

# *Lower Duwamish Waterway Group*

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

## **CRAB AND SHRIMP PILOT STUDY AND QUARTERLY SURVEYS DATA REPORT**

**For submittal to**

**The US Environmental Protection Agency**

**Region 10**  
Seattle, WA

**The Washington State Department of Ecology**

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## Acronyms

Acronym	definition
<b>CPUE</b>	catch per unit effort
<b>GPS</b>	global positioning system
<b>LDW</b>	Lower Duwamish Waterway
<b>MLLW</b>	mean lower low water
<b>QAPP</b>	Quality Assurance Project Plan
<b>RI</b>	Remedial Investigation
<b>RM</b>	river mile
<b>USGS</b>	US Geological Survey
<b>WAAS</b>	Wide Area Augmentation System

## 1.0 Introduction

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Data presented in this report were collected as part of the Phase 2 Remedial Investigation (RI) for the Lower Duwamish Waterway (LDW). These data will aid in estimating potential site-specific crab and shrimp harvest rates for the Phase 2 Human Health Risk Assessment. The field procedures used to conduct these surveys are described in detail in the Quality Assurance Project Plan (QAPP) for the clam, crab, and shrimp survey of the LDW (Windward 2003), and are also described briefly in Section 2.0 below.

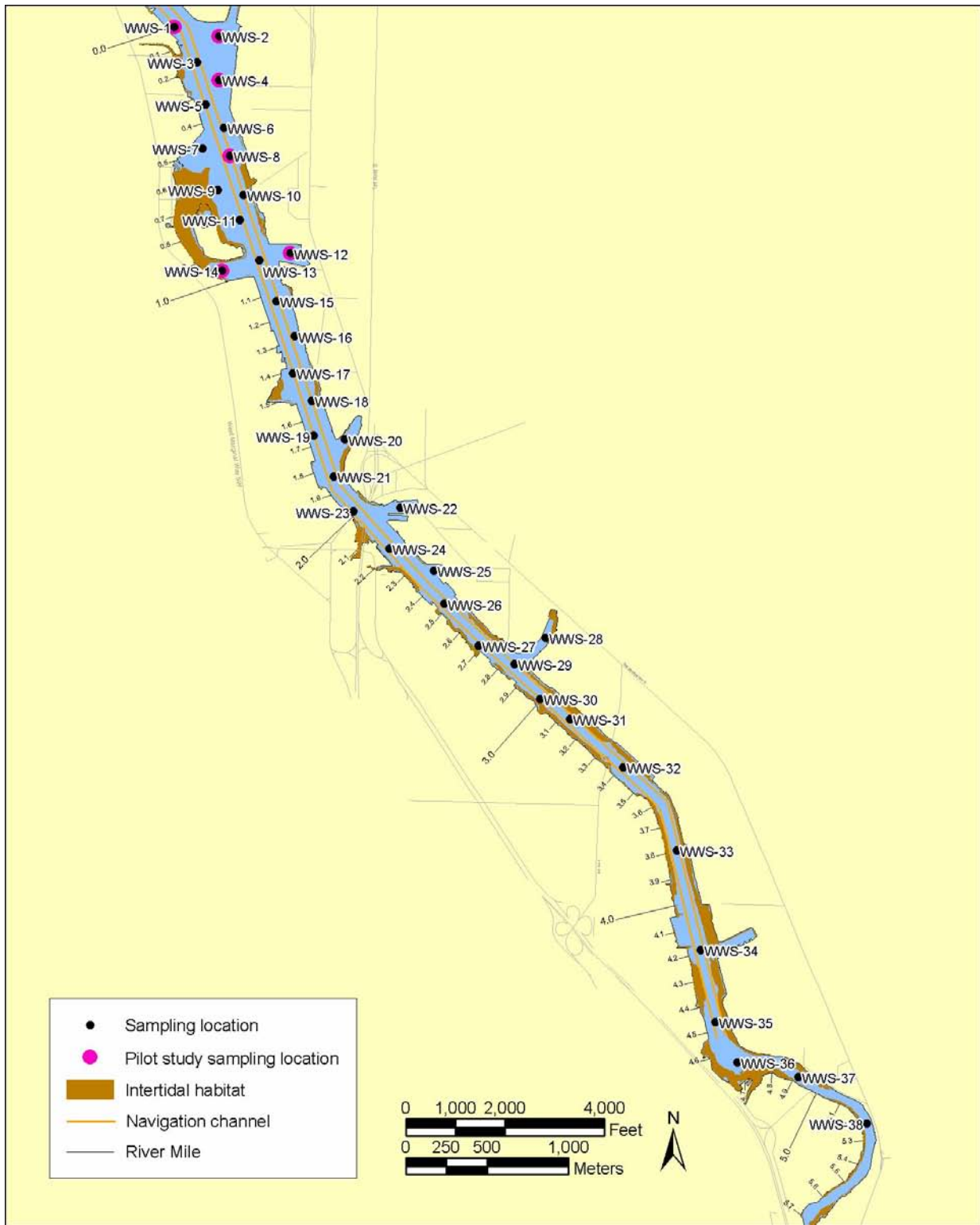
This report summarizes the results of an initial pilot study conducted in August 2003 and the results of the quarterly LDW crab and shrimp surveys conducted in September and November 2003 and February and May 2004. The results from the first three quarterly surveys (September 2003, November 2003, and February 2004) were previously submitted as interim data reports (Windward 2004a, b, c). The contents of those interim data reports are included in this data report, along with the results of the fourth quarterly survey.

The initial pilot study was conducted to determine which of two soak times (4-hour vs. 24-hour) produced the greatest numbers of crab and shrimp on a per-pull basis. Twenty-four-hour zinc timers were also tested during the pilot study to determine their behavior in estuarine salinities. The quarterly surveys provide data needed to estimate seasonal variation of the potential harvestability of crabs and shrimp throughout the year.

## 2.0 Methods

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The purpose of the quarterly crab and shrimp surveys is to estimate the potential harvest rate of crabs and shrimp by subsistence and recreational fishers in the LDW. To meet the study objectives, crab and shrimp traps were deployed at 38 sampling locations throughout the LDW study area (Figure 1). All species caught were examined and measured, then released to the LDW.



**Figure 1. Intertidal habitat and crab and shrimp sampling locations in the Lower Duwamish Waterway**

## 2.1 SAMPLING METHODS

Sampling locations were placed throughout the LDW study area with a relatively uniform sampling density by area. Consequently, there are more sampling locations in the northern portion of the study area because the river channel is wider there compared to the southern portion of the study area. Sampling stations were placed more than 100 m apart, so as to provide adequate spatial coverage over the entire LDW with a reasonable number of traps and to avoid potentially underestimating crab and shrimp abundances through trap competition. Based on the pilot study results described in Section 3.2 of this data report, traps were allowed a 4-hour soak time for each quarterly survey.

Windward conducted an initial pilot study from August 19-20, 2003 to identify the difference in catch rates, on a per-pull basis, associated with two different trap soak times (4-hour vs. 24-hour). The pilot study was conducted at several of the proposed sampling locations in the downstream end of the study area where crabs and shrimp are more likely to be found (Figure 1). Crab and shrimp traps were deployed at each sampling location approximately two hours prior to the day's higher-high tide and retrieved after four hours. All pertinent catch information was recorded, and traps were re-baited and redeployed for an additional 24 hours. Twenty-four-hour zinc timers were also tested at four of the pilot study locations during the 24-hour soak time to evaluate their behavior in estuarine salinities.

Windward conducted the first quarterly crab and shrimp survey from September 8-11, 2003, the second quarterly crab and shrimp survey from November 20-23, 2003, the third quarterly crab and shrimp survey from February 16-19, 2004, and the fourth quarterly crab and shrimp survey from May 24-27, 2004. All 38 stations were sampled utilizing the field procedures described in Section 3.2.1 of the QAPP. Crab and shrimp traps were deployed at each sampling location approximately two hours prior to the day's higher-high tide and retrieved after four hours.

Tidal information for the pilot study and the four quarterly surveys is presented in Table 1.

**Table 1. Daily tidal heights (in ft relative to MLLW) for the LDW at 8<sup>th</sup> Ave South during quarterly crab and shrimp surveys**

SAMPLING DATE	HIGH TIDE (TIME)	LOW TIDE (TIME)	HIGH TIDE (TIME)	LOW TIDE (TIME)
Pilot Survey				
8.19.2003	2.1 (05:06)	8.1 (11:56)	5.6 (16:50)	9.4 (22:42)
8.20.2003	1.7 (06:02)	8.3 (13:33)	6.6 (17:59)	9.1 (23:21)
First quarterly survey				
9.08.2003	9.4 (03:08)	-0.9 (10:13)	11.3 (17:31)	5.2 (23:05)
9.09.2003	9.6 (04:09)	-0.6 (10:58)	11.3 (18:04)	4.5 (23:44)
9.10.2003	9.7 (05:04)	-0.1 (11:38)	11.2 (18:31)	none
9.11.2003	3.7 (00:20)	9.7 (05:53)	0.7 (12:15)	11.0 (18:55)

SAMPLING DATE	HIGH TIDE (TIME)	LOW TIDE (TIME)	HIGH TIDE (TIME)	LOW TIDE (TIME)
Second quarterly survey				
11.20.2003	8.3 (01:43)	3.6 (07:22)	11.5 (13:41)	1.3 (20:33)
11.21.2003	9.4 (02:53)	4.4 (08:19)	11.6 (14:12)	-0.3 (21:11)
11.22.2003	10.5 (03:55)	5.1 (09:13)	11.7 (14:45)	-1.7 (21:50)
11.23.2003	11.4 (04:51)	5.8 (10:06)	11.7 (15:20)	-2.8 (22:32)
Third quarterly survey				
2.16.2004	10.7 (03:05)	8.2 (07:39)	10.4 (12:11)	-1.4 (20:03)
2.17.2004	11.3 (03:59)	7.8 (08:57)	10.3 (13:22)	-1.7 (20:59)
2.18.2004	11.9 (04:42)	7.1 (09:55)	10.3 (14:30)	-1.8 (21:50)
2.19.2004	12.2 (05:18)	6.3 (10:43)	10.3 (15:33)	-1.5 (22:35)
Fourth quarterly survey				
5.24.2004	11.1 (23:08)	7.1 (03:51)	8.4 (07:37)	-0.5 (16:15)
5.25.2004	11.1 (23:51)	6.8 (04:56)	7.9 (08:31)	0.2 (16:01)
5.26.2004	none	6.3 (06:05)	7.3 (09:46)	0.9 (16:52)
5.27.2004	1.8 (17:46)	11.1 (00:30)	5.4 (07:04)	6.9 (11:17)

Water depths (in ft below mean lower low water [MLLW]) were not recorded at the time of deployment or retrieval, but the water depth at each target location was obtained from LDW bathymetric data collected in October 2003 (DEA 2004) (Table 2).

**Table 2. Water depth (ft below MLLW) at each target crab and shrimp sampling location**

STATION	WATER DEPTH		STATION	WATER DEPTH
WWS-1	35.4		WWS-20	16.3
WWS-2	34.0		WWS-21	27.8
WWS-3	44.3		WWS-22	15.0
WWS-4	40.6		WWS-23	15.2
WWS-5	37.8		WWS-24	17.3
WWS-6	26.6		WWS-25	9.0
WWS-7	21.6		WWS-26	18.5
WWS-8	30.0		WWS-27	No data <sup>1</sup>
WWS-9	13.7		WWS-28	9.9
WWS-10	28.6		WWS-29	18.2
WWS-11	20.3		WWS-30	12.7
WWS-12	24.9		WWS-31	17.4
WWS-13	35.4		WWS-32	17.1
WWS-14	18.7		WWS-33	14.6
WWS-15	34.2		WWS-34	13.3
WWS-16	20.2		WWS-35	12.2
WWS-17	31.7		WWS-36	9.0
WWS-18	29.4		WWS-37	No data <sup>1</sup>
WWS-19	32.6		WWS-38	No data <sup>1</sup>

<sup>1</sup> Stations without depths were either obstructed during the bathymetric survey (WWS-27) or outside the surveyed area (WWS-37 and WWS-38)



After the designated soak time elapsed, the traps were revisited and quickly pulled up at constant speed to avoid potential crab or shrimp escape. All pertinent catch information was recorded, and the traps were stacked, cleaned of any debris, and prepared for the next day's sampling. Special care was taken to not dispose of used bait to the LDW, because the addition of food to the system might have negatively affected the subsequent day's catch.

## **2.2 SAMPLING GEAR**

Crabs and shrimp were collected using Ladner 30" SS rubber-wrapped crab traps and Ladner 30" nestable shrimp traps. The crab and shrimp traps at a given station were deployed on separate floats approximately 10-15 ft apart. Crab traps were baited with a mixture of frozen salmon heads and whole squid, while the shrimp traps were baited with a mixture of slow- and fast-smolting (dissolving) shrimp pellet bait. The crab bait was placed in nylon mesh bait bags and hung from the center of the crab trap in such a manner that the bag could not be opened or moved by the crabs. The shrimp bait was placed in 1-quart plastic Scotty brand bait jars with approximately forty 8-mm holes to allow the bait scent to exit without providing access to the bait itself.

Navigation to sample locations was achieved using a Magellan SporTrak GPS unit, upgraded to include the latest Wide Area Augmentation System (WAAS) technology.

## **2.3 CRAB AND SHRIMP SPECIES IDENTIFICATION AND SIZE MEASUREMENTS**

The station location, species, sex, and carapace length were recorded for each crab. The station location, species, and total length (rostrum to telson) were recorded for each shrimp. Crab and shrimp species were identified using a Pacific Northwest marine invertebrate key (Kozloff 1987).

## **2.4 DEVIATIONS FROM THE QAPP**

During the first quarterly crab and shrimp survey, Windward sampled 10 stations on each of the first three sampling days, and 8 stations on the fourth sampling day. During the second quarterly crab and shrimp survey, Windward sampled 12, 9, 10, and 7 stations on each sampling day, respectively. During the third quarterly crab and shrimp survey, Windward sampled 8, 11, 10, and 9 stations on each sampling day, respectively. During the fourth quarterly crab and shrimp survey, Windward sampled 10, 10, 10, and 8 stations on each sampling day, respectively. The QAPP indicated that sampling would follow a 13, 13, and 12 station daily sampling effort over three days. Because of space limitations on the boat and the desire to maximize field crew safety, the Windward field team leader decided to extend each quarterly survey to four days, instead of the three days indicated in the QAPP. Additionally, during the fourth quarterly survey, stations WWS-25 (~River Mile [RM] 2.4) and WWS-27 (~RM 2.7) were deployed slightly off their target locations (<25 m) as a result of barge traffic.

Windward used a mixture of fish and squid to bait the crab traps. The QAPP indicated that crab traps would be baited with a mixture of fish, squid, and clams. Clams were not as readily available as fish and squid. The Windward project manager was informed, and decided that a fish and squid mixture was acceptable.

The four quarterly crab and shrimp sampling efforts were conducted in September and November 2003, and February and May 2004, respectively. The QAPP indicated that quarterly surveys would be conducted in August, October, January, and late April. Because of scheduling delays in August, all quarterly sampling efforts were postponed by one month.

Prior to September 10, 2003, entrance tunnels of the shrimp traps were deployed to create a 90-degree corner inside the trap. Although deployment methods were not specifically specified in the QAPP, this deployment method is not consistent with methods typically used by commercial shrimp fishermen. This deviation, combined with the relatively short soak times, could have affected the ability of these traps to catch shrimp. For all sampling efforts on September 10 and 11, 2003, the shrimp traps were set up to avoid the 90-degree corner inside the trap. This correction was also used during subsequent surveys.

### **3.0 Results**

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Catch per unit effort (CPUE) was calculated for each trap to estimate potential harvest rates by recreational and subsistence fishers. Crab and shrimp data collected during the third quarterly survey were summarized by number and mean length of each species per sampling trap. CPUE was calculated for each crab and shrimp species collected per trap by counting the number of individuals of each species for each pull of the trap. Potential crab and shrimp catch data were summarized per sampling trap and for the entire LDW and presented in tables in the following sections.

#### **3.1 ENVIRONMENTAL CONDITIONS**

Weather during the first quarterly survey was mostly overcast with 5-10 mph wind and temperatures averaging 60 (°F). There was no precipitation during the survey period.

Weather during the second quarterly survey was variable and included rain, intermittent showers, 5-10 mph wind (with gusts to 30 mph), and temperatures in the mid-30s (°F). Precipitation was heaviest on the first and final days of sampling, with consistent rain and some showers. There was minimal precipitation during the second sampling day, and no precipitation on the third sampling day. River flow rates during the second quarterly survey were higher than during the first quarterly survey (Table 3).

Weather during the third quarterly survey period was mostly clear with little wind and temperatures in the mid 40s (°F), but also included a light rain shower on the second survey day. River flow rates during the third quarterly survey were higher than flow rates during the first quarterly survey, but lower than during the second quarterly survey (Table 3).

Weather during the fourth quarterly survey period was variable with light wind and temperatures in the mid 60s (°F), but also included rain on the third and fourth survey days. River flow rates during the fourth quarterly survey were higher than flow rates during the first quarterly survey, and generally lower than during the second and third quarterly surveys (Table 3).

Mean streamflow rates at the US Geological Survey stream gage at river mile 32 (USGS 12113000 Green River near Auburn, WA) during the quarterly surveys are presented in Table 3.

**Table 3. Mean streamflow in the Duwamish River at Auburn during quarterly crab and shrimp surveys**

FIRST QUARTERLY SURVEY		SECOND QUARTERLY SURVEY		THIRD QUARTERLY SURVEY		FOURTH QUARTERLY SURVEY	
DATE	STREAMFLOW M <sup>3</sup> /SEC (FT <sup>3</sup> /SEC)	DATE	STREAMFLOW M <sup>3</sup> /SEC (FT <sup>3</sup> /SEC)	DATE	STREAMFLOW M <sup>3</sup> /SEC (FT <sup>3</sup> /SEC)	DATE	STREAMFLOW M <sup>3</sup> /SEC (FT <sup>3</sup> /SEC)
9.8.2003	6.63 (234)	11.20.2003	96.3 (3400)	2.16.2004	36.6 (1290)	5.24.2004	23.5 (830)
9.9.2003	5.95 (210)	11.21.2003	66.8 (2360)	2.17.2004	37.4 (1320)	5.25.2004	23.4 (828)
9.10.2003	5.86 (207)	11.22.2003	47.6 (1680)	2.18.2004	36.8 (1300)	5.26.2004	27.1 (957)
9.11.2003	6.46 (228)	11.23.2003	44.2 (1560)	2.19.2004	36.8 (1300)	5.27.2004	43.9 (1550)

### 3.2 PILOT STUDY

Initial analysis of existing commercial crab catch data (described in Section 2.4.2 of the QAPP) suggested a 24-hour soak time might be more appropriate for the quarterly LDW crab survey study. However, pilot survey results indicated greater catch rates for the 4-hour soak versus the 24-hour soak. Based on the pilot study results, a 4-hour soak time was agreed upon with the agencies for the quarterly crab and shrimp surveys.

Zinc timers were tested at four of the six pilot study locations, and all released within 24 hours (+/- 1 hour). Because the total catch was greater for the 4-hour versus the 24-hour soak time, zinc timers were not necessary for any of the quarterly crab and shrimp surveys.

Table 4 summarizes the sampling results for both crab and shrimp traps at each of the six pilot study stations. Catch data were recorded for each station, soak time (4- versus 24-hour), and trap type. The CPUE for slender crabs (*Cancer gracilis*) was greater for the 4- versus 24-hour soak time at all six sample locations. The CPUE for red rock crabs (*C. productus*) was greater for the 4-hour soak time at two of the four stations

where red rock crabs were captured. The CPUE for Dungeness crabs (*C. magister*) was greater for the 4-hour soak time at four of the six sample locations. No shrimp were captured during the pilot study.

Survey forms and field notes from the August 19-20, 2003 pilot survey are provided in Appendix A.

**Table 4. Crab and shrimp pilot study results**

STATION	TRAP TYPE	SOAK TIME	SLENDER CRAB ( <i>CANCER GRACILIS</i> )			RED ROCK CRAB ( <i>CANCER PRODUCTUS</i> )			DUNGENESS CRAB ( <i>CANCER MAGISTER</i> )		
			# INDIVIDUALS (CPUE)	LENGTH RANGE (mm)	MEAN LENGTH (mm)	# INDIVIDUALS (CPUE)	LENGTH RANGE (mm)	MEAN LENGTH (mm)	# INDIVIDUALS (CPUE)	LENGTH RANGE (mm)	MEAN LENGTH (mm)
WWS-1	crab	~4 hr	5	98 - 105	101	9	127 - 160	149	6	154 - 160	157
WWS-1	crab	~24 hr	0	na	na	2	161 - 173	167	5	148 - 175	159
WWS-1	shrimp	~4 hr	1	107	107	0	na	na	0	na	na
WWS-1	shrimp	~24 hr	2	92 - 94	93	0	na	na	0	na	na
WWS-2	crab	~4 hr	10	93 - 103	98	1	133	133	1	151	151
WWS-2	crab	~24 hr	1	97	97	0	na	na	5	141 - 170	155
WWS-2	shrimp	~4 hr	0	na	na	0	na	na	0	na	na
WWS-2	shrimp	~24 hr	2	97 - 98	98	0	na	na	0	na	na
WWS-4	crab	~4 hr	12	92 - 108	100	2	106 - 127	117	7	134 - 177	155
WWS-4	crab	~24 hr	0	na	na	4	151 - 153	152	5	142 - 177	158
WWS-4	shrimp	~4 hr	1	100	100	0	na	na	0	na	na
WWS-4	shrimp	~24 hr	1	104	104	0	na	na	0	na	na
WWS-8	crab	~4 hr	14	65 - 109	94	0	na	na	1	146	146
WWS-8	crab	~24 hr	4	96 - 111	105	1	139	139	1	163	163
WWS-8	shrimp	~4 hr	4	80 - 100	91	0	na	na	0	na	na
WWS-8	shrimp	~24 hr	4	72 - 93	82	0	na	na	0	na	na
WWS-12	crab	~4 hr	11	79 - 109	101	0	na	na	1	125	125
WWS-12	crab	~24 hr	5	84 - 99	94	0	na	na	0	na	na
WWS-12	shrimp	~4 hr	1	80	80	0	na	na	0	na	na
WWS-12	shrimp	~24 hr	6	77 - 100	88	0	na	na	0	na	na
WWS-14	crab	~4 hr	10	70 - 103	89	0	na	na	1	145	145
WWS-14	crab	~24 hr	4	96 - 107	101	0	na	na	0	na	na
WWS-14	shrimp	~4 hr	1	86	86	0	na	na	0	na	na
WWS-14	shrimp	~24 hr	2	66 - 89	78	0	na	na	0	na	na

na – not applicable

### 3.3 CATCH RESULTS FROM QUARTERLY SURVEYS

All 38 stations were sampled using both crab and shrimp traps. Catch data were recorded for each station and trap type.

Information regarding the number of legal size crabs captured during the survey is provided for comparison purposes only. It is recognized that subsistence fishers may catch and consume crabs smaller than legal size.

Survey forms and field notes from the quarterly crab and shrimp surveys are provided in Appendices B-E.

#### 3.3.1 First quarterly crab and shrimp survey

The station WWS-1 shrimp trap was missing during the retrieval phase of the first quarterly survey. A new shrimp trap was redeployed on the second day of sampling at station WWS-1, and was again missing during the retrieval phase. No further attempts were made to sample station WWS-1 using a shrimp trap during the first quarterly survey.

Table 5a summarizes the first quarterly sampling results for each survey station. Slender crabs dominated the crab trap catch with a total of 228 individuals, followed by Dungeness crabs with 56, and finally red rock crabs with 24 individuals. Slender crabs were the only crabs captured in the shrimp traps with a total of 66 individuals. Slender crabs were captured as far upstream as station WWS-35 (~RM 4.5), red rock crabs were captured as far upstream as station WWS-24 (~RM 2.2), and Dungeness crabs were captured as far upstream as station WWS-34 (~RM 4.2). Of the 24 red rock crabs captured (13 females and 11 males), 19 were legal size ( $\geq 127$  mm, both sexes). Of the 56 total Dungeness crabs captured (53 males and 3 females), 23 were legal size ( $\geq 159$  mm, males only). One shrimp, a dock shrimp (*Pandalus danae*), was captured during this survey at station WWS-3.

#### 3.3.2 Second quarterly crab and shrimp survey

Table 5b summarizes the second quarterly sampling results for each survey station. Slender crabs dominated the crab trap catch for the second quarterly survey with a total of 209 individuals, followed by Dungeness crabs with 39 individuals, and red rock crabs with 14 individuals. Slender crabs were the only crabs captured in the shrimp traps (101 individuals). Slender crabs were captured as far upstream as station WWS-31 (~RM 3.1), red rock crabs were captured as far upstream as station WWS-19 (~RM 1.7), and Dungeness crabs were captured as far upstream as station WWS-33 (~RM 3.8). Of the 14 red rock crabs captured (1 female and 13 males), 12 were legal size ( $\geq 127$  mm, both sexes). Of the 39 Dungeness crabs captured (29 males and 10 females), 3 were legal size ( $\geq 159$  mm, males only). Sixty dock shrimp were captured during this survey as far upstream as station WWS-20 (~RM 1.7).

### 3.3.3 Third quarterly crab and shrimp survey

Table 5c summarizes the third quarterly sampling results for each survey station. Slender crabs dominated the crab trap catch for the third quarterly survey with a total of 321 individuals, followed by Dungeness crabs with 66 individuals, and red rock crabs with 2 individuals. Slender crabs were the only crabs captured in the shrimp traps (84 individuals). Slender crabs were captured as far upstream as station WWS-28 (~RM 2.8), red rock crabs were only captured at station WWS-3 (~RM 0.2), and Dungeness crabs were captured as far upstream as station WWS-33 (~RM 3.8). Both the red rock crabs captured were male and were legal size ( $\geq 127$  mm). Of the 66 Dungeness crabs captured (60 males and 6 females), 3 were legal size ( $\geq 159$  mm, males only). Only three dock shrimp were captured during this survey, all at station WWS-5 (~RM 0.3).

### 3.3.4 Fourth quarterly crab and shrimp survey

Table 5d summarizes the fourth quarterly sampling results for each survey station. Slender crabs dominated the crab trap catch for the fourth quarterly survey with a total of 161 individuals, followed by Dungeness crabs with 65 individuals, and red rock crabs with 15 individuals. Slender crabs were the only crabs captured in the shrimp traps (87 individuals). Slender crabs and Dungeness crabs were captured as far upstream as station WWS-33 (~RM 3.8), and red rock crabs were captured up to station WWS-21 (~RM 1.8). All 15 red rock crabs captured (12 males and 3 females) were legal size ( $\geq 127$  mm). Of the 65 Dungeness crabs captured (56 males and 9 females), 22 were legal size ( $\geq 159$  mm, males only). No dock shrimp were captured at any of the stations during this survey.

### 3.3.5 Comparison of results for all quarterly surveys

Tables 6a-6d summarize the results of the four quarterly surveys for the entire LDW. The total number of slender crabs captured during the fourth quarterly survey (248 individuals) was lower than the first three quarterly surveys (294, 310, and 321 individuals, respectively). The total number of red rock crabs caught during the fourth quarterly survey (15 individuals) was less than the 24 caught during the first quarterly survey, and higher than the 14 and 2 caught during the second and third quarterly surveys, respectively. The total number of Dungeness crabs caught during the fourth quarterly survey (65 individuals) was similar to the 66 caught during the third quarterly survey, and higher than the 56 and 39 caught during the first and second quarterly surveys, respectively. The total number of dock shrimp caught was lower for the third quarterly survey (3 individuals) when compared to the second quarterly survey (60 individuals); only one was caught during the first quarterly survey, and none were caught during the fourth quarterly survey.

### 3.4 OBSERVATIONS OF OTHER SPECIES

Observations of other non-target species during the pilot study and the first quarterly crab and shrimp survey included: Pacific staghorn sculpin (*Leptocottus armatus*), prickly sculpin (*Cottus asper*), shiner surfperch (*Cymatogaster aggregata*), an unidentified flatfish, an unidentified gunnel, sunflower star (*Pycnopodia helianthoides*), and an unidentified sea star.

Observations of other non-target species during the second quarterly crab and shrimp survey included: Pacific staghorn sculpin, prickly sculpin, shiner surfperch, an unidentified juvenile flatfish, shore crab (*Hemigrapsus* sp.), graceful decorator crab (*Oregonia gracilis*), and sunflower star.

Observations of other non-target species during the third quarterly crab and shrimp survey included: shiner surfperch, shore crab, and sunflower star.

Observations of other non-target species during the fourth quarterly crab and shrimp survey included: shiner surfperch, shore crab, graceful decorator crab, saddleback gunnel (*Pholis ornata*), Pacific staghorn sculpin, prickly sculpin, an unidentified sculpin, jellyfish (Phylum Cnidaria), and sunflower star.

All fish caught were tallied by approximate size class, while invertebrates were only tallied. All non-target species information is provided in Appendices A-E.



**Table 5a. First quarterly crab and shrimp survey results by station**

STATION	TRAP TYPE	SLENDER CRAB ( <i>CANCER GRACILIS</i> )			RED ROCK CRAB ( <i>CANCER PRODUCTUS</i> )			DUNGENESS CRAB ( <i>CANCER MAGISTER</i> )			DOCK SHRIMP ( <i>PANDALUS DANA</i> )		
		# INDIVIDUALS (CPUE)	LENGTH RANGE (mm)	MEAN LENGTH (mm)	# INDIVIDUALS (CPUE)	LENGTH RANGE (mm)	MEAN LENGTH (mm)	# INDIVIDUALS (CPUE)	LENGTH RANGE (mm)	MEAN LENGTH (mm)	# INDIVIDUALS (CPUE)	LENGTH RANGE (mm)	MEAN LENGTH (mm)
WWS-1	crab	7	92 - 111	105	6	113 - 170	139	13	125 - 174	151	0	na	na
WWS-1	shrimp	0	na	na	0	na	na	0	na	na	0	na	na
WWS-2	crab	6	89 - 110	102	1	156	156	2	164 - 165	165	0	na	na
WWS-2	shrimp	1	99	99	0	na	na	0	na	na	0	na	na
WWS-3	crab	6	96 - 115	106	2	136 - 184	150	8	138 - 183	158	0	na	na
WWS-3	shrimp	0	na	na	0	na	na	0	na	na	1	92	92
WWS-4	crab	5	100 - 111	105	8	118 - 165	139	3	121 - 176	150	0	na	na
WWS-4	shrimp	1	96	96	0	na	na	0	na	na	0	na	na
WWS-5	crab	6	102 - 112	107	2	131 - 153	142	1	161	161	0	na	na
WWS-5	shrimp	2	88 - 98	93	0	na	na	0	na	na	0	na	na
WWS-6	crab	6	80 - 105	93	0	na	na	0	na	na	0	na	na
WWS-6	shrimp	1	80	80	0	na	na	0	na	na	0	na	na
WWS-7	crab	6	76 - 107	94	1	126	126	0	na	na	0	na	na
WWS-7	shrimp	0	na	na	0	na	na	0	na	na	0	na	na
WWS-8	crab	10	80 - 105	94	0	na	na	0	na	na	0	na	na
WWS-8	shrimp	2	85	85	0	na	na	0	na	na	0	na	na
WWS-9	crab	10	80 - 104	94	0	na	na	2	133 - 163	148	0	na	na
WWS-9	shrimp	2	87 - 98	93	0	na	na	0	na	na	0	na	na
WWS-10	crab	6	87 - 104	97	0	na	na	2	160 - 165	163	0	na	na
WWS-10	shrimp	3	79 - 97	90	0	na	na	0	na	na	0	na	na
WWS-11	crab	7	92 - 107	99	0	na	na	5	115 - 175	145	0	na	na
WWS-11	shrimp	2	77 - 91	84	0	na	na	0	na	na	0	na	na
WWS-12	crab	5	76 - 100	87	0	na	na	0	na	na	0	na	na
WWS-12	shrimp	1	76	76	0	na	na	0	na	na	0	na	na
WWS-13	crab	14	77 - 103	95	0	na	na	0	na	na	0	na	na
WWS-13	shrimp	4	64 - 104	81	0	na	na	0	na	na	0	na	na
WWS-14	crab	9	77 - 102	90	0	na	na	0	na	na	0	na	na
WWS-14	shrimp	3	84 - 97	88	0	na	na	0	na	na	0	na	na
WWS-15	crab	16	70 - 103	90	0	na	na	0	na	na	0	na	na
WWS-15	shrimp	6	70 - 95	80	0	na	na	0	na	na	0	na	na
WWS-16	crab	11	76 - 104	95	0	na	na	0	na	na	0	na	na

STATION	TRAP TYPE	SLENDER CRAB ( <i>CANCER GRACILIS</i> )			RED ROCK CRAB ( <i>CANCER PRODUCTUS</i> )			DUNGENESS CRAB ( <i>CANCER MAGISTER</i> )			DOCK SHRIMP ( <i>PANDALUS DANAÉ</i> )		
		# INDIVIDUALS (CPUE)	LENGTH RANGE (mm)	MEAN LENGTH (mm)	# INDIVIDUALS (CPUE)	LENGTH RANGE (mm)	MEAN LENGTH (mm)	# INDIVIDUALS (CPUE)	LENGTH RANGE (mm)	MEAN LENGTH (mm)	# INDIVIDUALS (CPUE)	LENGTH RANGE (mm)	MEAN LENGTH (mm)
WWS-16	shrimp	4	71 - 89	79	0	na	na	0	na	na	0	na	na
WWS-17	crab	11	75 - 102	93	1	135	135	0	na	na	0	na	na
WWS-17	shrimp	3	73 - 102	84	0	na	na	0	na	na	0	na	na
WWS-18	crab	10	65 - 105	94	1	134	134	0	na	na	0	na	na
WWS-18	shrimp	4	90 - 101	96	0	na	na	0	na	na	0	na	na
WWS-19	crab	10	74 - 106	93	0	na	na	0	na	na	0	na	na
WWS-19	shrimp	0	na	na	0	na	na	0	na	na	0	na	na
WWS-20	crab	10	71 - 93	85	0	na	na	0	na	na	0	na	na
WWS-20	shrimp	0	na	na	0	na	na	0	na	na	0	na	na
WWS-21	crab	11	87 - 103	96	1	123	123	0	na	na	0	na	na
WWS-21	shrimp	1	80	80	0	na	na	0	na	na	0	na	na
WWS-22	crab	4	74 - 98	86	0	na	na	0	na	na	0	na	na
WWS-22	shrimp	2	60 - 74	67	0	na	na	0	na	na	0	na	na
WWS-23	crab	8	71 - 107	89	0	na	na	0	na	na	0	na	na
WWS-23	shrimp	4	71 - 88	76	0	na	na	0	na	na	0	na	na
WWS-24	crab	4	79 - 98	90	1	134	134	0	na	na	0	na	na
WWS-24	shrimp	2	75 - 79	77	0	na	na	0	na	na	0	na	na
WWS-25	crab	3	71 - 97	80	0	na	na	0	na	na	0	na	na
WWS-25	shrimp	2	67 - 86	77	0	na	na	0	na	na	0	na	na
WWS-26	crab	3	80 - 106	95	0	na	na	0	na	na	0	na	na
WWS-26	shrimp	3	73 - 95	86	0	na	na	0	na	na	0	na	na
WWS-27	crab	6	73 - 99	91	0	na	na	0	na	na	0	na	na
WWS-27	shrimp	2	77 - 104	91	0	na	na	0	na	na	0	na	na
WWS-28	crab	0	na	na	0	na	na	2	87 - 100	94	0	na	na
WWS-28	shrimp	0	na	na	0	na	na	0	na	na	0	na	na
WWS-29	crab	5	75 - 103	92	0	na	na	0	na	na	0	na	na
WWS-29	shrimp	1	81	81	0	na	na	0	na	na	0	na	na
WWS-30	crab	7	83 - 106	98	0	na	na	4	159 - 185	170	0	na	na
WWS-30	shrimp	5	74 - 96	84	0	na	na	0	na	na	0	na	na
WWS-31	crab	7	77 - 98	88	0	na	na	1	149	149	0	na	na
WWS-31	shrimp	2	87 - 106	95	0	na	na	0	na	na	0	na	na
WWS-32	crab	0	na	na	0	na	na	8	129 - 165	143	0	na	na
WWS-32	shrimp	2	100 - 102	101	0	na	na	0	na	na	0	na	na

STATION	TRAP TYPE	SLENDER CRAB ( <i>CANCER GRACILIS</i> )			RED ROCK CRAB ( <i>CANCER PRODUCTUS</i> )			DUNGENESS CRAB ( <i>CANCER MAGISTER</i> )			DOCK SHRIMP ( <i>PANDALUS DANAÉ</i> )		
		# INDIVIDUALS (CPUE)	LENGTH RANGE (mm)	MEAN LENGTH (mm)	# INDIVIDUALS (CPUE)	LENGTH RANGE (mm)	MEAN LENGTH (mm)	# INDIVIDUALS (CPUE)	LENGTH RANGE (mm)	MEAN LENGTH (mm)	# INDIVIDUALS (CPUE)	LENGTH RANGE (mm)	MEAN LENGTH (mm)
WWS-33	crab	0	na	na	0	na	na	2	117 - 165	141	0	na	na
WWS-33	shrimp	0	na	na	0	na	na	0	na	na	0	na	na
WWS-34	crab	0	na	na	0	na	na	3	112 - 146	134	0	na	na
WWS-34	shrimp	0	na	na	0	na	na	0	na	na	0	na	na
WWS-35	crab	0	na	na	0	na	na	0	na	na	0	na	na
WWS-35	shrimp	1	84	84	0	na	na	0	na	na	0	na	na
WWS-36	crab	0	na	na	0	na	na	0	na	na	0	na	na
WWS-36	shrimp	0	na	na	0	na	na	0	na	na	0	na	na
WWS-37	crab	0	na	na	0	na	na	0	na	na	0	na	na
WWS-37	shrimp	0	na	na	0	na	na	0	na	na	0	na	na
WWS-38	crab	0	na	na	0	na	na	0	na	na	0	na	na
WWS-38	shrimp	0	na	na	0	na	na	0	na	na	0	na	na

na – not applicable

**Table 5b. Second quarterly crab and shrimp survey results by station**

STATION	TRAP TYPE	SLENDER CRAB ( <i>CANCER GRACILIS</i> )			RED ROCK CRAB ( <i>CANCER PRODUCTUS</i> )			DUNGENESS CRAB ( <i>CANCER MAGISTER</i> )			DOCK SHRIMP ( <i>PANDALUS DANAÉ</i> )		
		# INDIVIDUALS (CPUE)	LENGTH RANGE (mm)	MEAN LENGTH (mm)	# INDIVIDUALS (CPUE)	LENGTH RANGE (mm)	MEAN LENGTH (mm)	# INDIVIDUALS (CPUE)	LENGTH RANGE (mm)	MEAN LENGTH (mm)	# INDIVIDUALS (CPUE)	LENGTH RANGE (mm)	MEAN LENGTH (mm)
WWS-1	crab	0	na	na	8	120 - 175	147	0	na	na	0	na	na
WWS-1	shrimp	2	79 - 81	80	0	na	na	0	na	na	0	na	na
WWS-2	crab	5	64 - 97	79	0	na	na	0	na	na	0	na	na
WWS-2	shrimp	10	66 - 95	78	0	na	na	0	na	na	14	80 - 110	100
WWS-3	crab	15	70 - 134	85	0	na	na	0	na	na	0	na	na
WWS-3	shrimp	7	69 - 81	74	0	na	na	0	na	na	17	86 - 112	103
WWS-4	crab	2	76 - 112	94	5	134 - 175	162	4	131 - 179	152	0	na	na
WWS-4	shrimp	9	71 - 97	84	0	na	na	0	na	na	7	91 - 106	100
WWS-5	crab	20	59 - 105	81	0	na	na	1	102	102	0	na	na
WWS-5	shrimp	4	75 - 82	77	0	na	na	0	na	na	4	90 - 109	101
WWS-6	crab	9	68 - 108	79	0	na	na	0	na	na	0	na	na
WWS-6	shrimp	1	55	55	0	na	na	0	na	na	2	84 - 89	87
WWS-7	crab	15	60 - 101	80	0	na	na	1	105	105	0	na	na

STATION	TRAP TYPE	SLENDER CRAB ( <i>CANCER GRACILIS</i> )			RED ROCK CRAB ( <i>CANCER PRODUCTUS</i> )			DUNGENESS CRAB ( <i>CANCER MAGISTER</i> )			DOCK SHRIMP ( <i>PANDALUS DANAE</i> )		
		# INDIVIDUALS (CPUE)	LENGTH RANGE (mm)	MEAN LENGTH (mm)	# INDIVIDUALS (CPUE)	LENGTH RANGE (mm)	MEAN LENGTH (mm)	# INDIVIDUALS (CPUE)	LENGTH RANGE (mm)	MEAN LENGTH (mm)	# INDIVIDUALS (CPUE)	LENGTH RANGE (mm)	MEAN LENGTH (mm)
WWS-7	shrimp	4	71 - 97	82	0	na	na	0	na	na	2	74 - 112	93
WWS-8	crab	6	62 - 80	73	0	na	na	0	na	na	0	na	na
WWS-8	shrimp	0	na	na	0	na	na	0	na	na	0	na	na
WWS-9	crab	11	64 - 131	90	0	na	na	2	111 - 124	118	0	na	na
WWS-9	shrimp	5	63 - 90	75	0	na	na	0	na	na	4	73 - 102	86
WWS-10	crab	6	61 - 90	75	0	na	na	0	na	na	0	na	na
WWS-10	shrimp	7	57 - 75	67	0	na	na	0	na	na	0	na	na
WWS-11	crab	16	61 - 103	83	0	na	na	0	na	na	0	na	na
WWS-11	shrimp	2	65 - 72	69	0	na	na	0	na	na	2	81 - 83	82
WWS-12	crab	5	89 - 105	96	0	na	na	0	na	na	0	na	na
WWS-12	shrimp	2	59 - 66	63	0	na	na	0	na	na	3	75 - 87	81
WWS-13	crab	3	82 - 101	94	0	na	na	0	na	na	0	na	na
WWS-13	shrimp	7	57 - 76	67	0	na	na	0	na	na	1	66	66
WWS-14	crab	18	73 - 100	87	0	na	na	0	na	na	0	na	na
WWS-14	shrimp	3	62 - 87	77	0	na	na	0	na	na	0	na	na
WWS-15	crab	17	60 - 104	78	0	na	na	0	na	na	0	na	na
WWS-15	shrimp	2	67 - 74	71	0	na	na	0	na	na	0	na	na
WWS-16	crab	12	69 - 104	83	0	na	na	0	na	na	0	na	na
WWS-16	shrimp	10	61 - 108	79	0	na	na	0	na	na	0	na	na
WWS-17	crab	4	64 - 102	85	0	na	na	1	189	189	0	na	na
WWS-17	shrimp	4	66 - 90	84	0	na	na	0	na	na	0	na	na
WWS-18	crab	6	67 - 88	80	0	na	na	1	144	144	0	na	na
WWS-18	shrimp	4	63 - 89	76	0	na	na	0	na	na	1	68	68
WWS-19	crab	4	90 - 105	97	1	180	180	1	150	150	0	na	na
WWS-19	shrimp	2	71 - 77	74	0	na	na	0	na	na	2	72 - 79	76
WWS-20	crab	9	72 - 102	81	0	na	na	0	na	na	0	na	na
WWS-20	shrimp	7	66 - 86	74	0	na	na	0	na	na	1	91	91
WWS-21	crab	7	72 - 107	94	0	na	na	0	na	na	0	na	na
WWS-21	shrimp	1	83	83	0	na	na	0	na	na	0	na	na
WWS-22	crab	4	67 - 84	75	0	na	na	0	na	na	0	na	na
WWS-22	shrimp	2	63 - 68	66	0	na	na	0	na	na	0	na	na
WWS-23	crab	8	62 - 81	74	0	na	na	0	na	na	0	na	na
WWS-23	shrimp	3	65 - 75	70	0	na	na	0	na	na	0	na	na

STATION	TRAP TYPE	SLENDER CRAB ( <i>CANCER GRACILIS</i> )			RED ROCK CRAB ( <i>CANCER PRODUCTUS</i> )			DUNGENESS CRAB ( <i>CANCER MAGISTER</i> )			DOCK SHRIMP ( <i>PANDALUS DANAE</i> )		
		# INDIVIDUALS (CPUE)	LENGTH RANGE (mm)	MEAN LENGTH (mm)	# INDIVIDUALS (CPUE)	LENGTH RANGE (mm)	MEAN LENGTH (mm)	# INDIVIDUALS (CPUE)	LENGTH RANGE (mm)	MEAN LENGTH (mm)	# INDIVIDUALS (CPUE)	LENGTH RANGE (mm)	MEAN LENGTH (mm)
WWS-24	crab	0	na	na	0	na	na	0	na	na	0	na	na
WWS-24	shrimp	0	na	na	0	na	na	0	na	na	0	na	na
WWS-25	crab	0	na	na	0	na	na	0	na	na	0	na	na
WWS-25	shrimp	0	na	na	0	na	na	0	na	na	0	na	na
WWS-26	crab	4	80 - 95	86	0	na	na	2	128 - 141	135	0	na	na
WWS-26	shrimp	1	72	72	0	na	na	0	na	na	0	na	na
WWS-27	crab	1	89	89	0	na	na	2	126 - 142	134	0	na	na
WWS-27	shrimp	0	na	na	0	na	na	0	na	na	0	na	na
WWS-28	crab	0	na	na	0	na	na	0	na	na	0	na	na
WWS-28	shrimp	0	na	na	0	na	na	0	na	na	0	na	na
WWS-29	crab	1	79	79	0	na	na	0	na	na	0	na	na
WWS-29	shrimp	1	94	94	0	na	na	0	na	na	0	na	na
WWS-30	crab	0	na	na	0	na	na	5	126 - 157	141	0	na	na
WWS-30	shrimp	1	29	29	0	na	na	0	na	na	0	na	na
WWS-31	crab	1	97	97	0	na	na	5	131 - 167	144	0	na	na
WWS-31	shrimp	0	na	na	0	na	na	0	na	na	0	na	na
WWS-32	crab	0	na	na	0	na	na	11	108 - 148	129	0	na	na
WWS-32	shrimp	0	na	na	0	na	na	0	na	na	0	na	na
WWS-33	crab	0	na	na	0	na	na	3	129 - 140	135	0	na	na
WWS-33	shrimp	0	na	na	0	na	na	0	na	na	0	na	na
WWS-34	crab	0	na	na	0	na	na	0	na	na	0	na	na
WWS-34	shrimp	0	na	na	0	na	na	0	na	na	0	na	na
WWS-35	crab	0	na	na	0	na	na	0	na	na	0	na	na
WWS-35	shrimp	0	na	na	0	na	na	0	na	na	0	na	na
WWS-36	crab	0	na	na	0	na	na	0	na	na	0	na	na
WWS-36	shrimp	0	na	na	0	na	na	0	na	na	0	na	na
WWS-37	crab	0	na	na	0	na	na	0	na	na	0	na	na
WWS-37	shrimp	0	na	na	0	na	na	0	na	na	0	na	na
WWS-38	crab	0	na	na	0	na	na	0	na	na	0	na	na
WWS-38	shrimp	0	na	na	0	na	na	0	na	na	0	na	na

na – not applicable

**Table 5c. Third quarterly crab and shrimp survey results by station**

STATION	TRAP TYPE	SLENDER CRAB ( <i>CANCER GRACILIS</i> )			RED ROCK CRAB ( <i>CANCER PRODUCTUS</i> )			DUNGENESS CRAB ( <i>CANCER MAGISTER</i> )			DOCK SHRIMP ( <i>PANDALUS DANAÉ</i> )		
		# INDIVIDUALS (CPUE)	LENGTH RANGE (mm)	MEAN LENGTH (mm)	# INDIVIDUALS (CPUE)	LENGTH RANGE (mm)	MEAN LENGTH (mm)	# INDIVIDUALS (CPUE)	LENGTH RANGE (mm)	MEAN LENGTH (mm)	# INDIVIDUALS (CPUE)	LENGTH RANGE (mm)	MEAN LENGTH (mm)
WWS-1	crab	0	na	na	0	na	na	0	na	na	0	na	na
WWS-1	shrimp	0	na	na	0	na	na	0	na	na	0	na	na
WWS-2	crab	17	85-117	103	0	na	na	0	na	na	0	na	na
WWS-2	shrimp	16	82-108	95	0	na	na	0	na	na	0	na	na
WWS-3	crab	3	95-107	102	2	147-152	150	3	130-155	140	0	na	na
WWS-3	shrimp	5	74-96	86	0	na	na	0	na	na	0	na	na
WWS-4	crab	11	77-133	100	0	na	na	18	127-172	144	0	na	na
WWS-4	shrimp	0	na	na	0	na	na	0	na	na	0	na	na
WWS-5	crab	10	64-104	84	0	na	na	0	na	na	0	na	na
WWS-5	shrimp	1	63	63	0	na	na	0	na	na	3	69-81	74
WWS-6	crab	4	76-98	83	0	na	na	1	148	148	0	na	na
WWS-6	shrimp	0	na	na	0	na	na	0	na	na	0	na	na
WWS-7	crab	6	73-106	93	0	na	na	2	156	156	0	na	na
WWS-7	shrimp	2	69-99	84	0	na	na	0	na	na	0	na	na
WWS-8	crab	6	70-93	82	0	na	na	4	114-155	137	0	na	na
WWS-8	shrimp	2	88-95	92	0	na	na	0	na	na	0	na	na
WWS-9	crab	1	94	94	0	na	na	9	110-155	135	0	na	na
WWS-9	shrimp	0	na	na	0	na	na	0	na	na	0	na	na
WWS-10	crab	5	70-101	89	0	na	na	3	124-158	142	0	na	na
WWS-10	shrimp	1	92	92	0	na	na	0	na	na	0	na	na
WWS-11	crab	7	63-110	82	0	na	na	1	132	132	0	na	na
WWS-11	shrimp	7	67-108	78	0	na	na	0	na	na	0	na	na
WWS-12	crab	16	69-101	84	0	na	na	0	na	na	0	na	na
WWS-12	shrimp	5	60-93	82	0	na	na	0	na	na	0	na	na
WWS-13	crab	12	63-99	76	0	na	na	1	155	155	0	na	na
WWS-13	shrimp	4	61-89	75	0	na	na	0	na	na	0	na	na
WWS-14	crab	13	63-94	77	0	na	na	0	na	na	0	na	na
WWS-14	shrimp	11	58-92	77	0	na	na	0	na	na	0	na	na
WWS-15	crab	10	67-101	90	0	na	na	1	145	145	0	na	na
WWS-15	shrimp	1	64	64	0	na	na	0	na	na	0	na	na
WWS-16	crab	13	71-104	87	0	na	na	0	na	na	0	na	na

STATION	TRAP TYPE	SLENDER CRAB ( <i>CANCER GRACILIS</i> )			RED ROCK CRAB ( <i>CANCER PRODUCTUS</i> )			DUNGENESS CRAB ( <i>CANCER MAGISTER</i> )			DOCK SHRIMP ( <i>PANDALUS DANAÉ</i> )		
		# INDIVIDUALS (CPUE)	LENGTH RANGE (mm)	MEAN LENGTH (mm)	# INDIVIDUALS (CPUE)	LENGTH RANGE (mm)	MEAN LENGTH (mm)	# INDIVIDUALS (CPUE)	LENGTH RANGE (mm)	MEAN LENGTH (mm)	# INDIVIDUALS (CPUE)	LENGTH RANGE (mm)	MEAN LENGTH (mm)
WWS-16	shrimp	7	78-108	93	0	na	na	0	na	na	0	na	na
WWS-17	crab	8	73-101	92	0	na	na	1	137	137	0	na	na
WWS-17	shrimp	1	101	101	0	na	na	0	na	na	0	na	na
WWS-18	crab	13	61-108	87	0	na	na	2	93-108	101	0	na	na
WWS-18	shrimp	3	75-91	85	0	na	na	0	na	na	0	na	na
WWS-19	crab	27	66-103	93	0	na	na	0	na	na	0	na	na
WWS-19	shrimp	2	89-98	94	0	na	na	0	na	na	0	na	na
WWS-20	crab	12	76-102	92	0	na	na	0	na	na	0	na	na
WWS-20	shrimp	3	83-85	84	0	na	na	0	na	na	0	na	na
WWS-21	crab	15	66-97	85	0	na	na	0	na	na	0	na	na
WWS-21	shrimp	4	67-92	79	0	na	na	0	na	na	0	na	na
WWS-22	crab	4	55-97	71	0	na	na	0	na	na	0	na	na
WWS-22	shrimp	1	98	98	0	na	na	0	na	na	0	na	na
WWS-23	crab	14	68-100	83	0	na	na	0	na	na	0	na	na
WWS-23	shrimp	3	68-107	89	0	na	na	0	na	na	0	na	na
WWS-24	crab	5	71-102	85	0	na	na	1	133	133	0	na	na
WWS-24	shrimp	0	na	na	0	na	na	0	na	na	0	na	na
WWS-25	crab	0	na	na	0	na	na	0	na	na	0	na	na
WWS-25	shrimp	0	na	na	0	na	na	0	na	na	0	na	na
WWS-26	crab	4	73-108	86	0	na	na	0	na	na	0	na	na
WWS-26	shrimp	5	68-104	93	0	na	na	0	na	na	0	na	na
WWS-27	crab	0	na	na	0	na	na	1	153	153	0	na	na
WWS-27	shrimp	0	na	na	0	na	na	0	na	na	0	na	na
WWS-28	crab	1	69	69	0	na	na	0	na	na	0	na	na
WWS-28	shrimp	0	na	na	0	na	na	0	na	na	0	na	na
WWS-29	crab	0	na	na	0	na	na	3	131-147	138	0	na	na
WWS-29	shrimp	0	na	na	0	na	na	0	na	na	0	na	na
WWS-30	crab	0	na	na	0	na	na	1	154	154	0	na	na
WWS-30	shrimp	0	na	na	0	na	na	0	na	na	0	na	na
WWS-31	crab	0	na	na	0	na	na	3	138-156	145	0	na	na
WWS-31	shrimp	0	na	na	0	na	na	0	na	na	0	na	na
WWS-32	crab	0	na	na	0	na	na	7	142-161	152	0	na	na
WWS-32	shrimp	0	na	na	0	na	na	0	na	na	0	na	na

STATION	TRAP TYPE	SLENDER CRAB ( <i>CANCER GRACILIS</i> )			RED ROCK CRAB ( <i>CANCER PRODUCTUS</i> )			DUNGENESS CRAB ( <i>CANCER MAGISTER</i> )			DOCK SHRIMP ( <i>PANDALUS DANAЕ</i> )		
		# INDIVIDUALS (CPUE)	LENGTH RANGE (mm)	MEAN LENGTH (mm)	# INDIVIDUALS (CPUE)	LENGTH RANGE (mm)	MEAN LENGTH (mm)	# INDIVIDUALS (CPUE)	LENGTH RANGE (mm)	MEAN LENGTH (mm)	# INDIVIDUALS (CPUE)	LENGTH RANGE (mm)	MEAN LENGTH (mm)
WWS-33	crab	0	na	na	0	na	na	4	123-157	144	0	na	na
WWS-33	shrimp	0	na	na	0	na	na	0	na	na	0	na	na
WWS-34	crab	0	na	na	0	na	na	0	na	na	0	na	na
WWS-34	shrimp	0	na	na	0	na	na	0	na	na	0	na	na
WWS-35	crab	0	na	na	0	na	na	0	na	na	0	na	na
WWS-35	shrimp	0	na	na	0	na	na	0	na	na	0	na	na
WWS-36	crab	0	na	na	0	na	na	0	na	na	0	na	na
WWS-36	shrimp	0	na	na	0	na	na	0	na	na	0	na	na
WWS-37	crab	0	na	na	0	na	na	0	na	na	0	na	na
WWS-37	shrimp	0	na	na	0	na	na	0	na	na	0	na	na
WWS-38	crab	0	na	na	0	na	na	0	na	na	0	na	na
WWS-38	shrimp	0	na	na	0	na	na	0	na	na	0	na	na

na – not applicable

**Table 5d. Fourth quarterly crab and shrimp survey results by station**

STATION	TRAP TYPE	SLENDER CRAB ( <i>CANCER GRACILIS</i> )			RED ROCK CRAB ( <i>CANCER PRODUCTUS</i> )			DUNGENESS CRAB ( <i>CANCER MAGISTER</i> )			DOCK SHRIMP ( <i>PANDALUS DANAЕ</i> )		
		# INDIVIDUALS (CPUE)	LENGTH RANGE (mm)	MEAN LENGTH (mm)	# INDIVIDUALS (CPUE)	LENGTH RANGE (mm)	MEAN LENGTH (mm)	# INDIVIDUALS (CPUE)	LENGTH RANGE (mm)	MEAN LENGTH (mm)	# INDIVIDUALS (CPUE)	LENGTH RANGE (mm)	MEAN LENGTH (mm)
WWS-1	crab	1	103	103	9	134-168	152	5	128-168	149	0	na	na
WWS-1	shrimp	1	104	104	0	na	na	0	na	na	0	na	na
WWS-2	crab	14	92-109	99	0	na	na	8	127-165	151	0	na	na
WWS-2	shrimp	4	76-104	90	0	na	na	0	na	na	0	na	na
WWS-3	crab	1	97	97	1	155	155	4	141-165	148	0	na	na
WWS-3	shrimp	0	na	na	0	na	na	0	na	na	0	na	na
WWS-4	crab	7	87-105	100	0	na	na	2	145-153	149	0	na	na
WWS-4	shrimp	2	98-101	100	0	na	na	0	na	na	0	na	na
WWS-5	crab	2	95-101	98	0	na	na	8	147-190	159	0	na	na
WWS-5	shrimp	1	90	90	0	na	na	0	na	na	0	na	na
WWS-6	crab	3	81-110	98	0	na	na	0	na	na	0	na	na
WWS-6	shrimp	5	90-105	98	0	na	na	0	na	na	0	na	na
WWS-7	crab	7	75-104	89	0	na	na	0	na	na	0	na	na



STATION	TRAP TYPE	SLENDER CRAB (CANCER GRACILIS)			RED ROCK CRAB (CANCER PRODUCTUS)			DUNGENESS CRAB (CANCER MAGISTER)			DOCK SHRIMP (PANDALUS DANAЕ)		
		# INDIVIDUALS (CPUE)	LENGTH RANGE (mm)	MEAN LENGTH (mm)	# INDIVIDUALS (CPUE)	LENGTH RANGE (mm)	MEAN LENGTH (mm)	# INDIVIDUALS (CPUE)	LENGTH RANGE (mm)	MEAN LENGTH (mm)	# INDIVIDUALS (CPUE)	LENGTH RANGE (mm)	MEAN LENGTH (mm)
WWS-7	shrimp	2	83-99	91	0	na	na	0	na	na	0	na	na
WWS-8	crab	2	71-96	84	3	128-152	142	2	146-152	149	0	na	na
WWS-8	shrimp	4	73-102	91	0	na	na	0	na	na	0	na	na
WWS-9	crab	2	72-81	77	0	na	na	4	127-150	140	0	na	na
WWS-9	shrimp	7	77-97	85	0	na	na	0	na	na	0	na	na
WWS-10	crab	4	78-102	91	0	na	na	6	144-165	151	0	na	na
WWS-10	shrimp	0	na	na	0	na	na	0	na	na	0	na	na
WWS-11	crab	5	83-108	98	0	na	na	4	120-163	142	0	na	na
WWS-11	shrimp	2	91-101	96	0	na	na	0	na	na	0	na	na
WWS-12	crab	4	69-97	86	0	na	na	1	142	142	0	na	na
WWS-12	shrimp	2	80-104	92	0	na	na	0	na	na	0	na	na
WWS-13	crab	4	79-101	94	0	na	na	4	143-164	155	0	na	na
WWS-13	shrimp	3	73-81	77	0	na	na	0	na	na	0	na	na
WWS-14	crab	3	94	94	0	na	na	0	na	na	0	na	na
WWS-14	shrimp	5	59-102	88	0	na	na	0	na	na	0	na	na
WWS-15	crab	6	82-106	94	0	na	na	3	136-166	148	0	na	na
WWS-15	shrimp	2	67-100	84	0	na	na	0	na	na	0	na	na
WWS-16	crab	16	76-102	90	0	na	na	0	na	na	0	na	na
WWS-16	shrimp	6	71-105	87	0	na	na	0	na	na	0	na	na
WWS-17	crab	2	98-106	102	0	na	na	4	154-170	162	0	na	na
WWS-17	shrimp	2	78-96	87	0	na	na	0	na	na	0	na	na
WWS-18	crab	7	90-108	101	1	165	165	2	155-168	162	0	na	na
WWS-18	shrimp	1	82	82	0	na	na	0	na	na	0	na	na
WWS-19	crab	3	87-110	101	0	na	na	0	na	na	0	na	na
WWS-19	shrimp	0	na	na	0	na	na	0	na	na	0	na	na
WWS-20	crab	8	79-107	90	0	na	na	0	na	na	0	na	na
WWS-20	shrimp	1	95	95	0	na	na	0	na	na	0	na	na
WWS-21	crab	10	73-108	94	1	132	132	1	168	168	0	na	na
WWS-21	shrimp	0	na	na	0	na	na	0	na	na	0	na	na
WWS-22	crab	3	61-70	66	0	na	na	0	na	na	0	na	na
WWS-22	shrimp	0	na	na	0	na	na	0	na	na	0	na	na
WWS-23	crab	8	83-109	92	0	na	na	0	na	na	0	na	na
WWS-23	shrimp	3	61-88	75	0	na	na	0	na	na	0	na	na

STATION	TRAP TYPE	SLENDER CRAB (CANCER GRACILIS)			RED ROCK CRAB (CANCER PRODUCTUS)			DUNGENESS CRAB (CANCER MAGISTER)			DOCK SHRIMP (PANDALUS DANAЕ)		
		# INDIVIDUALS (CPUE)	LENGTH RANGE (mm)	MEAN LENGTH (mm)	# INDIVIDUALS (CPUE)	LENGTH RANGE (mm)	MEAN LENGTH (mm)	# INDIVIDUALS (CPUE)	LENGTH RANGE (mm)	MEAN LENGTH (mm)	# INDIVIDUALS (CPUE)	LENGTH RANGE (mm)	MEAN LENGTH (mm)
WWS-24	crab	4	84-94	89	0	na	na	0	na	na	0	na	na
WWS-24	shrimp	11	68-93	84	0	na	na	0	na	na	0	na	na
WWS-25	crab	2	90	90	0	na	na	0	na	na	0	na	na
WWS-25	shrimp	1	82	82	0	na	na	0	na	na	0	na	na
WWS-26	crab	3	76-102	85	0	na	na	1	129	129	0	na	na
WWS-26	shrimp	2	62-92	77	0	na	na	0	na	na	0	na	na
WWS-27	crab	3	78-100	93	0	na	na	0	na	na	0	na	na
WWS-27	shrimp	8	51-90	78	0	na	na	0	na	na	0	na	na
WWS-28	crab	4	83-102	92	0	na	na	0	na	na	0	na	na
WWS-28	shrimp	1	73	73	0	na	na	0	na	na	0	na	na
WWS-29	crab	0	na	na	0	na	na	0	na	na	0	na	na
WWS-29	shrimp	1	97	97	0	na	na	0	na	na	0	na	na
WWS-30	crab	6	84-107	94	0	na	na	3	145-173	162	0	na	na
WWS-30	shrimp	4	57-96	68	0	na	na	0	na	na	0	na	na
WWS-31	crab	8	67-109	90	0	na	na	0	na	na	0	na	na
WWS-31	shrimp	3	64-92	77	0	na	na	0	na	na	0	na	na
WWS-32	crab	4	70-109	89	0	na	na	1	157	157	0	na	na
WWS-32	shrimp	3	89-92	90	0	na	na	0	na	na	0	na	na
WWS-33	crab	2	78-94	86	0	na	na	2	124-168	146	0	na	na
WWS-33	shrimp	0	na	na	0	na	na	0	na	na	0	na	na
WWS-34	crab	0	na	na	0	na	na	0	na	na	0	na	na
WWS-34	shrimp	0	na	na	0	na	na	0	na	na	0	na	na
WWS-35	crab	0	na	na	0	na	na	0	na	na	0	na	na
WWS-35	shrimp	0	na	na	0	na	na	0	na	na	0	na	na
WWS-36	crab	0	na	na	0	na	na	0	na	na	0	na	na
WWS-36	shrimp	0	na	na	0	na	na	0	na	na	0	na	na
WWS-37	crab	0	na	na	0	na	na	0	na	na	0	na	na
WWS-37	shrimp	0	na	na	0	na	na	0	na	na	0	na	na
WWS-38	crab	0	na	na	0	na	na	0	na	na	0	na	na
WWS-38	shrimp	0	na	na	0	na	na	0	na	na	0	na	na

na – not applicable

**Table 6a. Summary of first quarterly crab and shrimp survey results for the LDW (September 8-11, 2003)**

METHOD	SLENDER CRAB ( <i>CANCER GRACILIS</i> )			RED ROCK CRAB ( <i>CANCER PRODUCTUS</i> )			DUNGENESS CRAB ( <i>CANCER MAGISTER</i> )			DOCK SHRIMP ( <i>PANDALUS DANAÉ</i> )		
	# INDIVIDUALS (CPUE)	LENGTH RANGE (mm)	MEAN LENGTH (mm)	# INDIVIDUALS (CPUE)	LENGTH RANGE (mm)	MEAN LENGTH (mm)	# INDIVIDUALS (CPUE)	LENGTH RANGE (mm)	MEAN LENGTH (mm)	# INDIVIDUALS (CPUE)	LENGTH RANGE (mm)	MEAN LENGTH (mm)
Crab trap	228	65 - 115	94	24	113 - 184	140	56	87 - 185	149	0	na	na
Shrimp trap	66	60 - 104	85	0	na	na	0	na	na	1	92	92
<b>All traps</b>	<b>294</b>	<b>60 - 115</b>	<b>92</b>	<b>24</b>	<b>113 - 184</b>	<b>140</b>	<b>56</b>	<b>87 - 185</b>	<b>149</b>	<b>1</b>	<b>92</b>	<b>92</b>

na – not applicable

**Table 6b. Summary of second quarterly crab and shrimp survey results for the LDW (November 20-23, 2003)**

METHOD	SLENDER CRAB ( <i>CANCER GRACILIS</i> )			RED ROCK CRAB ( <i>CANCER PRODUCTUS</i> )			DUNGENESS CRAB ( <i>CANCER MAGISTER</i> )			DOCK SHRIMP ( <i>PANDALUS DANAÉ</i> )		
	# INDIVIDUALS (CPUE)	LENGTH RANGE (mm)	MEAN LENGTH (mm)	# INDIVIDUALS (CPUE)	LENGTH RANGE (mm)	MEAN LENGTH (mm)	# INDIVIDUALS (CPUE)	LENGTH RANGE (mm)	MEAN LENGTH (mm)	# INDIVIDUALS (CPUE)	LENGTH RANGE (mm)	MEAN LENGTH (mm)
Crab trap	209	59 - 134	83	14	120 - 180	155	39	102 - 189	136	0	na	na
Shrimp trap	101	29 - 108	75	0	na	na	0	na	na	60	66 - 112	96
<b>All traps</b>	<b>310</b>	<b>29 - 134</b>	<b>80</b>	<b>14</b>	<b>120 - 180</b>	<b>155</b>	<b>39</b>	<b>102 - 189</b>	<b>136</b>	<b>60</b>	<b>66 - 112</b>	<b>96</b>

na – not applicable

**Table 6c. Summary of third quarterly crab and shrimp survey results for the LDW (February 16-19, 2004)**

METHOD	SLENDER CRAB ( <i>CANCER GRACILIS</i> )			RED ROCK CRAB ( <i>CANCER PRODUCTUS</i> )			DUNGENESS CRAB ( <i>CANCER MAGISTER</i> )			DOCK SHRIMP ( <i>PANDALUS DANAÉ</i> )		
	# INDIVIDUALS (CPUE)	LENGTH RANGE (mm)	MEAN LENGTH (mm)	# INDIVIDUALS (CPUE)	LENGTH RANGE (mm)	MEAN LENGTH (mm)	# INDIVIDUALS (CPUE)	LENGTH RANGE (mm)	MEAN LENGTH (mm)	# INDIVIDUALS (CPUE)	LENGTH RANGE (mm)	MEAN LENGTH (mm)
Crab trap	237	55-133	88	2	147-152	150	66	93-172	142	0	na	na
Shrimp trap	84	58-108	86	0	na	na	0	na	na	3	69-81	74
<b>All traps</b>	<b>321</b>	<b>55-133</b>	<b>88</b>	<b>2</b>	<b>147-152</b>	<b>150</b>	<b>66</b>	<b>93-172</b>	<b>142</b>	<b>3</b>	<b>69-81</b>	<b>74</b>

na – not applicable

**Table 6d. Summary of fourth quarterly crab and shrimp survey results for the LDW (May 24-27, 2004)**

METHOD	SLENDER CRAB ( <i>CANCER GRACILIS</i> )			RED ROCK CRAB ( <i>CANCER PRODUCTUS</i> )			DUNGENESS CRAB ( <i>CANCER MAGISTER</i> )			DOCK SHRIMP ( <i>PANDALUS DANAÉ</i> )		
	# INDIVIDUALS (CPUE)	LENGTH RANGE (mm)	MEAN LENGTH (mm)	# INDIVIDUALS (CPUE)	LENGTH RANGE (mm)	MEAN LENGTH (mm)	# INDIVIDUALS (CPUE)	LENGTH RANGE (mm)	MEAN LENGTH (mm)	# INDIVIDUALS (CPUE)	LENGTH RANGE (mm)	MEAN LENGTH (mm)
Crab trap	161	61-110	93	15	128-168	150	65	120-190	152	0	na	na
Shrimp trap	87	10-105	85	0	na	na	0	na	na	0	na	na
<b>All traps</b>	<b>248</b>	<b>10-110</b>	<b>90</b>	<b>15</b>	<b>128-168</b>	<b>150</b>	<b>65</b>	<b>120-190</b>	<b>152</b>	<b>0</b>	<b>na</b>	<b>na</b>

na – not applicable

## 4.0 References

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