL-comp-1	142	11.2 J	3,920	261	12,800	209 J	20.6	1,750 C	C156	694	8.39 U	102	192 J
Starry flounder fillet													
LDW-T4-M-SF-FL-comp-1	221	16.2 J	4,650	370	15,300	240	21.4	2,000 C	C156	859	0.916	115	295 J
Striped perch fillet													
LDW-M-M-SP-FL-comp-1	193	25.3 J	8,730	545	28,300	489	50.4	3,990 C	C156	1,500	28.0 U	291	442 J
English sole whole body													
LDW-T1-M-ES-WB-comp-2	1,130	92.5	30,000	1,960	86,700	1,660	139	12,200 C	C156	5,040	3.57 U	879	1,610 J
LDW-T1-M-ES-WB-comp-4	2,070	165	43,600	2,800	120,000	2,430	185	17,100 C	C156	6,890	3.73	1,110	2,480 J
LDW-T2-M-ES-WB-comp-3	1,330	101	40,600	2,960	131,000	2,160	170	19,200 C	C156	7,700	5.04	1,130	2,712 J
LDW-T2-M-ES-WB-comp-5	1,520	105	31,600	1,890	102,000	1,650	131	13,000 C	C156	5,270	4.8 U	722	2,126 J
LDW-T3-M-ES-WB-comp-2	742	41.7	18,000	1,410	62,200	1,100	98.6	9,710 C	C156	4,070	3.17 J	640	1,419 J
LDW-T3-M-ES-WB-comp-3	765	52.8	25,500	1,470	92,500	1,360	92.1	14,600 C	C156	6,370	4.29 J	1,170	2,457 J
LDW-T4-M-ES-WB-comp-1	869	53.1	17,000	1,230	58,200	934	92.4	8,850 C	C156	3,600	2.58 U	555	1,361 J
Pacific staghorn sculpin whole body													
LDW-T1-D-PS-WB-comp-1	233	21.9 J	9,050	618	26,100	337	45.5	4,870 C	C156	1,520	12.6 U	353	532 J
LDW-T1-F-PS-WB-comp-1	490	23.9 J	13,700	890	38,400	602	52.3	6,060 C	C156	2,210	15 U	420	668 J
LDW-T2-C-PS-WB-comp-1	275	16.4 J	8,380	576	27,300	308 J	46.2	4,540 C	C156	1,590	2.07	303	482 J
LDW-T2-F-PS-WB-comp-1	189	14.1	8,750	646	29,600	416	47.4	5,580 C	C156	1,870	25.3 U	350	496 J

SPECIES TISSUE TYPE/ SAMPLE ID	PCB CONGENER CONCENTRATIONS (ng/kg ww)												TOTAL CONGENER CONCENTRATION (µg/kg ww) ^a
	PCB-077	PCB-081	PCB-105	PCB-114	PCB-118	PCB-123	PCB-126	PCB-156	PCB-157	PCB-167	PCB-169	PCB-189	
LDW-T3-D-PS-WB-comp-1	245	13.4	20,000	1,200	70,400	553	66.5	15,500 C	C156	4,610	4.84	1750	1,907 J
LDW-T3-E-PS-WB-comp-1	208	9.12	10,300	752	34,500	484	63.5	8,850 C	C156	3,000	3.62 U	923	1,048 J
LDW-T4-C-PS-WB-comp-1	54.2	11 J	5,880	413	19,800	212 J	25.9	3,570 C	C156	1,050	1.43	249	349.6 J
LDW-T4-D-PS-WB-comp-2	155	16.7 J	7,690	558	27,000	305 J	38.6	4,240 C	C156	1,500	1.71	315	505 J
Shiner surfperch whole body													
LDW-T1-A-SS-WB-comp-1	1,120	70.8 J	13,700	833	38,500	715	70.5	5,850 C	C156	2,420	23.3 U	458	700 J
LDW-T1-F-SS-WB-comp-1	1,740	113	18,900	1,270	54,000	1,150	128	9,180 C	C156	3,610	2.28 U	525	877 J
LDW-T2-B-SS-WB-comp-1	1,160	71.5	33,200	1,620	91,300	1,580	137	12,700 C	C156	4,630	1.76 U	559	1,055 J
LDW-T2-E-SS-WB-comp-1	5,940	187	195,000	11,400	812,000	7,750	370 J	108,000 C	C156	34,900	9.98 U	3,970	12,228 J
LDW-T3-C-SS-WB-comp-1	815	45.8	15,300	1,010	51,600	977	96.6	10,300 C	C156	4,210	3.59 U	773	1,009 J
LDW-T3-E-SS-WB-comp-1	940	53	21,600	1,140	87,100	1,240	299	38,500 C	C156	22,800	22.4	9,590	8,010 J
LDW-T3-F-SS-WB-comp-1	1,250	72.8	46,100	2,650	158,000	2,180	179	29,500 C	C156	11,900	6.06	3,070	3,522 J
LDW-T4-B-SS-WB-comp-1	899	75.8 J	15,500	993	48,900	770	79.2	7,110 C	C156	2,920	27.1 U	502	770 J
LDW-T4-D-SS-WB-comp-1	568	53.4 J	10,800	815	33,800	648	55.3	5,710 C	C156	2,320	20.8 U	409	532 J
Starry flounder whole body													
LDW-T4-M-SF-WB-comp-1	242	21.8 J	6,450	509	22,700	310	30.2	3,280 C	C156	1,460	1.24	252	458 J

^a Total PCB concentration calculated as the sum of the detected concentrations of all 209 PCB congeners, following summation rules in Appendix C

C156 - PCB-156 and PCB-157 co-elute; the combined concentration is presented as the concentration of PCB-156

Data qualifiers: C—concentration represents coelution; J - estimated concentration; U – not detected at RL shown

TEQs were calculated using the WHO mammalian TEFs (Van den Berg et al. 1998). For each sample, TEQs were calculated using three different methods: either zero, half RL, or full RL as the selected value for undetected PCB congeners (Table 3-3). The magnitude of the differences among the three TEQs calculated for each sample was small because the only coplanar congener that was reported as undetected in the tissue samples was PCB-169. The coelution between PCB-156 and PCB-157 does not affect the TEQ calculation because both congeners have a TEF of 0.0005. Overall, mammalian TEQs (half RL) ranged from 4.83 to 200 ng/kg ww. Mammalian TEQs and total PCB concentrations for fish tissue samples are presented graphically in Appendix F.

Table 3-3. Mammalian TEQs for fish tissue samples calculated with zero RL, half RL, and full RL assumptions

SPECIES/TISSUE TYPE/ SAMPLE ID	MAMMALIAN TEQs - FULL RL (ng/kg ww)	MAMMALIAN TEQs - HALF RL (ng/kg ww)	MAMMALIAN TEQs - ZERO RL (ng/kg ww)
English sole fillet			
LDW-T1-M-ES-FL-comp-1	22.0	22.0	22.0
LDW-T1-M-ES-FL-comp-2	15.6	15.5	15.5
LDW-T2-M-ES-FL-comp-1	22.8	22.7	22.7
LDW-T2-M-ES-FL-comp-2	24.4	24.4	24.3
LDW-T3-M-ES-FL-comp-1	9.87 J	9.77 J	9.66 J
LDW-T3-M-ES-FL-comp-2	17.8	17.8	17.8
LDW-T4-M-ES-FL-comp-1	7.96 J	7.88 J	7.81 J
Pile perch fillet			
LDW-M-M-PP-FL-comp-1	4.87 J	4.83 J	4.79 J
Starry flounder fillet			
LDW-T4-M-SF-FL-comp-1	5.40 J	5.40 J	5.40 J
Striped perch fillet			
LDW-M-M-SP-FL-comp-1	11.4 J	11.3 J	11.1 J
English sole whole body			
LDW-T1-M-ES-WB-comp-2	33.1	33.1	33.1
LDW-T1-M-ES-WB-comp-4	45.5	45.5	45.5
LDW-T2-M-ES-WB-comp-3	45.8	45.8	45.8
LDW-T2-M-ES-WB-comp-5	34.4	34.4	34.4
LDW-T3-M-ES-WB-comp-2	23.8 J	23.8 J	23.8 J
LDW-T3-M-ES-WB-comp-3	29.5 J	29.5 J	29.5 J
LDW-T4-M-ES-WB-comp-1	22.1	22.1	22.1
Pacific staghorn sculpin whole body			
LDW-T1-D-PS-WB-comp-1	11.0 J	11.0 J	10.9 J
LDW-T1-F-PS-WB-comp-1	14.2 J	14.2 J	14.1 J
LDW-T2-C-PS-WB-comp-1	10.9 J	10.9 J	10.9 J
LDW-T2-F-PS-WB-comp-1	12.1	11.9	11.8
LDW-T3-D-PS-WB-comp-1	24.4	24.4	24.4
LDW-T3-E-PS-WB-comp-1	15.9	15.8	15.8
LDW-T4-C-PS-WB-comp-1	7.23 J	7.23 J	7.23 J

SPECIES/TISSUE TYPE/ SAMPLE ID	MAMMALIAN TEQs - FULL RL (ng/kg ww)	MAMMALIAN TEQs - HALF RL (ng/kg ww)	MAMMALIAN TEQs - ZERO RL (ng/kg ww)
LDW-T4-D-PS-WB-comp-2	9.84 J	9.84 J	9.84 J
Shiner surfperch whole body			
LDW-T1-A-SS-WB-comp-1	16.1 J	16.0 J	15.9 J
LDW-T1-F-SS-WB-comp-1	25.7	25.7	25.7
LDW-T2-B-SS-WB-comp-1	33.7	33.7	33.7
LDW-T2-E-SS-WB-comp-1	200	200	200
LDW-T3-C-SS-WB-comp-1	22.3	22.3	22.3
LDW-T3-E-SS-WB-comp-1	62.2	62.2	62.2
LDW-T3-F-SS-WB-comp-1	55.2	55.2	55.2
LDW-T4-B-SS-WB-comp-1	18.9 J	18.8 J	18.7 J
LDW-T4-D-SS-WB-comp-1	13.7 J	13.6 J	13.4 J
Starry flounder whole body			
LDW-T4-M-SF-WB-comp-1	7.94 J	7.94 J	7.94 J

Data qualifiers: J - estimated concentration

3.1.2 Crab tissue results

All of the coplanar PCB congeners were detected in all of the crab composite tissue samples except PCB-81 and PCB-169 (Table 3-4). PCB-81 was not detected in two Dungeness crab edible meat composite samples. The RLs for PCB-81 were below the ACG established for crab edible meat samples (Appendix D of the QAPP). PCB-169 was not detected in one Dungeness crab and one slender crab hepatopancreas composite sample, and in two Dungeness crab and two slender crab edible meat composite samples. The RLs for PCB-169 were above the ACG of 0.68 ng/kg ww established for crab edible meat samples (Appendix D of the QAPP) in both hepatopancreas composite samples and in two of the edible meat composite samples (one Dungeness and one slender crab). RLs for PCB-169 ranged from 0.378 to 6.53 ng/kg ww. Dioxin-like PCB congeners, such as PCB-169, will be evaluated as TEQs in the risk assessments, rather than as individual congeners. However, because TEQs are calculated, rather than quantitated by the laboratory, comparisons of ACGs for individual PCB congeners to RLs are somewhat uncertain. The effect of the PCB-169 RL values on the calculated mammalian TEQ values will be discussed later in this section.

Table 3-4. Detection frequencies and concentration summaries of coplanar PCB congeners in LDW crab hepatopancreas and edible meat tissue samples

TISSUE TYPE/ PCB CONGENER	UNIT	DETECTION FREQUENCY	DETECTED CONCENTRATION			REPORTING LIMIT ^a	
			MINIMUM	MAXIMUM	MEAN ^b	MINIMUM	MAXIMUM
Dungeness crab hepatopancreas							
PCB-077	ng/kg ww	2/2	2,070	3,060	2,570	na	na
PCB-081	ng/kg ww	2/2	91.2	148	120	na	na
PCB-105	ng/kg ww	2/2	49,000	56,300	52,600	na	na
PCB-114	ng/kg ww	2/2	2,840	2,990	2,920	na	na
PCB-118	ng/kg ww	2/2	167,000	188,000	178,000	na	na
PCB-123	ng/kg ww	2/2	2,280	2,400	2,340	na	na
PCB-126	ng/kg ww	2/2	189	241	215	na	na
PCB-156	ng/kg ww	2/2	27,900 C	30,700 C	29,300 C	na	na
PCB-157	ng/kg ww	2/2	C156	C156	C156	na	na
PCB-167	ng/kg ww	2/2	10,300	12,200	11,300	na	na
PCB-169	ng/kg ww	1/2	8.56	8.56	8.56	6.53	6.53
PCB-189	ng/kg ww	2/2	2,240	2,520	2,380	na	na
Slender crab hepatopancreas							
PCB-077	ng/kg ww	2/2	1,840	2,250	2,050	na	na
PCB-081	ng/kg ww	2/2	94.4	123	109	na	na
PCB-105	ng/kg ww	2/2	18,900	21,300	20,100	na	na
PCB-114	ng/kg ww	2/2	1,110	1,250	1,180	na	na
PCB-118	ng/kg ww	2/2	50,700	62,100	56,400	na	na
PCB-123	ng/kg ww	2/2	964	1,110	1,040	na	na
PCB-126	ng/kg ww	2/2	94.0	142	118	na	na
PCB-156	ng/kg ww	2/2	8,330 C	9,880 C	9,110 C	na	na
PCB-157	ng/kg ww	2/2	C156	C156	C156	na	na
PCB-167	ng/kg ww	2/2	3,500	4,000	3,750	na	na
PCB-169	ng/kg ww	1/2	4.29	4.29	4.29	3.60	3.60
PCB-189	ng/kg ww	2/2	499	508	504	na	na
Dungeness crab-edible meat							
PCB-077	ng/kg ww	3/3	148	218	194	na	na
PCB-081	ng/kg ww	1/3	9.49 J	9.49 J	9.49	10.8	11.4
PCB-105	ng/kg ww	3/3	2,200	2,630	2,370	na	na
PCB-114	ng/kg ww	3/3	171	211	187	na	na
PCB-118	ng/kg ww	3/3	6,330	8,040	7,050	na	na
PCB-123	ng/kg ww	3/3	83.4	114	95.8	na	na
PCB-126	ng/kg ww	3/3	10.2	12.4	11.1	na	na
PCB-156	ng/kg ww	3/3	866 C	1,110 C	987 C	na	na
PCB-157	ng/kg ww	3/3	C156	C156	C156	na	na
PCB-167	ng/kg ww	3/3	352	425	389	na	na
PCB-169	ng/kg ww	1/3	0.468	0.468	0.468	0.391	0.854

TISSUE TYPE/ PCB CONGENER	UNIT	DETECTION FREQUENCY	DETECTED CONCENTRATION			REPORTING LIMIT ^a	
			MINIMUM	MAXIMUM	MEAN ^b	MINIMUM	MAXIMUM
PCB-189	ng/kg ww	3/3	57.7	87.5	71.2	na	na
Slender crab edible meat							
PCB-077	ng/kg ww	4/4	232	456	324	na	na
PCB-081	ng/kg ww	4/4	12.8 J	25.4	19.4	na	na
PCB-105	ng/kg ww	4/4	2,900	4,380	3,570	na	na
PCB-114	ng/kg ww	4/4	238	324	280	na	na
PCB-118	ng/kg ww	4/4	7,980	11,400	9,840	na	na
PCB-123	ng/kg ww	4/4	146	210	175	na	na
PCB-126	ng/kg ww	4/4	12.6	23.1	17.3	na	na
PCB-156	ng/kg ww	4/4	1,170 C	1,650 C	1,410 C	na	na
PCB-157	ng/kg ww	4/4	C156	C156	C156	na	na
PCB-167	ng/kg ww	4/4	432	645	543	na	na
PCB-169	ng/kg ww	2/4	0.626	0.707	0.667	0.378	0.848
PCB-189	ng/kg ww	4/4	54.4	95.7	72.7	na	na

^a RL range for non-detect samples

^b Reported mean concentrations are the average of the detected concentrations only; RLs were not included in calculation of the mean concentration

na – not applicable

C156 - PCB-156 and PCB-157 co-elute; the combined concentration is presented as the concentration of PCB-156

Data qualifiers: C—concentration represents coelution; J - estimated concentration

The concentrations of the individual coplanar PCB congeners and total PCB concentrations (i.e., the sum of the detected concentrations of all 209 congeners) for all crab tissue samples are presented in Table 3-5. Total PCB concentrations for the crab hepatopancreas composite samples ranged from 790 to 3,618 µg/kg ww. The total PCB concentrations for the crab edible meat composite samples ranged from 111 to 181 µg/kg ww (Table 3-5). Crab tissue plots of total PCB concentrations as the sum of the congeners versus the total PCB concentrations as the sum of the Aroclors as well as PCB pattern plots are presented in Appendix F.

Table 3-5. Coplanar PCB congener and total PCB concentrations in crab tissue samples

SPECIES TISSUE TYPE/ SAMPLE ID	PCB CONGENER CONCENTRATIONS (ng/kg ww)												TOTAL PCB CONGENER CONCENTRATION (µg/kg ww) ^a
	PCB-077	PCB-081	PCB-105	PCB-114	PCB-118	PCB-123	PCB-126	PCB-156	PCB-157	PCB-167	PCB-169	PCB-189	
Dungeness crab hepatopancreas													
LDW-T3-M-DC-HP-comp-1	3,060	148	56,300	2,990	188,000	2,400	241	30,700 C	C156	12,200	8.56	2,240	3,622 J
LDW-T4-M-DC-HP-comp-1	2,070	91.2	49,000	2,840	167,000	2,280	189	27,900 C	C156	10,300	6.53 U	2,520	3,618 J
Slender crab hepatopancreas													
LDW-T1-M-SC-HP-comp-1	2,250	123	18,900	1,110	50,700	964	142	8,330 C	C156	3,500	4.29	508	790 J
LDW-T2-M-SC-HP-comp-2	1,840	94.4	21300	1,250	62,100	1,110	94	9,880 C	C156	4,000	3.6 U	499	1,047 J
Dungeness crab edible meat													
LDW-T1-M-DC-EM-comp-2	218	9.49 J	2,270	178	6,330	89.9	10.6	866 C	C156	352	0.854 U	57.7	111 J
LDW-T3-M-DC-EM-comp-1	217	11.4 U	2,630	211	8,040	114	12.4	1,110 C	C156	425	0.391 U	68.4	149 J
LDW-T4-M-DC-EM-comp-1	148	10.8 U	2,200	171	6,790	83.4	10.2	985 C	C156	389	0.468	87.5	148.7 J
Slender crab edible meat													
LDW-T1-M-SC-EM-comp-2	456	25.4	4,380	324	10,800	190	23.1	1,650 C	C156	636	0.707	95.7	174.7 J
LDW-T2-M-SC-EM-comp-5	355	24.9 J	3,980	314	11,400	210	20.4	1,620 C	C156	645	0.626	78.8	181 J
LDW-T2-M-SC-EM-comp-6	251	14.6 J	2,900	238	7,980	146	13.2	1,170 C	C156	457	0.378 U	61.9	129.7 J
LDW-T3-M-SC-EM-comp-2	232	12.8 J	3,020	244	9,160	155	12.6	1,180 C	C156	432	0.848 U	54.4	134 J

^a Total PCB concentration calculated as the sum of the detected concentrations of all 209 PCB congeners, following summation rules in Appendix C

C156 - PCB-156 and PCB-157 co-elute; the combined concentration is presented as the concentration of PCB-156

Data qualifiers: C—concentration represents coelution; U - not detected at RL shown; J - estimated concentration

TEQs were calculated for each of the crab tissue samples using the WHO mammalian TEF values (Van den Berg et al. 1998; see Appendix C). For each sample, TEQs were calculated using three different methods: either zero, half RL, or full RL as the selected value for undetected PCB congeners (Table 3-6). The magnitude of the differences among the three TEQs for each sample was small. The coelution between PCB-156 and PCB-157 does not affect the TEQ calculation because both congeners have a TEF of 0.0005. Overall, TEQs (half RL) ranged from 2.49 to 66.4 ng/kg ww. Mammalian TEQs and total PCB concentrations for crab tissue samples are presented graphically in Appendix F.

Table 3-6. Mammalian TEQs for crab tissue samples calculated with zero RL, half RL, and full RL assumptions

SPECIES/TISSUE TYPE/SAMPLE ID	MAMMALIAN TEQs - FULL RL (ng/kg ww)	MAMMALIAN TEQs - HALF RL (ng/kg ww)	MAMMALIAN TEQs - ZERO RL (ng/kg ww)
Dungeness crab hepatopancreas			
LDW-T3-M-DC-HP-comp-1	66.4	66.4	66.4
LDW-T4-M-DC-HP-comp-1	56.7	56.7	56.7
Slender crab hepatopancreas			
LDW-T1-M-SC-HP-comp-1	26.3	26.3	26.3
LDW-T2-M-SC-HP-comp-2	23.7	23.7	23.7
Dungeness crab edible meat			
LDW-T1-M-DC-EM-comp-2	2.49 J	2.49 J	2.48 J
LDW-T3-M-DC-EM-comp-1	3.02	3.01	3.01
LDW-T4-M-DC-EM-comp-1	2.54	2.54	2.54
Slender crab edible meat			
LDW-T1-M-SC-EM-comp-2	4.91	4.91	4.91
LDW-T2-M-SC-EM-comp-5	4.62 J	4.62 J	4.62 J
LDW-T2-M-SC-EM-comp-6	3.17 J	3.17 J	3.16 J
LDW-T3-M-SC-EM-comp-2	3.25 J	3.24 J	3.24 J

Data qualifiers: J - estimated concentration

3.2 MS/MSD ANALYSES

This section presents the results of the MS/MSD analysis by analyte group and compares the QC limits to those provided in the QAPP (Windward 2004). In general, the results of the MS/MSD results are within the QC limits and the results do not indicate significant matrix effects for these samples. The MS/MSD analysis results are presented in full in Appendix B.

3.2.1 Butyltins

Seven samples were run as MS/MSD samples for the butyltin analyses. All of the MS/MSD results for butyltins were within the accuracy limits of 20-130% and the

precision limit of 50%, except for one sample, LDW-T2-M-ES-WB-comp-1 associated with SDG K2409451. The recoveries of tributyltin, dibutyltin, and monobutyltin ranged from 4-12% in both the MS and MSD results for this sample. The LCS and SRM butyltin results associated with the MS/MSD analyses were within QC limits. These results do not suggest a systematic problem with the butyltin analyses.

3.2.2 Organochlorine pesticides

Seven samples were run as MS/MSD samples for the organochlorine pesticide analyses. All of the MS/MSD results were within the accuracy limits of 30-150% and the precision limit of 50%, except for the following results:

- ◆ The recovery of endrin aldehyde in MS sample LDW-T1-M-DC-EM-comp-1 associated with SDG K2409809 was 27%, which is below the lower QC limit of 30%.
- ◆ The MS and MSD recoveries of 4,4'-DDT in sample LDW-T2-M-ES-WB-comp-3 associated with SDG K2409451 were -173% and -149%, respectively. The negative recoveries are a result of native sample concentration being four times the spike value, which overwhelms the signal from the MS/MDS spike. The negative recoveries in these samples were likely because of the presence of PCBs in these samples that interfered with the measurement of the 4,4'-DDT matrix spike.
- ◆ The recovery of 4,4'-DDT in the MS and MSD samples for LDW-T3-E-PS-WB-comp-1 associated with SDG K2409445 were 183% and 204%, respectively, which are above the upper QC limit for accuracy (150%). This compound was not detected in the original sample; therefore, the results are unaffected by any potential high bias.
- ◆ The MSD recovery of 4,4'-DDT in sample LDW-T4-M-ES-WB-comp-2 associated with SDG K2409451 was 166%, which is above the upper QC limit of 150%. This compound was not detected in the original sample; therefore, the results are unaffected by any potential high bias.

3.2.3 PCBs (Aroclors)

Seven samples were run as MS/MSD samples for the PCBs (Aroclors) analyses. All of the MS/MSD results were within the accuracy limits of 38-150% and the precision limit of 50%, except for the following results:

- ◆ The MS and MSD recoveries of Aroclor 1016 in sample LDW-T2-M-ES-WB-comp-1 associated with SDG K2409451 were above the upper QC limit for accuracy at 193% and 190%, respectively. This Aroclor was not detected in the original sample; therefore, the results are unaffected by any potential high bias.
- ◆ The MS and MSD recoveries of Aroclor 1016 in sample LDW-T2-M-ES-WB-comp-2 associated with SDG K2409451 were above the upper QC limit at 224%

and 188%, respectively. This Aroclor was not detected in the original sample; therefore, the results are unaffected by any potential high bias. Additionally, the MS recovery for this sample was above the QC limit for Aroclor 1260 at 183%, while the MSD was within QC limits for this Aroclor at 116%.

3.2.4 Semivolatile organic compounds

Seven samples were run as MS/MSD samples for the SVOC analyses. All of the MS/MSD results were within the accuracy limits of 20-130% and the precision limit of 50%, except for the following results:

- ◆ The MSD recovery of 4-chloro-3-methylphenol in sample LDW-T4-D-PS-WB-comp-1 associated with SDG K2409445 was above the upper QC limit for accuracy at 142%. This analyte was not detected in the original sample; therefore, the results are unaffected by any potential high bias.
- ◆ In sample LDW-T4-M-ES-WB-comp-2, associated with SDG K2409451, the MS recovery for 4-nitrophenol was 134% and the MSD recovery of 4-chloro-3-methylphenol was 132%, which are above the upper QC limits. These compounds were not detected in the original sample; therefore, the results are unaffected by any potential high bias.

3.2.5 Polycyclic aromatic hydrocarbons

Three samples were run as MS/MSD samples for the PAH analyses. All of the MS/MSD results were within the accuracy limits of 20-130% and the precision limit of 50%.

3.3 DDT CONFIRMATION RESULTS

The total DDT results from the original Method 8081 analysis and the confirmation analysis are presented in Table 3-7. The only DDT isomers that were detected in the confirmation analyses were 4,4'-DDE and 4,4'-DDD. The four isomers most commonly detected in the Method 8081 analyses were 4,4'-DDT, 2,4' DDT, 4,4'-DDE, and 4,4'-DDD; the highest concentrations were reported for the two DDT isomers. The confirmation analysis results confirm the JN qualification of the original sample results. Specifically, all the results from the confirmation analysis are much lower than the original result. Thus, the original reported concentrations of DDT compounds appear to reflect the presence of both PCB congeners and DDT isomers in the sample, and were elevated because of interference.

Table 3-7. Total DDT concentrations in the original Method 8081 analysis relative to the MS confirmation results

SAMPLE	ORIGINAL METHOD 8081 TOTAL DDTs RESULT (µg/kg ww)	CONFIRMATION TOTAL DDTs RESULT (µg/kg ww)
LDW-T3-D-SS-WB-comp-1	200 JN	7.1 U
LDW-T1-M-DC-HP-comp-1	390 JN	94
LDW-T2-M-ES-WB-comp-3	280 JN	95
LDW-T4-M-DC-HP-comp-1	290 JN	7.1 U
LDW-T3-M-DC-HP-comp-1	440 JN	76
LDW-T3-F-SS-WB-comp-1	450 JN	31
LDW-T3-E-SS-WB-comp-1	570 JN	32.4
LDW-T2-E-SS-WB-comp-1	1,020 JN	49

Data qualifiers: JN – analysis indicates that the result is likely affected by the presence of interfering compounds, value is an estimate; U – not detected at RL shown

Note, however, that the DDT confirmation analyses were run using the original sample extracts. The confirmation analyses were conducted 6 months after extraction, which greatly exceeds the maximum 45-day extract holding time. Therefore, the results of these analyses should be treated as qualitative and useful as an estimate of the DDT isomer concentrations, but will not be incorporated into the project database.

3.4 DATA VALIDATION RESULTS

Independent data validation of all congener data packages was conducted by Laboratory Data Consultants. All results were found to be usable for the Phase 2 RI, with the exception of the result for PCB-001 in sample LDW-T1-M-ES-FL-comp-1, which was rejected because the lab was unable to quantify the associated internal standard. The complete data validation report is presented in Appendix D.

The MS/MSD data were not submitted for data validation because no data were qualified as a result of these analyses. Instead, the MS/MSD analyses were conducted to provide an additional indicator of the overall quality of the tissue data set. The DDT confirmation data were not submitted for validation because the confirmation analyses were conducted outside of the acceptable holding time for the sample extracts. The confirmed data were evaluated qualitatively, and will not be imported into the database.

PCB congener analyses were conducted in accordance with the QAPP, with the following exceptions. The QAPP listed MS/MSD samples as required quality assurance (QA) samples for this analysis. However, MS/MSD samples are not required for EPA Method 1668A. Consultation among Axys, EPA, and Windward determined that MS/MSD samples would not be required QA samples. In addition, the required standard reference material (SRM) frequency was not met due to an error by laboratory. One tissue SRM was run for the three tissue SDGs. No data qualification resulted from the SRM frequency.

The 46 tissue samples were analyzed for PCB congeners by Axys in three SDGs (DPWG15741, DPWG15924, DPWG15926). Select congeners in 34 samples were either restated as undetected (U) or were qualified as estimated (J) based on the data review. Method blank results and internal standard recoveries were the only source of validation qualifiers; all other QC requirements were met.

Four method blanks contained PCB congeners. The PCB congener concentrations were compared to the method blank results and most of the affected PCB congeners were either not detected or they were present at concentrations more than five times the concentrations in the blank. However, some detected PCB congener results in 34 samples were qualified as undetected (U) with elevated RLs because of the presence of the PCB congeners in the blank (i.e., the concentrations were within five times the method blank concentration). The samples and the qualified PCB congeners are summarized in Table 3-8.

Table 3-8. Summary of PCB congeners qualified because of blank contamination

PCB CONGENER	NUMBER OF QUALIFIED SAMPLES	RANGE OF QUALIFIED RESULTS (ng/kg ww)	
		MINIMUM	MAXIMUM
PCB-1	22	0.686 U	23.7 U
PCB-2	15	0.243 U	8.43 U
PCB-3	20	0.46 U	20.5 U
PCB-11	16	1.28 U	34 U
PCB-12	6	12.4 U	28.8 U
PCB-15	3	25.7 U	96.2 U
PCB-23	4	6.84 U	10.7 U
PCB-104	1	3.88 U	3.88 U

U – not detected at RL shown

Internal standard recoveries were all within QC limits with the exception of three results. The internal standard recovery for PCB-001 was too low for quantification in LDW-T1-M-ES-FL-comp-1, so the result for the congener in this sample was not reported and should be considered a rejected result. The recovery for PCB-126 in sample LDW-T2-E-SS-WB-comp-1 was slightly above the upper QC limit; the detected result for PCB-126 was J-qualified as a result. Low recoveries of PCB-003 and PCB-004 for LDW-T1-M-ES-FL-comp-1 resulted in J-qualification of detected and nondetected results for these congeners in the sample.

4.0 References

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