

**APPENDIX E. RATIONALE FOR THE FISHERS
SURVEY DESIGN**

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Appendix E

This appendix provides an overview of the rationale for the Lower Duwamish Waterway (LDW) fishers survey design, which is presented in Section 6.1 of the main document.

E.1 KEY SOURCES OF INFORMATION REGARDING FISHING ON THE LDW

In addition to consultation with EPA, Ecology, Seattle-King County Public Health (SKCPH), Department of Health (DOH), Duwamish River Cleanup Coalition (DRCC), and Environmental Coalition of South Seattle (ECOSS), four key sources of information were used to design the survey:

- ◆ 1997 King County Study
- ◆ 2004 LDW Human Access Survey
- ◆ 2010 Public Health Survey
- ◆ ECOSS interviews with community representatives

These four sources are summarized in Table E-1. In addition, a conversation with a WDFW game warden regarding his observations and knowledge about fishing along the LDW (Chandler 2014), was considered for survey design. However, this source was not included in Table E-1 because it is anecdotal information and was only available as a verbal communication.

Table E-1. Summary of key studies/surveys that provide information regarding LDW fishing

Name	Reference	When Conducted	Geographic Area	No. of Interviews Conducted	Study Objective(s)
1997 King County Study	King County (1999)	June 22 through August 30, 1997 (surveys were conducted on 10 Saturdays, 10 Sundays, and 10 weekdays)	Public access locations and piers on the Duwamish River and Elliott Bay	1,183 people (1,947 total interviews)	Determine the amounts and types of seafood collected in the Duwamish River and Elliott Bay for the purpose of developing rates of seafood consumption for use in King County's human health risk assessment for this area. Three locations (Seacrest Park in West Seattle, Elliott Bay Pier in Myrtle Edwards Park, and Spokane Street Bridge ^a) accounted for 92% of the survey attempts.
2004 LDW Human Access Survey	Windward (2005)	July 2004	LDW	none	Conduct qualitative reconnaissance survey to obtain information regarding where people can access the LDW and may come into contact with intertidal sediment during the collection of seafood or other activities.
2010 Public Health Survey	Barry (2013) ^b	July 23 through August 7, 2010 (weekends and Friday evenings during a salmon season)	Spokane Street Bridge and T-105	35	Evaluate the effectiveness of LDW DOH fish consumption advisory signs for communication of risk information and determine if additional action is needed. Respondents were asked questions regarding their fishing habits and their awareness of the contamination present in the LDW.
ECOSS Interviews	Task 2 of the LDW fishers study (Windward 2013)	October and November, 2013	Duwamish Valley	54	Gather input from community representatives (which included some fishers) for consideration in the design of this fishers study. See Section 3 of the main document for additional details.

^a This location is called Harbor Island in the study.

^b A final report for this survey was never issued, and thus a personal communication that included the transmittal of the survey data to Windward is cited here.

DOH – Department of Health

ECOSS – Environmental Coalition of South Seattle

LDW – Lower Duwamish Waterway

T-105 – Terminal 105

E.2 FISHING LOCATIONS ON THE DUWAMISH

As discussed in the guidelines developed for the fishers study, a tiered approach was developed for the fishers study to reflect the fishing frequency at various locations along the LDW. This section summarizes the available information from past studies regarding fishing locations along the LDW that was used to develop this tiered approach.

The 1997 King County Study asked anglers to provide information regarding the seafood they were collecting at locations along the Duwamish. Table E-2 presents a summary of the locations where interviews were conducted, which are shown on Map E-1. The vast majority (82%) of interviews from the Duwamish River locations were conducted on Harbor Island (i.e., at the Spokane Street Bridge). During this survey, all locations were visited by surveyors at least once on each of the 30 survey days.

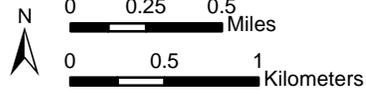
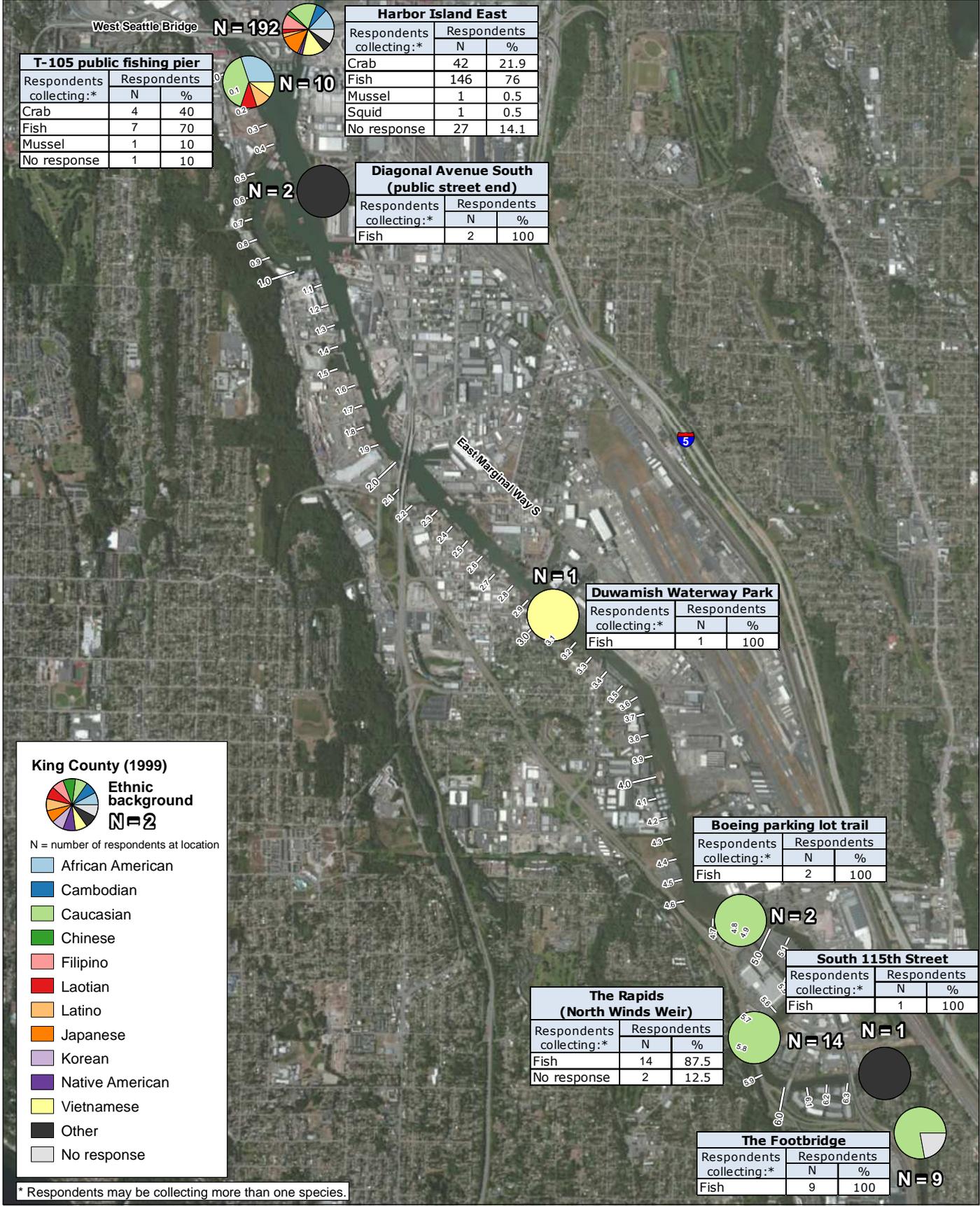
Table E-2. Duwamish River fishing locations from the 1997 King County Study

Location	LDW River Mile	Count	Percent
Harbor Island East	na	192	82%
T-105 public fishing pier	0.1	10	4%
Diagonal Ave. South (public street end)	0.5 – 0.7	2	0.9%
Duwamish Waterway Park	3.0	1	0.4%
Boeing Parking Lot trail	4.8	2	0.9%
The Rapids (North Winds Weir)	5.7	16	7%
South 115th Street	6.4 – 6.5	1	0.4%
The Footbridge	6.8	9	4%
Grand Total	-	233	-

na – not applicable

T-105 – Terminal 105

The 2010 Public Health Survey did not ask anglers for information regarding their preferred fishing locations. However, of the 33 anglers who were interviewed at fishing locations along the Duwamish during the study, 30 anglers (91%) were interviewed at the Spokane Street Bridge and 3 anglers (9%) were interviewed at T-105. Additionally, Table E-3 presents information regarding the number of anglers observed (but not necessarily surveyed) at the survey locations when surveys were conducted. It is not known whether surveyors visited both survey locations on each survey day. Two interviews were conducted in a coffee shop in the South Park neighborhood, but no other locations along the Duwamish River were visited as part of this survey.



Map E-1. Duwamish River fishing locations surveyed during the 1997 King County Study (King County 1999)

Table E-3. Count of anglers observed at survey locations during the 2010 King County Survey

Date	Day of Week	Time of Day	Count of Anglers Observed ^a	
			Spokane Street Bridge	T-105 Public Fishing Pier
July 23, 2010	Friday	evening	10	13
July 24, 2010	Saturday	mid-day	8	1
July 25, 2010	Sunday	morning	4	unknown ^b
July 30, 2010	Friday	evening	4	15
July 31, 2010	Saturday	morning	3 – 12	unknown ^b
August 1, 2010	Sunday	mid-day	6	unknown ^b
August 6, 2010	Friday	evening	10	unknown ^b
August 7, 2010	Saturday	morning	3	unknown ^b

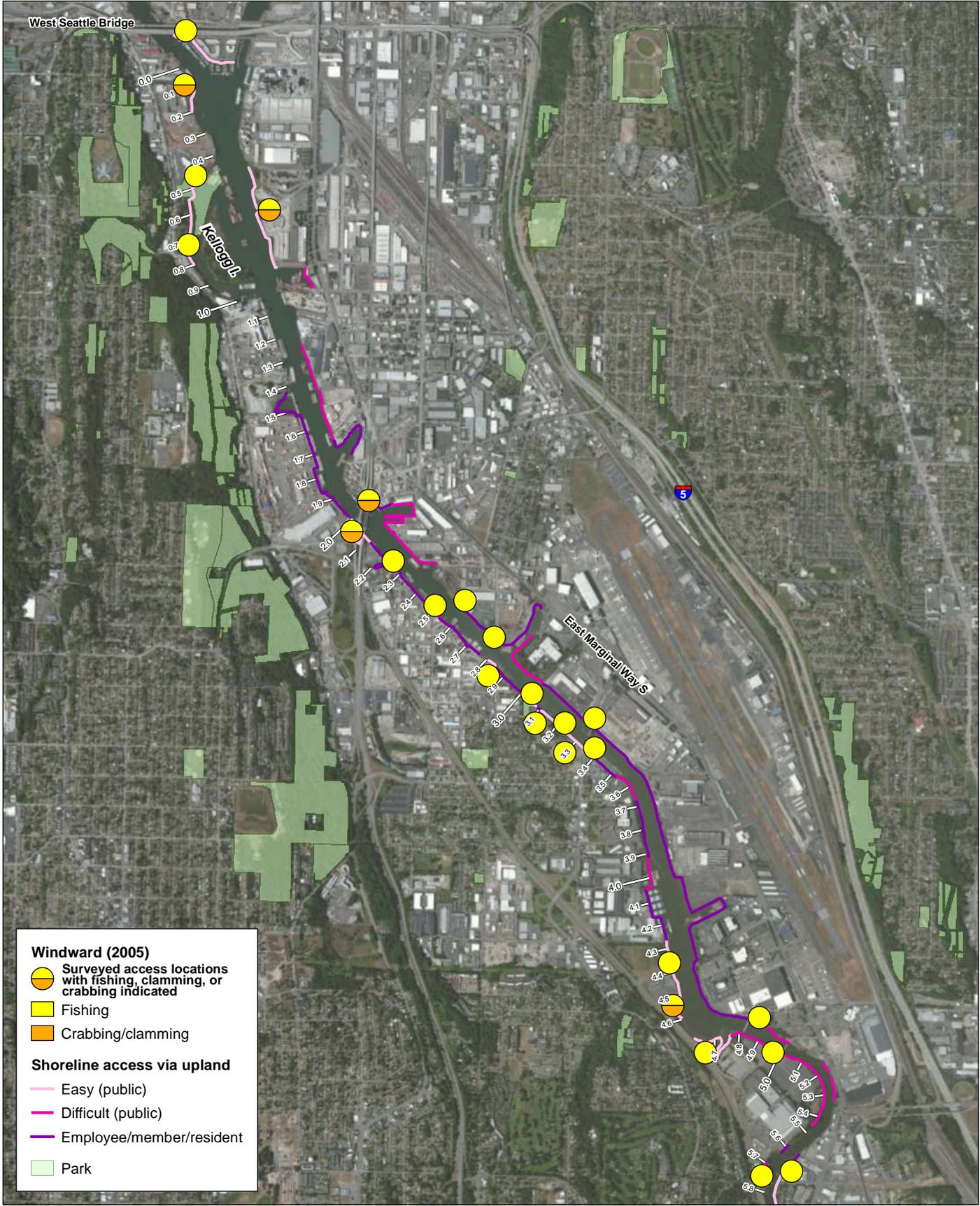
^a This count represents the number of anglers observed at a location at the time when surveys were conducted; all anglers at a given location were not necessarily interviewed.

^b Information regarding the number of anglers observed was not included in the data summary. It is unknown whether surveyors visited T-105 on these days.

T-105 – Terminal 105

As described in the 2004 LDW Human Access Survey, the ease of public access to the LDW is highly variable. 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 are difficult to access from land. Presumably, the general public may fish at all locations that have been designated as easy access, 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 as was discussed in the fishers study Work Plan, the majority of these publicly accessible locations (25 locations¹) could be potential fishing locations (these locations are shown on Map E-2). The results of this survey are useful in understanding the locations where river access, and therefore the potential for shore fishing, may occur. However, no attempt was made during the 2004 LDW Human Access Survey to identify the frequency of use or to confirm that fishing occurs at these locations.

¹ Of the 27 locations evaluated in the LDW human use survey, Map E-2 shows only the 25 locations identified as having potential fishing/harvesting. Details regarding these locations (E1 to E7 on the east side of the LDW, W1 to W18 on the west side of the LDW, and C1 to C2 on Harbor Island) can be found in the Human Access Survey Results Memorandum (Windward 2005).



Map E-2. Possible fishing locations identified during the LDW human access survey (Windward 2005)

Specific fishing locations were not identified as part of the ECOSS interviews, but interviewees were asked to indicate which zones along the LDW they visited to collect seafood. This information, which was summarized in Section 3 of the main document (see Table 3-1 and Map 3-1), showed that Zones 1 and 2 were the most popular locations. Of the 23 fishers who provided information on their fishing locations, 19 interviewees (83%) indicated that they fished in Zone 1 and 13 interviewees (57%) indicated that they fished in Zone 2. These zones include the Spokane Street Bridge (Zone 1) and T-105 (Zone 2). The next most popular locations were within Zones 3, 10, 11, and 12, with five to seven fishers (20 to 30% of the 23 fishers interviewed) indicating that they fished in each of these zones.

In addition, Kim Chandler, a Washington Department of Fish and Wildlife game warden familiar with enforcement activities in the area, reported that the three most popular fishing locations in the fishers study area include the Spokane Street Bridge (which is by far the most popular location), T-105, and both upstream and downstream of the “oxbow” near the Boeing Bridge (i.e., the area near the Boeing Parking Lot trail) (Chandler 2014). Additionally, Mr. Chandler reported that although the individuals they encounter on the Duwamish River are primarily targeting salmon, they do see some individuals collecting resident species (e.g., bottom fish and herring). These fishers that collect resident species are generally observed only at the Spokane Street Bridge and T-105.

E.3 SEASONALITY OF FISHING ON THE LDW

As discussed in the guidelines developed for the fishers study, the higher frequency of fishing during the warmer (i.e., summer) months as compared with the colder (i.e., non-summer months) was used to allocate more resources to the times of the year when more fishers are likely to be present along the LDW. This section summarizes the available information from past studies regarding the seasonality of fishing along the LDW that was used to develop this approach.

The 1997 King County Study asked anglers to provide information regarding the months of the year during which they fished. Table E-4 presents a summary of these responses by the location where the survey was conducted. The highest fishing frequency was reported in July and August (approximately 70% of fishers said they fished during this time). June and September were the next most popular months, with approximately 40% of anglers indicating that they fished during this time. All other months (i.e., October through May) had fishing frequencies of 20% or lower.

Table E-4. Fishing months reported by fishers interviewed at locations along the Duwamish River in the 1997 King County Study

Interview Location	Number of Fishers Who Reported Fishing During Each Month												
	nr ^a	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec
Harbor Island	73	17	18	17	18	25	50	82	84	43	21	19	20
T-105	2	1	1	2	2	2	6	8	7	5	3	2	2
Diagonal Ave	-	-	-	-	-	-	-	2	-	-	-	-	-
Duwamish Waterway Park	-	-	-	-	-	-	-	-	1	-	-	-	-
Boeing Parking Lot	-	-	-	-	-	-	-	-	2	-	-	-	-
South 115 th	1	-	-	-	-	-	-	-	-	-	-	-	-
The footbridge	9	-	-	-	-	-	-	-	-	-	-	-	-
Total Responses	85	18	19	19	20	27	56	92	94	48	24	21	22
Percent of Total	-	14%	14%	14%	15%	20%	42%	70%	71%	36%	18%	16%	17%

^a Indicates that information regarding the months during which anglers reported fishing was not obtained.

^b Percent of the total was calculated based on the 132 anglers who provided information about the months during which they fished.

nr – no response provided

The 2010 Public Health Survey did not ask anglers in which season they fished. However, the survey was conducted only during late July and early August (i.e., during the time of year when fishing was reported to be the most frequent along the Duwamish River in the 1997 King County Study).

Information regarding the seasonality of fishing was not a part of the ECOSS interviews, although several interviewees mentioned information regarding this topic and suggested that most fishers are out during the warmer months (late spring through early fall), which overlaps with popular salmon runs (e.g., Chinook and Coho²). However, it should be noted that the timing of the salmon runs was not a factor in designing the survey because the focus of the survey is on individuals targeting resident seafood.

E.4 TIMING OF FISHING ON THE LDW

As discussed in the guidelines developed for the fishers study, the past studies did not attempt to characterize preferences regarding fishing times. Rather, the times when the interviews were conducted were recorded as part of these studies and help provide some qualitative information regarding fisher preferences. This information was used to develop the general guidelines regarding the timing of the fishers study.

² Information regarding the specific regulations for salmon fishing for Marine Area 10 and the Duwamish River is provided in the Washington State Department of Fish and Wildlife’s sport fishing rules pamphlet (2013). The new regulations (which will go into effect in April 2014) have not yet been published, and thus the specific dates for the summer 2014 salmon fishing season are not yet known. However, salmon fishing seasons are not expected to change drastically from the previous year.

The days of the week and times of interviews conducted as part of the 1997 King County Study are summarized in Table E-5. Of the 217 interviews conducted along the Duwamish, 165 (76%) were conducted on weekends and 52 (24%) were conducted on weekdays. The times at which the interviews were conducted were summarized by location and time category in Table E-5. Although these records indicate when interviews were conducted (not necessarily when the most fishers were present at the fishing locations), it is useful to note the times of day when the most interviews were conducted. As shown in this table, the most common times on weekdays were early mornings (5-8am), evenings (3 to 7 p.m.), and late evenings (7 to 10 p.m.). The most common fishing times on weekends were mid-day (11 a.m. to 3 p.m.) and evening (3 to 7 p.m.).

Table E-5. Interview dates and times for the Duwamish River locations in the 1997 King County Study

Day of the Week and Location	Number of Interviews Conducted				
	Early Morning (5am - 8am)	Morning (8am - 11am)	Mid-Day (11am - 3pm)	Evening (3pm - 7pm)	Late Evening (7pm - 10pm)
Weekdays (n = 52)^a					
Boeing Parking Lot	-	-	-	-	2
Harbor Island	12	3	8	13	9
Terminal 105	-	2	-	-	2
Total No. of Interviews	12 (23%)	5 (10%)	8 (15%)	13 (25%)	13 (25%)
Weekends (n = 165)					
Diagonal Ave.	-	2	-	-	-
Duwamish Waterway Park	-	-	1	-	-
Harbor Island	16	25	28	51	26
South 115th	-	1	-	-	-
Terminal 105	-	-	2	4	-
The Footbridge	1	1	7	-	-
Total No. of Interviews	17 (10%)	29 (18%)	38 (23%)	55 (33%)	26 (16%)

Note: The 1997 King County Study was conducted during the summer when there are more daylight hours.

^a Weekdays interviews were conducted on Tuesdays, Wednesdays, and Thursdays.

^b Weekend interviews were conducted on both Saturdays and Sundays.

The 2010 Public Health Survey did not ask anglers for information regarding the times during which they usually fished. However, some information is available based on the records of the surveyors who conducted the on-river interviews. Of the 33 anglers who were interviewed at fishing locations along the Duwamish, 16 anglers (48%) were interviewed on a Friday evening, 12 anglers (36%) were interviewed on a weekend morning, and 5 anglers (15%) were interviewed mid-day on a weekend. The interviews conducted at T-105 were conducted on either a Friday evening (n = 2) or mid-day on a weekend (n = 1). Interviews were not conducted on weekdays, other

than Friday evenings. Since this survey did not attempt to characterize fisher preferences, this information should only be considered qualitatively.

As with the seasonality of fishing, information regarding the timing of fishing was not a part of the ECOSS interviews. However, several interviewees mentioned that the most popular times of day for fishing are mornings, evenings, and weekends (exact times may depend on tides), although some people (e.g., people who work non-traditional hours or who are retired) may fish at any time.

E.5 LANGUAGES PREFERRED BY ANGLERS ON THE LDW

As discussed in the guidelines developed for the fishers study, a list of the top 10 languages expected to be spoken by fishers along the Duwamish was developed, along with information regarding the priority for having the survey translated into a given language and the priority for having the ability to verbally administer the survey. This prioritization was based primarily on input from ECOSS, who considered the following information in developing these recommendations:

- ◆ ECOSS’ on-the-ground knowledge and past experience
- ◆ Information from past fishing-related studies (i.e., the 1997 King County Study and the 2010 Public Health Survey)
- ◆ Information obtained as part of the 2013 ECOSS interviews

Table E-6 summarizes these top 10 languages for the Duwamish River area and notes if they should be considered for interpretation (i.e., ECOSS staff will verbally translate the survey and responses in real time) and/or translation of the written survey.

Table E-6. Languages to be used during the LDW fishers study

Language ^a	Survey Administration	
	Translate Written Survey?	Priority for Having Verbal Ability for On-River Surveys ^b
English	-	-
Hmong	no	high priority
Khmer	no ^c	high priority
Korean	yes	moderate priority
Lao	no ^c	high priority
Mienh	no	high priority
Simplified Chinese	yes	low priority
Spanish	yes	low priority
Tagalog	yes	moderate priority
Vietnamese	yes	moderate priority

^a Languages are listed alphabetically and are not intended to indicate priority for inclusion in the survey.

^b Priority is based on expectation regarding whether participants might self administer a written survey and/or whether participants would prefer the survey be administered verbally.

high priority – indicates that it is not expected that participants from these language groups would be able to self administer a written survey.

moderate priority – indicates participants from the language groups may be able to self administer a written survey if needed. However, in the ECOSS interviews (Section 3 of the main document), participants from this language group indicated that they would prefer to take the survey verbally. In addition, the 1997 King County Study and the 2010 Public Health Survey indicate there are fishers from these language groups on the LDW (see Tables E-7 and E-8).

low priority – indicates that participants from these language groups may be able to self administer a written survey if needed and that few fishers from these language groups were identified in the 1997 King County Study and the 2010 Public Health Survey.

^c If during the course of the survey, fishers who would be willing to self administer written surveys in Khmer or Lao are identified, the survey may also be translated into these languages.

E.5.1 Information based on ECOSS’ past experiences

ECOSS has considerable on-the-ground knowledge that has been gained from their past experiences working with groups in South Seattle, which has included fishers. Information regarding the expected literacy of the various groups and the numbers of fishers along the Duwamish who would prefer the various languages were considered by ECOSS when developing their language recommendations for the fishers study.

E.5.2 Information from past studies

The 1997 King County Study did not report information regarding languages preferred by anglers, but did record the ethnic background of interviewees. This information by location is summarized in Table E-7 (Map E-1 shows the location of these Duwamish River fishing sites). Although this information cannot directly be converted to language preferences, it indicates the diversity of fishers along the Duwamish. In addition to English, the survey was translated to three languages for conducting the survey (Vietnamese, Korean, and Tagalog), although the use of English was not an issue for the majority of survey participants.³

Table E-7. Ethnicity information for interviews conducted at Duwamish River fishing locations in the 1997 King County Study

Ethnic Background	All Locations	All Locations except Harbor Island	Count by Fishing Locations Along the Duwamish							
			Harbor Island	T-105	Diagonal Ave.	Duwamish Waterway Park	Boeing Parking Lot	The Rapids	South 115th	The Footbridge
African American	28	3	25	3	-	-	-	-	-	-
Cambodian	13	-	13	-	-	-	-	-	-	-
Caucasian	64	29	35	4	-	-	2	16	-	7
Chinese	5	-	5	-	-	-	-	-	-	-
Filipino	19	-	19	-	-	-	-	-	-	-

³ Study results did not specify the language in which individual surveys were conducted.

Ethnic Background	All Locations	All Locations except Harbor Island	Count by Fishing Locations Along the Duwamish							
			Harbor Island	T-105	Diagonal Ave.	Duwamish Waterway Park	Boeing Parking Lot	The Rapids	South 115th	The Footbridge
Japanese	25	-	25	-	-	-	-	-	-	-
Korean	2	-	2	-	-	-	-	-	-	-
Laotian	6	1	5	1	-	-	-	-	-	-
Latino	6	1	5	1	-	-	-	-	-	-
Native American	4	-	4	-	-	-	-	-	-	-
Vietnamese	29	2	27	1	-	1	-	-	-	-
Other ^a	12	3	9	-	2	-	-	-	1	-
No response	20	2	18	-	-	-	-	-	-	2
Total	233	41	192	10	2	1	2	16	1	9

^a The "other" category includes eastern European, Hawaiian, middle eastern, pacific islander, Thai, and individuals who listed themselves as other.

T-105 – Terminal-105

The 2010 Public Health Survey asked anglers about their preferred language (Table E-8). As can be seen in this table, the most common responses were English (51%) and Vietnamese (23%). At T-105, Cambodian (i.e., Khmer) was the most commonly preferred language (n = 2). However, despite these language preferences, it should be noted that of the 35 interviews that were conducted, 32 were conducted in English, 2 were conducted in Vietnamese, and 1 was conducted in Spanish. It should be noted that there is limited information from previous studies about language preference at specific locations. However, in the 2010 Public Health Survey, Khmer-speaking fishers were encountered several times at T-105.

Table E-8. Language information from the 2010 Public Health Survey

Preferred Language	Count	Percent of Total	Count by Survey Location		
			South Park Coffee Shop	Spokane Street Bridge	T-105
Cambodian ^a	3	9%	-	1	2
English	18	51%	2	15	1
Laotian / Cambodian ^a / Thai	1	3%	-	1	-
Mongolian	1	3%	-	1	-
Spanish	2	6%	-	2	-
Tagalog	2	6%	-	2	-
Vietnamese	8	23%	-	8	-

^a Cambodian is also referred to as Khmer.

T-105 – Terminal-105

E.5.3 Information from ECOSS Interviews

The language information from the ECOSS interviews was summarized in Section 3.2.3 of the main document. The most common preferred languages for individuals who reported fishing along the Duwamish were Mienh, Lao, English, Vietnamese, and Hmong. For all respondents (i.e., including fishers and non-fishers), the most common preferred languages were Mienh, Vietnamese, Spanish, Lao, English, and Khmer.

E.6 PHYSICAL AND ENVIRONMENTAL CONSIDERATIONS

In addition to the factors already discussed, the survey design is flexible so that the following physical/environmental factors can be taken into consideration:

- ◆ **Tides** – Tidal conditions, as they relate to preferred conditions for collecting various types of seafood, will be considered when scheduling surveys. For example:
 - Crab* – Crabbing is often considered to be most productive on a rising tide, and thus individuals targeting crab may be more likely to be present at these tidal conditions.
 - Salmon* – The best time to fish for salmon is generally within an hour of slack tide (salmon are known to feed more when there is little tidal change because this requires expending less effort to chase food).
 - Perch and other small fish* – A rising tide may bring small fish into shallower water to hunt prey, which may make them more accessible to anglers.
- ◆ **Target species** – Survey timing and frequency will take into consideration information regarding the open season for a given species or the season when a given species is most likely to be present in the LDW. For example, the open season for Dungeness Crab in Marine area 10 for 2013 was from July 1 through September 2 (Thursdays to Mondays only), which could influence when individuals targeting crab are present. Additionally, based on information provided by personnel from the Washington State Department of Fish and Wildlife (WDFW) (Bosworth 2013) and fishing preferences reported in the 2010 Public Health Survey (Barry 2013), the majority of fishers on the LDW are expected to be targeting salmon. Although there are specific regulations regarding salmon fishing, the focus of the LDW fishers study is on individuals who are targeting resident seafood. Because most of the non-salmon fisheries in the Duwamish River do not have a seasonal component, it is unknown whether individuals targeting specific resident species will be present at only certain times of the year.
- ◆ **Weather** – Survey timing will be flexible to avoid periods of inclement weather when fishers are less likely to be present.

During the course of the fishers study, other physical/environmental factors found to impact fisher presence along the LDW will be taken into consideration when planning and scheduling survey days.

E.7 REFERENCES

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