

# Lower Duwamish Waterway Group

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

## LOWER DUWAMISH WATERWAY FISHERS STUDY WORK PLAN

**FINAL**

### Prepared for:

**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
AOC	Administrative Order on Consent
API	Asian and Pacific Islander
DOH	Washington State Department of Health
Ecology	Washington State Department of Ecology
ECOSS	Environmental Coalition of South Seattle
EPA	US Environmental Protection Agency
FS	feasibility study
LDW	Lower Duwamish Waterway
LDWG	Lower Duwamish Waterway Group
Public Health	Public Health - Seattle & King County
RI	remedial investigation
T-105	Terminal 105
WDFW	Washington State Department of Fish and Wildlife
Windward	Windward Environmental LLC

## Executive Summary

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This work plan presents the approach for the Lower Duwamish Waterway (LDW) fishers<sup>1</sup> study being conducted by the Lower Duwamish Waterway Group (LDWG) under the Administrative Order on Consent (AOC) (EPA and Ecology 2000). The goal of the fishers study is to gather information from people who either harvest or consume seafood from the LDW or who may assist in understanding aspects of LDW seafood consumption in order to improve the effectiveness of institutional controls related to seafood consumption during and following the upcoming sediment cleanup. This document describes the technical work to be conducted for the fishers study, including data collection, data analysis, and discussion of the results with the US Environmental Protection Agency (EPA), the Washington State Department of Ecology (Ecology), Public Health – Seattle & King County (Public Health), the Washington State Department of Health (DOH), and the community.

Two key questions are being investigated in the study: 1) How is the LDW currently being used for the collection and consumption of seafood, particularly resident seafood? 2) What is currently known by the community about the risks of consuming seafood collected from the LDW? These questions will form the basis for the year-long survey to be conducted as part of the study. The survey will be designed based on input from public health advisors and the community as well as key lessons learned and data gaps identified in other seafood consumption studies that have been conducted in the LDW.

LDWG will conduct the study (from design through report generation), with oversight by EPA and Ecology. Advisors from Public Health and DOH will provide input throughout the study as will community representatives, who will provide valuable information regarding their communities. Windward Environmental LLC (Windward) will coordinate the study activities for LDWG, produce the required deliverables, and manage the data. The Environmental Coalition of South Seattle (ECOSS) will review deliverables, conduct interviews with community representatives to help design the study and survey, and will implement both the pilot test and the survey. Triangle Associates will provide input into community outreach.

There are six tasks associated with the LDW fishers study: work plan preparation, identification of the population to be surveyed and development of the survey questions, implementation plan development, pilot test and implementation plan finalization, survey implementation, and data analysis and report generation. The formal deliverables for the LDW fishers study are this work plan (draft and final), an

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<sup>1</sup> The term “fishers” is used in this study to refer to anyone who harvests seafood (with the exception of the commercial catch of salmon by Muckleshoot tribal members) from the LDW. Seafood harvested may include both fish and shellfish (e.g., crabs, clams, mussels). Similarly, the term “fishing” is used in this study to refer to the harvest of any of these types of seafood.

implementation plan (draft and final), and a data report (draft and final). The year-long survey is scheduled to begin in early 2014, with the final report being completed in 2015.

# 1 Introduction

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The Washington State Department of Health (DOH) has issued the following seafood consumption advisories (WSDOH 2005) for the Lower Duwamish Waterway (LDW):

- ◆ No resident fish (e.g., English sole, starry flounder, perch) or crabs from the LDW should be consumed because of PCB contamination. This recommendation does not include salmon or other non-resident fish.
- ◆ The consumption of shellfish (e.g., crabs) from the LDW should be avoided due to potential chemical and biological contamination.
- ◆ For Chinook salmon throughout Puget Sound, no more than one meal per week should be consumed; for blackmouth Chinook salmon, no more than two meals per month should be consumed (WSDOH 2008).
- ◆ Furthermore, DOH recommends that future updates of the LDW seafood consumption advisory be based on long-term fish and shellfish tissue monitoring trends and that the Washington State Department of Fish and Wildlife (WDFW) restrict or actively discourage fishing for LDW resident species to support the protection of public health (WSDOH 2005).

These advisories are referenced in the recently released US Environmental Protection Agency (EPA) Proposed Plan (2013) for the LDW, which outlines proposed sediment cleanup in the LDW. Despite the remediation of contaminated sediment through dredging, capping, enhanced natural recovery, and monitored natural recovery, risks from seafood consumption following the sediment cleanup are predicted to be greater than certain risk thresholds for human health (depending on the amount of seafood consumed). Therefore, seafood consumption advisories (at some level) are expected to remain in effect and will be included as an institutional control. The purpose of this fishers study is to improve the effectiveness of institutional controls related to seafood consumption advisories.

This work plan discusses the study goal (Section 2); existing information and data needs identified in previous studies that involved fishing in or the consumption of seafood from the LDW (Section 3); study tasks and roles and responsibilities (Section 4); and the project schedule and deliverables (Section 5).

## 2 Study Goal

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The goal of the fishers study is to gather information from people who either harvest or consume seafood from the LDW or who may assist in understanding aspects of LDW seafood consumption in order to improve the effectiveness of institutional controls related to seafood consumption.

The results of the fishers study are expected to provide information on the following:

- ◆ **How is the LDW currently being used for the collection and consumption of seafood, particularly resident seafood?** Who is fishing on the river? Why? Where? When? What is being caught, and what is being done with the catch? Who is preparing and eating the seafood? How is it being prepared?
- ◆ **What is currently known by the community about the risks of consuming seafood collected from the LDW?** Do the various fisher groups know about the seafood consumption advisories and risks? How are they currently getting this information? If people are continuing to fish, why? How do people understand risk? What are the perceptions/cultural models of risk among the groups that fish for and consume LDW seafood?

Once the fishers study has been completed, EPA and the Washington State Department of Ecology (Ecology) will be better able to answer the following questions:

- ◆ How could risk communication in general be improved?
- ◆ How could the effectiveness of current seafood consumption advisories be improved?
- ◆ Are there alternative approaches to communicating risk that would be more effective?
- ◆ What communication venues would be most trusted and effective?

The study will not be used to generate quantitative seafood consumption rates. In addition, risk communication/outreach measures to be implemented during or following the fishers study are not included in this scope; these measures will be explored using different mechanisms and potentially with different parties or groups. Also, the study will not address potential mitigation measures. Mitigation alternatives are part of the institutional control plan effort that will be led by EPA and Ecology.



## **3 Review of Existing Information and Identification of Data Needs**

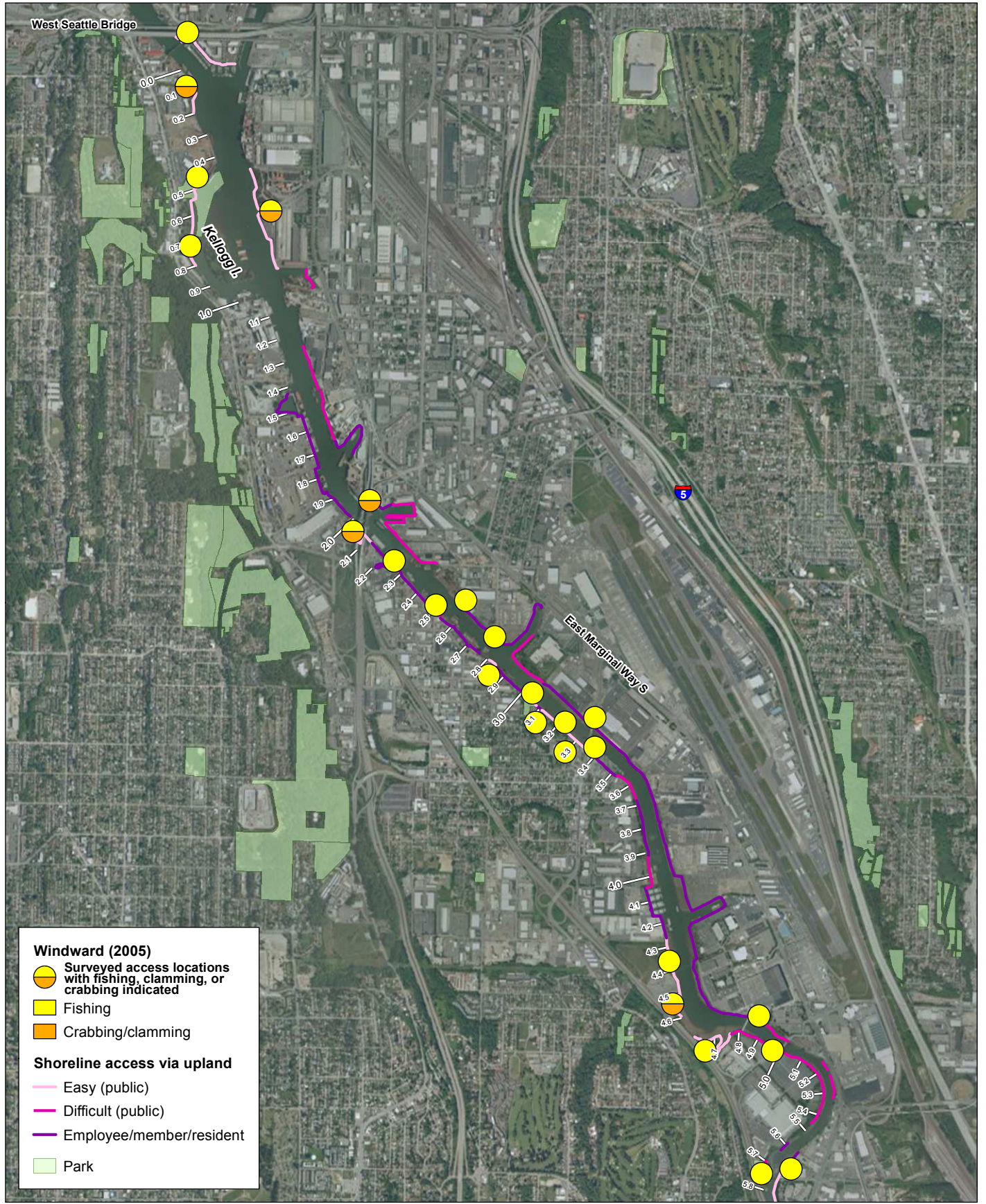
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To assist in planning the fishers study, a review of existing information was performed. This section briefly describes the results of the LDW human access survey (Windward 2005) (Section 3.1), a summary of existing seafood consumption studies (Section 3.2), and the key findings of those studies, including data needs (Section 3.3).

### **3.1 HUMAN ACCESS SURVEY RESULTS**

The physical setting of the LDW dictates how and where people might fish in the waterway. This information will be helpful in designing and implementing the fishers study. The physical setting of the LDW and the potential for human access of the waterway have been previously summarized in a technical memorandum that described potential human access locations on the LDW (Windward 2005). This memorandum is attached as Appendix A to this work plan, for reference.

Potential human uses of the LDW (including fishing) based on the survey and observations by survey participants at each numbered site of the survey are summarized in Appendix A (Table 3-3 and Figures 3-1a through 3-1d); only fishing and harvesting uses are summarized in Map 1. The majority of the potential human access locations identified during the land portion of the human access survey were at King County, City of Seattle, and Port of Seattle public access areas and parks or street ends.



Shoreline access via the upland was separated into three categories: easy public access, difficult public access, and employee/member/resident access. Shoreline areas not assigned to any of these categories were not accessible by land or the access is unknown. No attempt was made during the survey to identify the frequency of use. All of the surveys conducted via land, motorboat, or kayak were done on weekdays.

The human access survey (Windward 2005) reported 7 sites (E1 to E7 on Figures 3-1a to 3-1d in Appendix A) on the eastern side of the LDW (Appendix A, Table 3-3) and 18 sites (W1 to W18 on Figures 3-1a to 3-1d in Appendix A) on the western side of the LDW (Appendix A, Table 3-3) that are accessible to the public from land (Map 1). Two additional sites (C1 and C2, Figure 3-1a in Appendix A) were identified as being accessible to the public from land on the southern end of Harbor Island (Appendix A, Table 3-3). Appendix B of the human access survey (Appendix A) provides a link to photographs taken at locations in the LDW.

As described in Appendix A, the ease of public access to the LDW is highly variable (Appendix A, Figure 3-1b). There are many stretches of the LDW where several hundred feet of shoreline have either easy public access or employee/member/resident access. In contrast, other segments of the LDW have difficult access from land. Presumably, the general public may fish at all locations that have been designated as easy access (Map 1), and homeowners can fish along the shorelines of their properties. Fishing access is more restricted within industrial properties, with some access at specified areas for employees or group members. The quality of these areas for fishing is not well known, but the maps indicate that the majority of locations evaluated on both sides of the river (i.e., 25 of the 28 locations with pie graphs on Figures 3-1a through 3-1d of Appendix A<sup>2</sup>) could be potential fishing locations based on observations during field surveys or interviews. These maps are useful in understanding the locations where river access, and therefore the potential for shore fishing may occur, particularly for people who are not employees/members/residents with properties on the LDW. Access issues are not applicable to the Muckleshoot Indian Tribe and Suquamish Tribe, which are both federally recognized Tribes with usual and accustomed fishing rights in the area. The Muckleshoot Indian Tribe currently conducts seasonal commercial, ceremonial, and subsistence netfishing operations in the LDW. The Suquamish Tribe actively manages resources north (downstream) of the Spokane Street Bridge, located just north of the LDW.

The LDW human access survey (Windward 2005) did not include the Spokane Street Bridge. Although not a part of the LDW site, the bridge is immediately downstream of the LDW and thus will be included in the fishers study. During a creel study of the LDW and Elliott Bay in the late 1990s (King County 1999), Harbor Island East (also

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<sup>2</sup> Of the 28 locations evaluated in the LDW human use survey (Windward 2005), Map 1 shows only the 25 locations identified as having potential fishing/harvesting.

called the Spokane Street Bridge) was identified as the third most populous fishing location, after two locations in Elliott Bay. Results of the King County study (1999) are discussed in more detail in Section 3.2.

## **3.2 REVIEW OF EXISTING SEAFOOD CONSUMPTION STUDIES**

This section provides a review of existing regional seafood consumption studies (not including tribal seafood consumption studies) (Section 3.2.1), as well as other recent non-regional studies that may be relevant (Section 3.2.2). Each of these studies was reviewed to determine how it might be useful in understanding fishing in and the consumption of seafood from the LDW, as well as in planning the fishers study. Key findings from the studies and identified data needs are summarized in Section 3.3.

### **3.2.1 Existing regional studies/surveys**

The following regional studies/surveys were reviewed:

- ◆ Amber Lenhart's Master's thesis, in progress (Lenhart 2013)
- ◆ An Evaluation of Fish Consumption and Environmental Concern in Low Income and Food Insecure Populations in Seattle (Schmidt 2011)
- ◆ Survey of Duwamish River angler awareness of fish advisory survey to determine the effectiveness of signage evaluation (Barry 2013)
- ◆ Lower Duwamish Waterway Outreach Summary (ECOSS 2011)
- ◆ Mercury and arsenic exposure in Japanese and Korean communities (Tsuchiya et al. 2008a; 2008b; 2009)
- ◆ Asian and Pacific Islander (API) seafood consumption study in King County, Washington (EPA 1999)
- ◆ *King County Combined Sewer Overflow Water Quality Assessment for the Duwamish River and Elliott Bay* (King County 1999)
- ◆ Recreational fishing surveys of Puget Sound (Landolt et al. 1985, 1987)

These studies/surveys were reviewed to aid in the design and implementation of the fishers study. The authors of King County (1999), Barry (2013), and Lenhart (2013) were contacted directly to solicit additional information about the studies. The other studies were reviewed based on published reports or articles because they were less focused on the LDW.

Barry (2013), Environmental Coalition of South Seattle (ECOSS) (2011), and King County (1999) indicated that people are catching and consuming seafood from the LDW. These studies/surveys found that fishers are targeting species for which there is

not an LDW-specific consumption advisory (such as salmon<sup>3</sup>) and that fishers are also collecting crabs and bottom fish despite recommendations/ advisories against their consumption.<sup>4</sup>

Some anecdotal information about fishing in the LDW can also be gleaned from online forums. For example, Washington Lakes.com (Washington Lakes 2013) features several posts from people related to fishing in the LDW, which may be useful for targeting when and where people may be fishing in the LDW.

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<sup>3</sup> Salmon caught in the LDW have similar contaminant concentrations as salmon caught elsewhere in Puget Sound (WSDOH 2008). The following advisories apply to both Puget Sound and Duwamish River salmon (WSDOH 2008): Chinook salmon (limit consumption to one meal per week), blackmouth Chinook salmon (limit consumption to two meals per month). There are no meal restrictions for coho, chum, pink, or sockeye salmon. Note that at the time that the King County (1999) survey was conducted, there were no advisories for salmon for Puget Sound.

<sup>4</sup> As discussed in Section 1, advisories against the consumption of resident fish and shellfish in the LDW have been in place since 2005 (WSDOH 2005). Prior to that, and in the 1990s when the King County (1999) survey was conducted, there were signs along the LDW stating that bottom fish, crabs, and shellfish might be unsafe to eat due to pollution.

**Table 1. Regional seafood consumption studies**

Study/Survey	When Conducted	Geographic Area	Objective(s)	Key Results	Lessons Learned
Amber Lenhart's Master's thesis (Lenhart 2013)	In progress (2012-2013)	Central and south Seattle	Learn about factors that generally influence fishing activity and fish consumption in urban (Seattle) waters among population groups that have fishing/fish traditions. Learn more about how people choose where to fish.	Study gathered information (through focus groups) about who is fishing and who may fish in the future in the LDW. Recruitment is mainly through a key contact from the Mien community. Focus groups with 36 participants (mostly Mien or Lao) have been completed with 2 to 3 more focus groups anticipated before data analysis begins in summer 2013. Preliminary findings indicated that fishing was done by Hispanic, Vietnamese, Mien, Lao, Khmer, Filipino, and Hungarian people (though not necessarily in the LDW). Preliminary findings also indicated that people travel several miles to go fishing.	Initial plan to recruit study participants from food bank did not work. Researcher went to community organizations and used a snowball (i.e., chain referral) approach for recruitment. Foreign language skills required for many focus groups.
Evaluation of Fish Consumption and Environmental Concern in Low Income and Food Insecure Populations in Seattle (Schmidt 2011)	February and March 2011	South Park and Rainier Beach	Evaluate fish consumption and environmental concern among food bank clients.	Reported rates of fish consumption and 40% prevalence of fishing as a food source among clients at the South Park and Rainier Valley food banks. Sixteen respondents (of 199 food bank clients interviewed) reported fishing in the Duwamish River. Seven fished seasonally during the summer for salmon. Six respondents said they got the majority of the fish they consumed from local bodies of water (including all of Puget Sound).	Fish consumption was common among individuals in the study (who were also all low-income), among diverse racial and ethnic groups
Survey of Duwamish River angler awareness of fish advisory survey to determine the effectiveness of signage evaluation (Barry 2013)	July 23 through August 7, 2010 (weekends and some evenings during a salmon season)	Fishing piers at Spokane Street Bridge and T-105	Determine effectiveness of LDW advisory signs.	Fishers were consuming LDW bottom fish and/or crabs. There is poor understanding of immediate versus long-term health effects of contaminated seafood among the respondents. The current advisory approach was viewed as not adequate by the survey authors. Subsistence fishing was not thought to be common but may occur. At least 57 fishers (not necessarily unique) were observed on eight different days at the Spokane Street Bridge. At least 29 fishers (not necessarily unique) were observed on three different days at T-105. This sample size may be representative, but this is not known.	Recommended trying different fishing locations and different times of day and conducting focus groups to better understand number of fishers. Foreign language skills required for many interviews.

Study/Survey	When Conducted	Geographic Area	Objective(s)	Key Results	Lessons Learned
Lower Duwamish Waterway Outreach Summary (ECOSS 2011)	November and December 2010	South Seattle, Skyway, central Seattle, and Federal Way	Raise awareness of LDW risks; explain FS public comment period; answer and record community concerns.	<p>Study reported that "several" people said they knew of others who fished in the LDW. East African Christians eat fish about twice per week and each of the 40 days before Easter. "Many" people, particularly from East African communities, reported purchasing fish directly from people who had caught fish themselves, outside of grocery stores, such as at roadside stands, as well as obtaining fish from friends and relatives who fish. In most cases they did not know where the fish came from.</p> <p>This effort was not designed to assess the number of LDW fishers. Only two people (of 1,005 people contacted) reported fishing on the LDW, but this was not a focused effort to identify LDW fishers based on geography or activities.</p>	Learned that most people did not know LDW by location (study had large geographic area). It is important to partner with community organizations.
Mercury and arsenic exposure in Japanese and Korean communities (Tsuchiya et al. 2008a; 2008b; 2009)	2005 to 2006	Puget Sound area	Obtain seafood intake data, determine mercury seafood tissue concentrations for various species consumed, and examine hair and toenails of study participants for mercury levels.	<p>Fish consumption rates were identical for the Japanese (n = 106) and Korean (n = 108) women surveyed. The Korean women consumed more shellfish, and the Japanese women consumed more salmon. Fish and seafood for both groups were commonly purchased at local Asian grocery stores.</p> <p>This effort was not specific to the LDW, and most of the consumption documented was of store-bought fish and seafood.</p>	Mercury intakes rates for the two groups varied substantially because of different consumption behaviors. The Japanese group had higher mercury intake due to higher finfish consumption.
API seafood consumption study in King County, Washington (EPA 1999)	1997	King County (primarily the International District of Seattle)	Describe seafood consumption by members of the API community in King County.	<p>About 33% of respondents "fish" although most seafood consumed was shellfish purchased from stores. Did not ask about specific harvest location because this was deemed culturally intrusive. Mien, Hmong, and Laotians seemed to harvest seafood more than did other groups (up to ~30% average of total consumed by category). Vietnamese harvested 23% of the bottom fish they consumed.</p> <p>No specific information about fishing locations was collected.</p>	Further study of Hmong, Laotian, Mien, and Vietnamese was recommended because they harvest more local seafood. Six percent of fishers reported being concerned about safety of fish. Education beyond high school was related to use of posted warning signs, pamphlets, and telephone information services. Translational and foreign language capabilities were needed for several groups. Community participation was emphasized throughout the study.

Study/Survey	When Conducted	Geographic Area	Objective(s)	Key Results	Lessons Learned
<i>King County Combined Sewer Overflow Water Quality Assessment for the Duwamish River and Elliott Bay</i> (King County 1999)	Ten Saturdays, ten Sundays, and ten weekdays between June 22, 1997, and August 30, 1997	LDW and Elliott Bay	Determine amounts and types of seafood collected in the LDW and Elliott Bay.	<p>During survey period, most people approached at least initially agreed to participate.</p> <p>Study stated that they did not attempt to estimate the total number of fishers and people who consume LDW or Elliott Bay seafood. At all LDW locations, 31 surveys were at least partially completed with people fishing in the LDW (T-105, Diagonal Avenue South, Duwamish Waterway Park, Boeing parking lot trail, The Rapids), and 192 were at least partially completed at Harbor Island East (the Spokane Street Bridge).</p> <p>The study found that Elliott Bay and LDW fishers (combined) ate the seafood they caught, gave it away, released it, or used it as bait. The study overall found that most of the species collected were crabs, followed by salmon and perch, with salmon contributing the greatest proportion by weight.</p>	Report only stated limitations to estimating annual consumption and noted the results may be overestimated because the study focused on people found to be fishing. They stated that the study would tend to underestimate the true number of fishers due to bias inherent in creel surveys.
Recreational fishing surveys of Puget Sound (Landolt et al. 1985, 1987)	1983 to 1985	Commencement Bay, Sinclair Inlet, Elliott Bay, and Edmonds	Determine overall exposure to contaminants through the consumption of fish caught by recreational anglers.	The Spokane Street Bridge appears to have been the only Duwamish site included in this survey of 4,181 shoreside anglers. Results were presented for all locations in Elliott Bay combined (including the Spokane Street Bridge among many other locations). There was a follow-up to the shoreside angler survey, but it focused on boating anglers, which make up only about 4% of total anglers. All Elliott Bay interviews were performed at the Armeni Boat Ramp in West Seattle, near Alki Beach.	In Landolt et al. (1985), fishing activity peaked between 6 p.m. and midnight and was greatest during the autumn. Squid, hake, tomcod, pollock, and Pacific cod were the most commonly taken species. Most fishers ate only fillets, and catches were usually consumed by more than one person. Anglers were primarily Caucasian. Given that this study is almost 30 years old, the fishing use and demographics may have changed dramatically.

Note: Seafood includes marine and freshwater fish and shellfish.

API – Asian and Pacific Islanders

EPA – US Environmental Protection Agency

T-105 – Terminal 105

ECOSS – Environmental Coalition of South Seattle

LDW – Lower Duwamish Waterway



Table 2 provides some summary information from Barry (2013); the fishing locations and results are summarized in Map 2. As shown in Table 2, most fishers at the Spokane Street Bridge were fishing for salmon, while fishers at Terminal 105 (T-105) were more opportunistic. The preferred language of fishers at the Spokane Street Bridge was English followed by Vietnamese, then Tagalog and Spanish, and then several other East Asian languages. Information on fishing frequency from Barry (2013) was less quantitative, but many fishers (n = 12) at the Spokane Street Bridge and one fisher at T-105 indicated they fish once per week or more in the LDW. Barry (2013) noted that the total number of LDW fishers is unknown because of the small study size and limited survey duration (three weekends).

**Table 2. Fishing information and ethnicity from Barry (2013) study**

Survey Question	Location <sup>a</sup>	
	Spokane Street Bridge (n = 29)	T-105 (n = 3)
<b>What are you fishing for? (% of people reporting they fished for each item)<sup>b</sup></b>		
Salmon	69	100
English Sole	14	100
Flounder	14	100
Perch	17	100
Crabs	24	100
Herring <sup>c</sup>	3	na
<b>What is your preferred language? (% of respondents)<sup>d</sup></b>		
Tagalog	7	
Vietnamese	28	
Cambodian	3	67
Laotian, Cambodian, Thai	3	
Spanish	7	
English	48	33
Mongolian	3	

Source: Barry (2013)

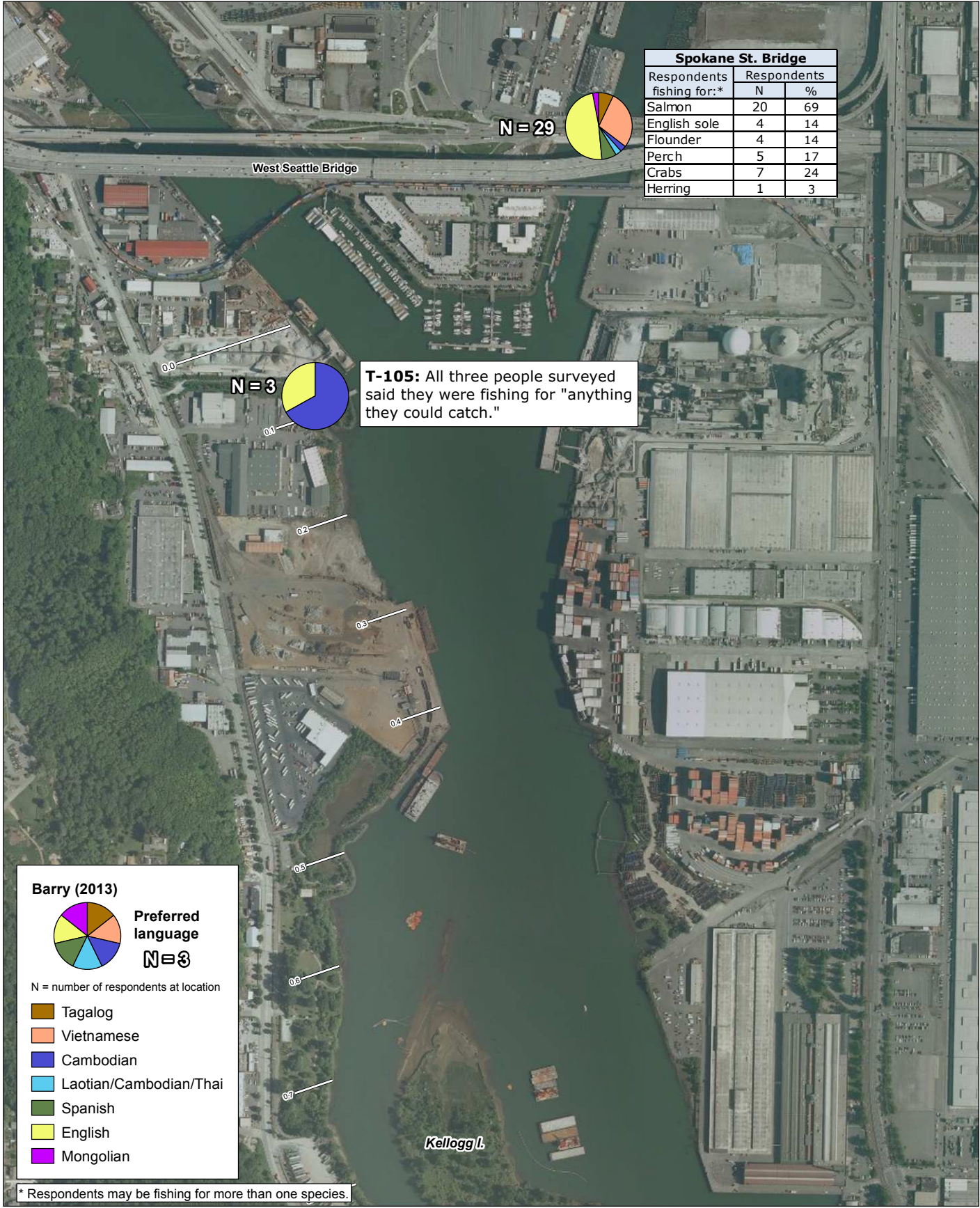
<sup>a</sup> "n" refers to the number of individuals interviewed. The number for the Spokane Street Bridge excluded one individual who was not fishing at the time of survey. The total number also excluded two people interviewed at a South Park coffee shop. The Spokane Street Bridge was called Harbor Island East in King County (1999).

<sup>b</sup> Some of those interviewed answered with more than one response.

<sup>c</sup> This percentage (i.e., one individual) reported specifically fishing for herring; it is not known whether people who were fishing for "anything" would also take herring.

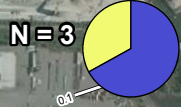
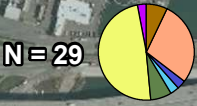
<sup>d</sup> The question regarding preferred language was in relation to how people would like to receive additional information to improve awareness.

T-105 – Terminal 105



**Spokane St. Bridge**

Respondents fishing for:*	Respondents	
	N	%
Salmon	20	69
English sole	4	14
Flounder	4	14
Perch	5	17
Crabs	7	24
Herring	1	3



**T-105:** All three people surveyed said they were fishing for "anything they could catch."

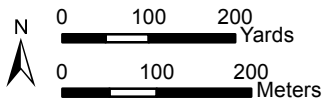
**Barry (2013)**

**Preferred language**  
N = 3

N = number of respondents at location

- Tagalog
- Vietnamese
- Cambodian
- Laotian/Cambodian/Thai
- Spanish
- English
- Mongolian

\* Respondents may be fishing for more than one species.



**Map 2. Fisher survey data from Barry (2013)**

The King County (1999) study, which also presented LDW-specific results, was conducted over one summer during daylight hours (see Table 1). This study surveyed just over 200 fishers from the LDW and Harbor Island East: surveys were at least partially completed with 31 people fishing in the LDW (i.e., T-105, Diagonal Avenue S, Duwamish Waterway Park, Boeing parking lot trail, The Rapids), and surveys were at least partially completed with 192 people fishing at Harbor Island East (i.e., the Spokane Street Bridge), with a range of ethnicities, especially at the Spokane Street Bridge location (Table 3 and Map 3). As indicated on Map 3, most interviews at LDW locations were at T-105 (n = 10) and The Rapids (n = 16). Fish (type not specified but salmon were included) were the most common seafood people were trying to collect (Table 3). No respondents at Harbor Island East or any of the LDW locations reported that they were trying to collect clams. Most respondents did not indicate what they planned to do with their catch (Table 3). Some of the respondents reported the frequency of their fishing efforts (Table 4).

**Table 3. Ethnicity and fishing information from the LDW and Harbor Island East in King County (1999)**

Survey Question	LDW Locations <sup>a</sup>		Harbor Island East <sup>c</sup>	
	Responses (n) <sup>b</sup>	%	Responses (n) <sup>b</sup>	%
<b>What is your ethnic background?</b>				
African American	3	9.7	25	13
Cambodian			13	6.8
Caucasian	22	71	34	17.7
Chinese			5	2.6
Filipino			19	9.9
Laotian	1	3.2	5	2.6
Latino	1	3.2	5	2.6
Japanese			25	13
Korean			2	1
Native American			4	2.1
Vietnamese	2	6.5	27	14.1
Other	2	6.5	10	5.2
No response			18	9.4
<b>What seafood are you collecting today?<sup>d</sup></b>				
Crab	4	12.9	42	21.9
Fish <sup>e</sup>	26	83.9	146	76
Mussel	1	3.2	1	0.5
Squid	0	0	1	0.5
No response	3	9.7	27	14.1

Survey Question	LDW Locations <sup>a</sup>		Harbor Island East <sup>c</sup>	
	Responses (n) <sup>d</sup>	%	Responses (n) <sup>d</sup>	%
<b>What will you do with the seafood you collect at this location?<sup>d</sup></b>				
Bait	1	3.2	10	5.2
Eat myself	2	6.5	5	2.6
Eat with others	3	9.7	14	7.3
Give away	0	0	2	1
Release	1	3.2	2	1
Other	1	3.2	1	0.5
No response	25	80.6	161	83.9
<b>Total number of respondents(n) in study</b>	<b>31</b>		<b>192</b>	

Source: King County (1999)

<sup>a</sup> LDW locations include T-105, Diagonal Avenue South, Duwamish Waterway Park, Boeing parking lot trail, and The Rapids (see Map 3).

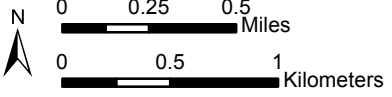
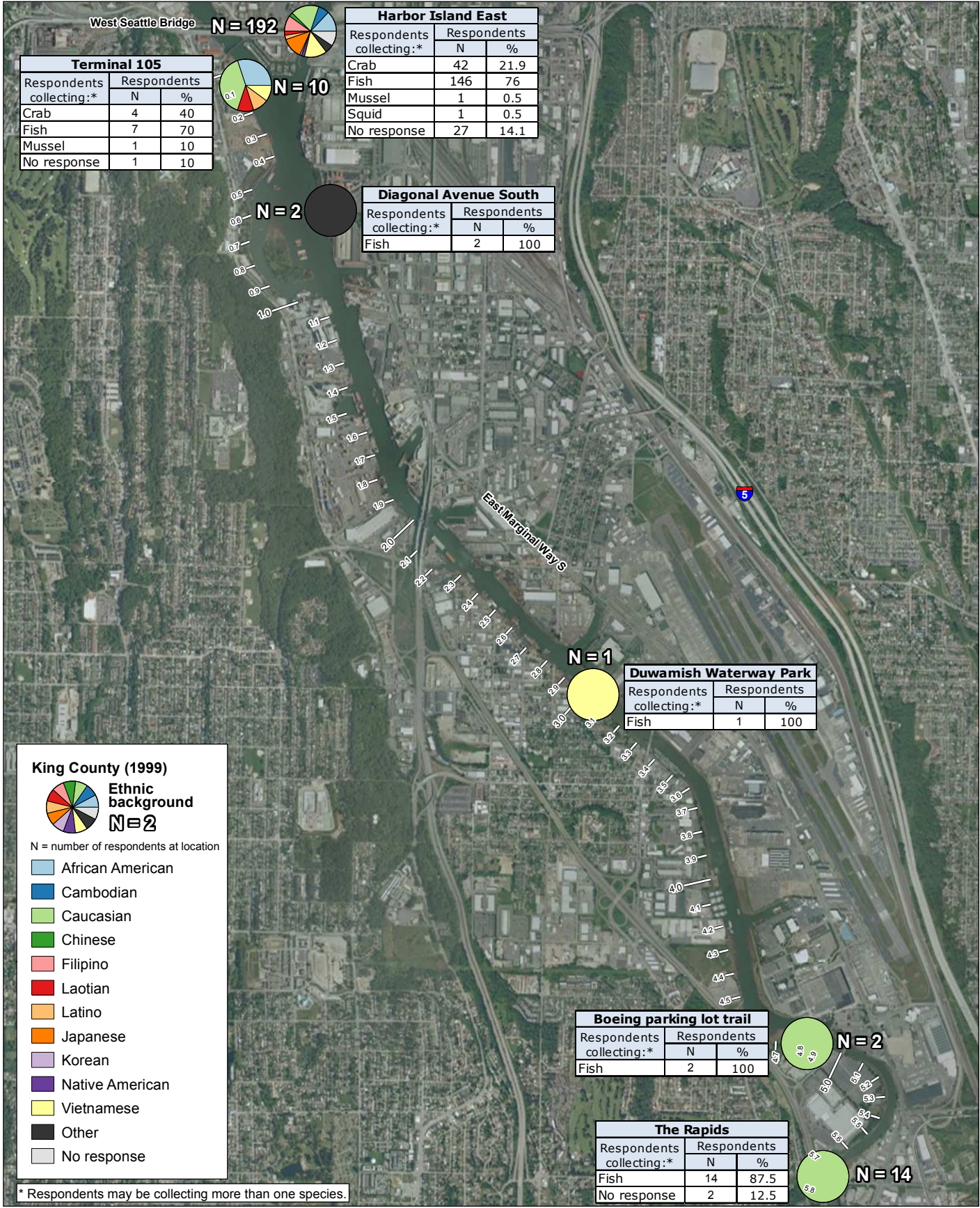
<sup>b</sup> The number of responses reflects the number of individuals with the specified response for each question, except for the final row of the table which lists the total number of respondents at each location.

<sup>c</sup> The location called Harbor Island East in this study is commonly called the Spokane Street Bridge.

<sup>d</sup> Some of those interviewed answered with more than one response.

<sup>e</sup> Any fish, including salmon.

T-105 – Terminal 105



**Map 3. Fisher survey data from King County (1999)**

**Table 4. Fishing frequency for the LDW locations and Harbor Island East in King County (1999)**

Survey Question	Responses (n) <sup>a</sup>	Frequency		
		Min	Max	Mean
<b>How often do you collect at this location? (days/yr)<sup>b</sup></b>				
LDW locations <sup>c</sup>	26	0	56	10.8
Harbor Island East <sup>d</sup>	120	0	168	17.9

Source: King County (1999)

<sup>a</sup> Not all people surveyed provided a response to this question.

<sup>b</sup> Seafood collected includes fish (including salmon) and shellfish.

<sup>c</sup> LDW locations include T-105, Diagonal Avenue South, Duwamish Waterway Park, Boeing parking lot trail, and The Rapids (see Map 3).

<sup>d</sup> The location called Harbor Island East in this study is commonly referred to as the Spokane Street Bridge.

T-105 – Terminal 105

Several of the studies in Table 1 included significant community involvement: Lenhart (2013), Schmidt (2011), and EPA (1999). In the case of EPA (1999), the community was involved in shaping the study design and in participant recruitment. As discussed in Section 2.2, community participation will be an important component of the current study. In the case of Lenhart (2013) and EPA (1999), participants in these studies were also compensated for their time to encourage participation.

### 3.2.2 Recent non-regional studies

Two other studies were reviewed because they were performed recently at other Superfund sites. A phone survey of licensed anglers was performed for Portland Harbor (Sunding and Buck 2012) in Oregon, and a creel angler study was performed for the Lower Passaic River (AECOM [in prep]) in New Jersey. These surveys had different purposes than those of the LDW fishers study but are useful because they were also conducted for Superfund-listed waterways with diverse fishing populations.

The purpose of the Portland Harbor survey (Sunding and Buck 2012) was “to estimate the number of people consuming fish from Portland Harbor on a yearly basis, the levels of Portland Harbor fish consumption among these consumers, and the distribution of resident versus migratory fish consumption for people consuming fish from the Harbor.” A total of 2,176 licensed anglers were interviewed by telephone, although only 32% of these lived within 30 minutes of driving from Portland Harbor. The study also included some qualitative focus groups with five cultural groups in Portland (i.e., African American, Asian American, Hispanic/Latino, Native American, and Russian/Slavic). The Hispanic/Latino focus groups were conducted in Spanish; all other interviews and focus groups were conducted in English. Language barriers were not mentioned as an issue in the study. Two self-identified homeless people were contacted by telephone; efforts to understand fishing within the homeless/transient

community were reported as “on-going.” The study estimated that 7,800 people consume fish from Portland Harbor annually.<sup>5</sup>

The primary objective of the Lower Passaic River creel angler study was “to collect data to support a site-specific baseline human health risk assessment (HHRA) of the Lower Passaic River Study Area” (AECOM [in prep]). This study included boat and land angler counts (approximately 1,800 anglers were observed in 2,450 sightings) and interviews. Interviews were conducted at specific sites during 136 8-hour study days (i.e., 69 weekdays and 67 weekend days or holidays) over four seasons from September 2011 through September 2012. A probability model, which used older creel study data from the Passaic River and socioeconomic data, was used to try to predict the days and times when fishing would be most likely. This information was used to help design the field “intercept” portion of the study. Participant incentives were used in some cases (\$15 gift card to local bait/tackle shop) to help encourage participation in the survey. Staff offered gift cards to individuals who had been approached and refused to participate multiple times and to anglers who had participated multiple times. A total of 15 gift cards were distributed. Most anglers who received a gift card were willing to be interviewed or re-interviewed. Interviews were conducted in both English and Spanish.

### **3.3 SUMMARY OF KEY FINDINGS AND DATA GAPS FROM STUDIES**

Overall, studies to date indicate that fishing occurs on the LDW, but there are still gaps when it comes to understanding who is fishing, who is consuming the catch (if it is retained), why they fish, and why seafood consumption advisories may not be effective. The Barry (2013) and King County (1999) studies provide information about specific fishing locations and language needs that may be helpful in the design of the fishers survey. Information from the forthcoming Amber Lenhart thesis may also prove useful, assuming that the LDW is identified as a fishing location. Barry (2013) and King County (1999) both indicated that locations in the LDW are being fished several times per week by some individuals and people are consuming their catch. Fishing at the Spokane Street Bridge (Harbor Island East) is much more common than at locations on the LDW. Although many of the fishers in both studies were pursuing salmon (this was explicitly asked in Barry (2013), and salmon was observed as catch in King County (1999)), fishers were also collecting resident fish and shellfish despite seafood consumption advisories/recommendations against seafood consumption posted at the time of these surveys. Fishers on the LDW are diverse, and many may prefer to communicate in a language other than English.

These studies provide helpful information for the fisher study, for both the design and implementation of the survey and conducting community outreach. The two recent

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<sup>5</sup> This survey (Sunding and Buck 2012) was conducted only with licensed anglers. Based on Oregon State Police records for citations and warnings, the authors estimated that the percentage of anglers fishing without a license is no more than 13.5%.

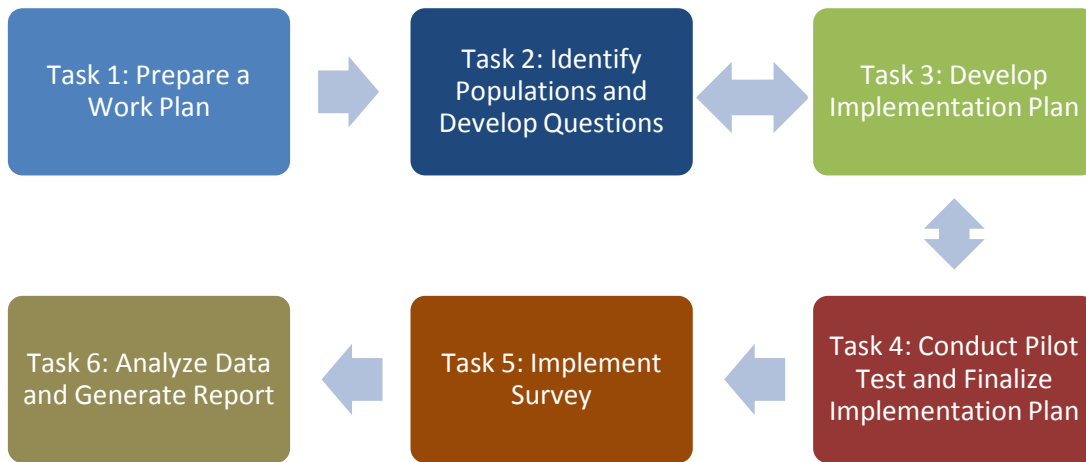
surveys from Portland Harbor and the Lower Passaic River are also useful for providing ideas on different survey approaches (e.g., telephone, observational angler counts) and considerations for surveys performed at Superfund sites. An issue that came up in the Passaic survey, which is also anticipated for the LDW survey, is how to motivate people to participate initially and also repeatedly because the LDW survey, like the Passaic survey, will be conducted over a full year. For the Passaic survey, gift cards were used as incentives, and interviews were kept brief to minimize the imposition of participation in the survey.

The Portland Harbor telephone survey of anglers was able to reach many fishers, but it focused only on licensed anglers and included many fishers who did not fish in Portland Harbor. Because the seafood consumption advisories pertain to LDW resident species, this type of approach may not be appropriate.



## 4 LDW Fishers Study Tasks and Roles and Responsibilities

The fishers study is composed of six tasks (Figure 1), consistent with the tasks in the Administrative Order on Consent (AOC) (EPA and Ecology 2000) and the study goal (Section 2). This section describes the activities associated with those tasks and the roles and responsibilities of the parties involved in these tasks.



**Figure 1. Tasks for the LDW fishers study**

### 4.1 ROLES AND RESPONSIBILITIES

Under the oversight of EPA and Ecology, the Lower Duwamish Waterway Group (LDWG) and its contractors will conduct the fishers study in accordance with the AOC (EPA and Ecology 2000).

Specifically, Windward Environmental LLC (Windward) will provide technical expertise in the fishers study, coordinate the activities for LDWG (including coordination of the activities for subcontractors ECOSS and Triangle), produce the required deliverables, and manage the data. Windward has experience in developing fish consumption studies for environmental justice communities, interpretation of fish consumption survey data, and data management. ECOSS will implement both the pilot study and the survey as well as assist in outreach to the community, development of the implementation plan, and review of deliverables. Triangle Associates will provide input regarding community outreach.

As valued members of the technical team, public health advisors (i.e., representatives of Public Health – Seattle & King County [Public Health] and DOH) will provide input throughout the fishers study. Because Public Health and DOH are responsible for communicating health risk information associated with seafood consumption, representatives from these organizations will provide valuable expertise in developing and implementing the survey, including providing expertise on the use of qualitative

survey methods. The public health advisors will review the documents, including planning documents and results, and will provide input on community outreach, and drafting survey questions. In addition, the public health advisors may help with community representative recruitment and follow-up. Public Health representatives will be compensated by LDWG for their advisory role, whereas DOH representatives (and WDFW representatives, if consulted by DOH) will receive funding for their participation from other sources. Both the Agencies and LDWG will consult with these public health agencies throughout the study.

Community representatives will be involved throughout the fishers study, providing insight into their communities, with the intent to maximize the representation of the various community groups that may fish in or consume seafood from the LDW. These representatives will provide input on the cultural sensitivities associated with implementing and interpreting the study to ensure that the data are representative of the fishing community. The goal is to represent a range of cultural backgrounds, involving organizations that serve different cultural and linguistic groups.

The community representatives will provide input to ensure that the survey questions are being asked in a manner that is culturally appropriate. They will also be asked for input with regard to the content of the draft survey questions (within the scope of this fishers study) and for possible methods to reach survey participants (in addition to finding participants while they are fishing on the LDW). They will be asked to provide feedback on any potential adverse impacts of the survey or its results so that these impacts may be avoided to the extent possible. Methods for the community representatives to provide their input throughout the study (e.g., through the formation of a group and/or individually) will be determined in consultation with the community representatives.

In addition, LDW stakeholders (e.g., Tribes, Duwamish River Cleanup Coalition [DRCC]) that have been participating in the review of remedial investigation/feasibility study (RI/FS) documents will provide input on this work plan, the implementation plan, and the data report through the LDW RI/FS stakeholder process established by EPA and Ecology, which applies to all formal AOC deliverables (including those identified in Sections 4 and 5). In general, this process involves the submittal of a document by LDWG to EPA and Ecology, which then share the document with stakeholders. Stakeholder comments are compiled by EPA and Ecology, shared with LDWG, and may be incorporated into comments submitted by EPA and Ecology to LDWG, which are then addressed by LDWG. For more complex deliverables, LDWG may provide a briefing to stakeholders, usually about a week after stakeholders have received the draft document.

Table 5 summarizes by task the anticipated involvement of each of the different parties. Details on the activities of each task are provided in Sections 4.2.1 through 4.2.6.

**Table 5. Overview of participation in fishers study tasks**

Task	LDWG/ Windward	EPA/ Ecology	ECOSS	Triangle	Public Health Advisors <sup>a</sup>	Community Representatives <sup>b</sup>	Stakeholders <sup>c</sup>
<b>Task 1</b>							
Prepare work plan	X						
Review work plan		X			X		X
<b>Task 2</b>							
Prepare summary of information to be gathered in study	X	X	X		X		
Determine approach to gather community input	X	X	X	X	X		
Conduct interviews with community representatives	X <sup>d</sup>		X		X <sup>d</sup>	X	
Prepare summary of interviews	X		X				
Review interview summary		X			X	X	
<b>Task 3</b>							
Prepare draft implementation plan	X		X		X		
Review draft implementation plan		X			X	X	X
<b>Task 4</b>							
Conduct pilot test and summarize results	X		X				
Review pilot test results	X	X	X		X	X	
Revise implementation plan	X		X		X		
Review final implementation plan		X			X	X	X
<b>Task 5</b>							
Conduct survey			X				
Manage survey data	X						
Provide and receive quarterly updates	X	X	X		X	X	

Task	LDWG/ Windward	EPA/ Ecology	ECOSS	Triangle	Public Health Advisors <sup>a</sup>	Community Representatives <sup>b</sup>	Stakeholders <sup>c</sup>
<b>Task 6</b>							
Summarize preliminary findings	X						
Review preliminary survey findings		X	X		X	X	
Prepare draft data report	X						
Review draft data report		X	X		X	X	X
Prepare draft fact sheet	X				X		
Review draft fact sheet		X	X		X	X	

<sup>a</sup> The term “public health advisors” includes representatives from both Public Health – Seattle & King County and DOH.

<sup>b</sup> The level of participation is up to individuals and may vary. For example, some individuals may decline to review certain items.

<sup>c</sup> Stakeholders are defined by the AOC (EPA and Ecology 2000). Some individuals who are members of groups that are AOC stakeholders may also act as community representatives for the Fisher Study.

<sup>d</sup> A LDWG representative or a public health advisor may also participate in some of the interviews.

AOC – Administrative Order on Consent

DOH – Washington State Department of Health

Ecology – Washington State Department of Ecology

ECOSS – Environmental Coalition of South Seattle

EPA – US Environmental Protection Agency

Public Health – Public Health – Seattle & King County

## **4.2 FISHERS STUDY AOC TASKS**

The tasks described in this section are those included in the first amendment to the AOC (EPA and Ecology 2013).

### **4.2.1 Task 1: Work plan preparation**

This work plan constitutes Task 1 and presents the approach for the LDW fishers study. This work plan summarizes past LDW and regional fishers surveys, and describes the technical work to be conducted for the fishers study, including both information collection and general data analysis efforts.

### **4.2.2 Task 2: Identification of population and question development**

Task 2 lays the groundwork for the development and implementation of the survey. The primary goal of this task is to gather input from community representatives for consideration in the design the study, including specific survey questions as well as survey techniques.

#### **4.2.2.1 Summary of information to be gathered**

LDWG will compile a summary of the types of information that may be gathered as part of the fishers study based on the goals of the fishers study and lessons learned from past studies. This summary will be discussed with EPA/Ecology, the public health advisors, and ECOSS prior to conducting interviews with community representatives. Based on these discussions, a list of questions for the interviews will be developed as well as a plan to document responses.

#### **4.2.2.2 Interviews with community representatives**

Interviews will be conducted with community representatives from a variety of cultural and linguistic groups that may either fish or consume seafood from the LDW. The interviews will be conducted by ECOSS, who may also be accompanied at some interviews by a LDWG representative or a public health advisor. The purpose of these interviews is to obtain feedback on the best way to obtain the information sought in the study, including how and where questions can be asked most effectively to achieve a broad representation of these populations, as well as whether additional questions should be asked that are within the scope of the study. Community representatives may be compensated per standard industry practice.

The interview process may require extra effort to reach non-English or limited-English speakers and economically disadvantaged community members. ECOSS will be reaching out to and communicating with non-English speaking groups as well as the rest of the community. Through these discussions, ECOSS will clearly:

- ◆ State the purpose and goal of the study
- ◆ State the roles and responsibilities of all parties involved with the study

- ◆ Describe details related to study design, duration, critical milestones, compensation, opportunities for and barriers to community participation in the study, and use of study information (benefits and potential harm)
- ◆ Ask how the community representatives would like to be involved in the study, including receiving information and providing feedback on the study
- ◆ Solicit help in identifying specific LDW fishers and seafood consumers, including how to find these individuals and how best to communicate with them (considering the diversity of the LDW fishers and seafood consumers), including survey locations, times, and techniques, as well as which languages might be needed
- ◆ Seek feedback on survey questions, including how and if they should be asked and what will be asked (within the scope of this study) in order to make sure the questions make sense and are not negatively perceived

#### **4.2.2.3 Summary of findings**

Findings from the interviews will be summarized in the form of a table that identifies target populations for the survey, a list of organizations contacted, and a summary of key information obtained. These materials will be submitted for review to EPA/Ecology and the public health advisors. Community representatives will also be welcome to review the summary.

#### **4.2.3 Task 3: Implementation plan development**

Based on input from the interviews and from EPA/Ecology, the public health advisors, and ECOSS, LDWG will draft an implementation plan that describes the survey and how it will be carried out. The implementation plan will present the questionnaire,<sup>6</sup> where and how often interviews will take place, and how the questions will be asked during the survey. The implementation plan will also specify the approach for the pilot test and how the results of the pilot test will be incorporated into the year-long study.

The general study approach will involve a year-long quantitative survey, which may include some open-ended questions (such as asking whether the respondent has anything to add). This survey will be supplemented with qualitative interviews with key informants, if needed (see Section 4.2.5). The survey techniques used will be determined based on study needs, community input, a review of other studies, and a review of EPA guidance on conducting fish consumption surveys (EPA 1998).

It is anticipated that the study will focus primarily on interviewing fishers on the river. If needed, additional surveys will be conducted with individuals off the river, including consumers who are not fishers but who consume seafood from the LDW,

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<sup>6</sup> Note that the questions may later be modified based on the results of the pilot test, if needed.

potentially with a modified questionnaire (which may include additional questions on seafood preparation and consumption). These individuals may be identified using a “snowball” technique wherein existing study subjects suggest future subjects from among their acquaintances. Survey participants may be compensated for their participation in the survey per standard industry practice.

The surveys will be conducted by ECOSS with oversight and assistance by LDWG/EPA/Ecology and assistance by Public Health, as needed. Windward will maintain survey materials and data and perform data analyses.

LDWG and EPA/Ecology will meet with the public health advisors and the community representatives to discuss the draft implementation plan and receive comments; this review will be in addition to the standard stakeholder review process provided under the AOC (EPA and Ecology 2000). EPA will perform a human subjects review of the implementation plan during this time; the overall project schedule may be affected by this review.

#### **4.2.4 Task 4: Pilot test and implementation plan finalization**

##### **4.2.4.1 Pilot test**

A pilot test of the survey questions will be performed. The pilot test will provide information for finalizing the survey questions and the implementation plan.

A small pilot test will be conducted by ECOSS staff to test the survey questions to determine if any revisions are needed. Interviewers will be trained by ECOSS and Public Health, as needed.

The pilot test will include discussions with participants to assess what the questions mean to them and their thought process in responding to ensure that questions are translated correctly and are clear. Pilot test participants may be compensated per standard industry practice.

EPA, Ecology, the public health advisors, and the community representatives will review and provide feedback on the pilot test results as well as any proposed changes to the survey or implementation plan based on the pilot test.

##### **4.2.4.2 Finalize implementation plan**

The implementation plan will be revised by LDWG based on the results of the pilot test and the input received from the EPA during the human subjects review, public health advisors, and the community representatives. Care will be taken in the survey design and data management strategy to ensure that participant confidentiality will be maintained throughout this survey and during any future use of the survey data. The implementation plan will be approved by EPA/Ecology following AOC procedures (EPA and Ecology 2000).

#### **4.2.5 Task 5: Survey implementation**

The survey will be conducted by ECOSS with LDWG/EPA/Ecology/Public Health oversight over the course of 1 year to capture seasonal variability.

The survey will be developed and conducted in English and other languages, as needed, in order to communicate with a diverse population of fishers. EPA/Ecology, public health advisors, and LDWG will determine together which languages are needed based on feedback from the interviews as well as other survey information. ECOSS will provide translation services, as needed. Their current capabilities include Korean, Vietnamese, Cambodian, Spanish, and Somali, but other translation services may also be procured, as needed. Compilation and analysis of the completed survey forms and data management will be conducted by Windward. Translators will assist Windward if survey forms are completed in a language other than English. A qualified field supervisor will ensure that the survey is implemented appropriately. Six to eight months into the survey, up to fifteen key informant interviews may be conducted in which specific issues, such as risk perception, are discussed. Interviews would be conducted by ECOSS (with assistance by Public Health, if needed) for this qualitative portion of the study. Key informants may include community representatives or individuals identified by ECOSS and others during the survey; they will be compensated with gift cards.

EPA, Ecology, the public health advisors, and the community representatives will be updated on a quarterly basis, either through meetings or through a written update. During the survey, the community representatives will provide anecdotal feedback from the community, as available, regarding the perceived effectiveness of survey questions and methods. If it is possible to modify how the survey is being administered in order to better achieve the study goal without jeopardizing study integrity, small changes to the survey design may be made once the survey has begun. Windward will retain hard copies of surveys and act as data manager. Care will be taken to ensure that data are stored in a manner that maintains participant confidentiality.

#### **4.2.6 Task 6: Data analysis and report generation**

This task involves analyzing the survey data, summarizing of results, and reporting of findings.

##### **4.2.6.1 Summarize data**

LDWG will compile the data in a database, perform initial data analysis, and provide summary tables to EPA/Ecology and the public health advisors, and preliminary findings will be discussed. If individual-level data are released, the data will be coded with identifiers removed to preserve participant anonymity.



#### **4.2.6.2 Review preliminary findings**

LDWG, EPA/Ecology, and the public health advisors will meet with the community representatives to discuss the preliminary findings, including a discussion on data use, potential negative impacts, and ways to ensure that there is a correct understanding of the responses (by allowing access to raw survey materials, if needed).

#### **4.2.6.3 Data report**

LDWG will prepare a draft data report for submittal to EPA, Ecology, the public health advisors, the community representatives, and LDW stakeholders for review and comment. The data report will be finalized per the AOC process (EPA and Ecology 2000).

#### **4.2.6.4 Presentation of results**

LDWG will present the final results to the public health advisors and the community representatives using a Microsoft PowerPoint® presentation that will be made available to EPA/Ecology. At this meeting, the community representatives will be encouraged to provide feedback on the community involvement process.

#### **4.2.6.5 Develop a fact sheet**

LDWG will provide a draft fact sheet that summarizes the key results of the study to EPA/Ecology, public health advisors, ECOSS, and community representatives.

## 5 Schedule and Deliverables

A schedule that is consistent with the AOC (EPA and Ecology 2000), is presented in Table 6 and will be maintained for project deliverables. It is anticipated that the survey will begin in 2014 and be completed in 2015.

**Table 6. Schedule for task deliverables**

Task	Deliverable to EPA and Ecology	Completion Schedule
Task 1	Notify EPA and Ecology of contractors/subcontractors	Completed
	draft work plan – outlines fishers study tasks and schedule (for review)	June 13, 2013
	final work plan – outlines the final fishers study tasks and schedule	30 working days after the receipt of EPA/Ecology comments
Task 2	na	Initiated after submittal of the draft work plan
Task 3	draft implementation plan – outlines how the study will be conducted (for review)	45 working days after the submittal of the interview summary (Task 2)
Task 4	final implementation plan – outlines the final plan for how the study will be conducted	30 working days after the receipt of EPA/Ecology comments on the revised draft
Task 5	na	Initiated after final approval of the implementation plan
Task 6	draft data report – summarizes the results of the study (for review)	60 working days after the completion of the year-long survey (Task 5)
	final data report – summarizes the final results of the study	45 working days after the receipt of EPA/Ecology comments

Note: Progress reports will be submitted monthly for the duration of the fishers study, consistent with the requirements set forth in the AOC (EPA and Ecology 2000).

AOC – Administrative Order on Consent

EPA – US Environmental Protection Agency

Ecology – Washington State Department of Ecology

na – not applicable

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