

The Brattle Group

FISH CONSUMPTION IN PORTLAND HARBOR

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I. EXECUTIVE SUMMARY

This brief summarizes initial results from a current study in which we examine fish consumption patterns in the Willamette River of Portland Harbor. Important goals of the study are to identify an estimate of 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. We form estimates of these based on self-reported Portland Harbor fish consumption patterns from a random sample of anglers licensed to fish in Oregon. Self-reported consumption patterns are collected in a telephone survey; the random sample of licensed anglers is drawn from a comprehensive list of licensed anglers maintained by the Oregon Department of Fish and Wildlife. The work presented here is relevant to the Portland Harbor Superfund Remediation because, to our knowledge, there does not exist data on fish consumption patterns specific to Portland Harbor. Previous work presented in the Baseline Human Health Risk Assessment of the Portland Harbor Superfund Remedial Investigation Report relies on studies based on fish consumption patterns of people from a National Fish Consumption Survey and from a study performed by the Columbia River Inter-Tribal Fish Commission (CRITFC). In summary, our work specifically investigates fish consumption patterns in Portland Harbor, and therefore, represents an important information source for the evaluation of public health risks associated with consuming fish from the Harbor and guiding outreach to potentially affected communities.

Our analysis estimates that the number of people consuming resident fish from Portland Harbor inclusive of anglers' families is approximately 7,800. Our sample is represented by members of various race-ethnicities including the Asian, Eastern European, Hispanic and Native American communities. Consistent with anecdotal evidence, larger shares of some of these groups reported fish consumption from Portland Harbor than the rest of the population. For example, only 19% of non-Eastern European, non-Native American whites reported fish consumption from Portland Harbor, while 38% of Eastern European licensed anglers reported consumption.

Interestingly, the levels of fish consumption among anglers consuming fish (migratory or resident) closely resembles levels fish consumption assumed in other works related to Portland Harbor (Remedial Investigation for the Portland Harbor Superfund Site). Among fish consumers we find the 99th percentile of fish consumption from Portland Harbor to be 139 g/day; the 95th percentile of to be 54 g/day and the 90th percentile to be 30 g/day.

We find similar levels for *resident* fish consumption among *resident* fish consumers. Resident

fish consumers in the 99th percentile of Portland Harbor resident fish consumption consume 146 g/day; those in the 95th percentile consume 35 g/day; and those in the 90th percentile consume 22 g/day. Based on the estimate of 7,800 resident fish consumers, this distribution translates into approximately 78 people consuming at the 99th percentile or above; 314 people consuming between the 95th and 99th percentile of consumption; and 392 people consuming between the 90th and 95th percentiles.

Although the levels of fish consumption among those consuming resident and migratory fish are similar to what is assumed in past works, the empirical evidence from our telephone survey on fish preparation methods and the overall composition of fish consumption provides new insight. For example, more than 95% of anglers reporting consumption of fish from Portland Harbor said they always cook their fish before consumption, and the majority of anglers report that the fillet is the most commonly consumed part of the fish. Related to the composition of consumption, we find that among licensed anglers who report consuming *migratory* or *resident* fish from Portland Harbor, the distribution of migratory versus resident fish consumption at average consumption levels is 87% migratory fish and 13% resident fish. Further, based on our telephone survey, the 90th percentile of *resident* fish consumption among licensed anglers who reported consuming *any* fish from Portland Harbor is 0 g/day. The 99th percentile of *resident* fish consumption among licensed anglers who reported consuming *any* fish from Portland Harbor is 22 g/day. In terms of servings of resident fish at the 99th percentile, this suggests a little less than a serving per week.

The survey results are based on a random sample of licensed anglers, and so our results speak only to consumption patterns among anglers and, under further assumptions, to the households of anglers. However, if there exists consumption of Portland Harbor fish caught by unlicensed anglers, then we cannot use our survey results to quantify the number of such individuals or their corresponding levels of consumption. We use data from the Oregon State Police on non-compliance warnings and citations issued to anglers to account for consumption by unlicensed anglers. We estimate that unlicensed anglers account for no more than 13.5% of anglers in Portland Harbor.

The telephone survey has been supplemented with qualitative research consisting of focus groups, informal interviews, written surveys, web surveys and intercept surveys. The aim of this qualitative research was to document the existence of fish consumption among subpopulations that may have been underrepresented in the telephone survey. Through this additional research we were able to further document fish consumption from Portland Harbor, and in some instances

considerable resident fish consumption; however, consumption levels reported were within the range found in the telephone survey. Because the qualitative research non-randomly selected respondents, we cannot use the results to estimate the number of licensed anglers among non-respondents who consume fish from the Harbor. Nonetheless we recognized that the qualitative research methods might avail us to information that was not obtained in the telephone survey, and that this information might be useful even if not generalizable. Although the qualitative research is still on-going we provide some preliminary results in the discussion section.

In summary, our study demonstrates that the Willamette River is an important food source to Oregonians; primarily migratory fish, and especially salmon.

II. RESEARCH DESIGN

The survey research for this study was approved by the Internal Review Board for Human Subjects Research at Portland State University. The objective of this study is to obtain an estimate of the number of people consuming fish from Portland Harbor, an estimate of the levels of Portland Harbor fish consumption among these consumers, and the distribution of resident versus migratory fish being consumed from the Harbor. We estimate these using a random sample of anglers licensed to fish in Oregon; the sample is drawn from the universe of all households with a licensed angler in 2011. The advantage of this approach is that fishing in Portland Harbor requires an Oregon fishing license. If illegal fishing in Portland Harbor is minimal or if license status is unrelated to fish consumption levels then our sample will still be representative of overall fish consumption patterns. Thus, we use the responses from respondents to our survey to formulate an estimate of the number of people consuming fish from Portland Harbor, and their corresponding levels of consumption.

II.1. Sampling frame

The Oregon Department of Fish and Wildlife (ODFW) provided a comprehensive list of anglers with an Oregon fishing license for 2011; the list included name and contact information of all anglers by license type.

The list of license holders received from ODFW consists of several types of licenses including: Angler, blind angler, combination angler, disabled vet combination angler, landowner angler, pioneer combination, senior angler, senior combination angler, senior combination manual, sports pac, wheelchair angler and youth under 14 angler. We reports counts by license type in table 1. These license types are largely mutually exclusive categories so that together they

represent the entirety of all licensed anglers for 2011¹. In compliance with human subjects protection guidelines we limit our sampling frame² to anglers over the age of eighteen. To minimize household survey burden and to reduce household statistical dependence in our final sample, we limit our sampling frame to a set of unique households. That is, only one angler from each household is eligible to be included in the pool from which we draw our sample. Ultimately, we form an estimate of consumption at the household level, which takes into account consumption of fish caught by multiple anglers within the same household. We identify households by combining all license records in the fishing license database with identical addresses or identical phone numbers. We retain the license record corresponding to the oldest individual within a household for inclusion in the sampling frame. Finally, we only consider anglers with a recorded address in Oregon or Washington as eligible for inclusion in our final sample, since anglers from these two states are most likely to regularly fish in Portland Harbor due to their proximity to the site.

Table 1. Summary of Oregon fishing license types and frequencies

License Description	Number of Licenses
Angler	299,388
Blind Angler	61
Combination	82,885
Disabled Vet Combination	12,007
Landowner Angling	267
Pioneer Combination	45,204
Senior Angling	7,613
Senior Combination	3,185
Senior Combination Manual	1,150
Sports Pac	37,718
Wheelchair Angler	87
Youth Under 14 Angling	18,129
Total	507,694

Once accounting for these criteria we are left a sampling frame representing approximately 400,000 households containing an adult licensed angler. Of these households, we assume those within closer proximity to the lower Willamette River are more likely to fish and consume fish from the relevant stretch of the Willamette River. Therefore, we stratify our sample based on driving distance to Portland Harbor from the street address reported in the fishing license record

¹ There is some double counting which results from replacement or duplicate purchases. Also youth anglers fishing tags are free, but sports pac requires a purchase—both types of tags are recorded.

² A sampling frame is a comprehensive list of all potential respondents eligible to be included in the pool from which a sample is drawn.

database. For each license we geocode the reported street address using ArcGIS 10.1, a geographic information software package, and assign latitude and longitude coordinates to the record. For a small number of observations we were unable to locate the reported address. In these cases, we use ArcGIS to assign latitude and longitude coordinates based on the centroid of the zip code reported with the license record. We used the Service Area tool in the Network Analyst toolbox for ArcGIS in conjunction with a network dataset of U.S. roads provided by Environmental Systems Research Institute to categorize each household according to driving time to the nearest point of the Portland Harbor; the categories are 0 to 30 minutes, 31 to 60 minutes, 61 to 90 minutes, 91 to 120 minutes and beyond 120 minutes.

II.2. Sample size

From a statistical standpoint we desire a precise estimate of the share of households with a Portland Harbor fish consuming angler. This requires a sample of at least four hundred households if we desire to generalize to the larger population with at least 95% confidence and with a 5% sampling error. Similarly, in order to precisely estimate the level of fish consumption among households reporting consumption we require a sample of approximately 400 households. Thus, if the percentage of households consuming Portland Harbor fish is 20% then we would need at least 2,000 households in our sample.

As already noted, we suspect that households closer to Portland Harbor will have a higher share of people consuming Portland Harbor fish. If this is the case then it is more efficient to sample more households that are in closer proximity to Portland Harbor than those farther from it. Based on some initial sampling we determined it most efficient to draw approximately 33% of our sample from households residing within 30 minutes driving distance to Portland Harbor; 33% from households residing within 30 to 60 minutes; 17% from households residing within 60 to 90 minutes; 11% from households within 90 to 120 minutes; and 5% from households residing beyond 120 minutes but still in the states of Oregon or Washington. Our final sample reflects this strategy, in table 2 we report the composition of our sample according to distance from Portland Harbor. Slight deviations from these proportions are due to minor differences in response rates across strata.

Table 2. Sample distribution by driving distance from Portland Harbor

Interval	Respondents by Interval ^a	Share of total sample
0 to 30 minutes	707	32%
31 to 60 minutes	739	34%
61 to 90 minutes	360	17%
91 to 120 minutes	237	11%
120 Plus minutes	133	6%
Total	2176	100%

^aExcludes 38 respondents who reported they did not know if they had consumed fish from Portland Harbor.

II.3. Telephone survey

We developed a telephone survey with the specific objective of obtaining information regarding the consumption of fish from Portland Harbor. The survey begins with questions designed to help improve recall on the main questions of interest—Portland Harbor fish consumption. We begin with a question that probes whether the respondent has gone fishing in Portland Harbor during the past year, and if so, then we ask what types of fish they have caught. Following these questions we move directly to the main survey questions. We ask if the respondent has consumed fish from Portland Harbor during the past year, and we ask for the last time they consumed fish from the Harbor. We follow with a question that asks the respondent to list all of the types of fish they have eaten in the past year. For each fish respondents list, we ask how frequently they consume the fish and about their levels of consumption in terms of servings. We identify a serving as 6 oz. of fish (~170 grams) which we suggest is approximately the size of two decks of playing cards. Regarding household consumption, we ask if anybody else in their household consumes fish caught from Portland Harbor. Next we ask a few questions about how they prepare fish for consumption. To assess exposure duration we ask how long respondents have been consuming fish from the Harbor and for how long they intend to continue fishing at Portland Harbor. We conclude the survey with questions about their race-ethnicity and their household size and composition.

The survey was conducted via telephone by experienced telephone interviewers from the Survey Research Lab at Portland State University. Before any calling began all interviewers received both standardized interviewing and project-specific training and were completely familiarized with the survey instrument. To minimize human error survey software was used. Calling took

place daily between 11:00 a.m. and 8:00 p.m.. The response rate for eligible numbers was 42%, and the overall response rates including false and unreachable numbers was just over 29%.

III. SURVEY RESULTS

The final sample is based on responses from 2,176 licensed anglers. Approximately 90% of the sample is male, and the average age is 54 years with a median of 55 years. The youngest person in the sample is 18 years and the oldest is 94 years. Our sample is slightly more male and older than the general population of licensed anglers. This is a result of always designating the oldest licensed angler from a household as the only angler eligible to be selected into our sample. While this may bias our sample towards the behaviors of older males, we find that older males are the most likely to be catching fish from Portland Harbor for consumption, and among consumers they are the highest consumers.

The racial-ethnic breakdown of our sample is given in Table 3, along with results from the 2010 U.S. Census for the general population (adults and youth under 18 years of age). The population is defined by intersecting Census tract population data with the boundaries delineating driving times to Portland Harbor as depicted in Map 1 (appended at the end of the document). Notably, our sample of adult licensed anglers has more Alaskan or Native Americans than the general population of adults and youth under 18 years of age, and slightly fewer Asian Americans and African Americans than the general population. Differences between the Census data and our sample data may be due to fishing habit or demographics such as age. However, it is impossible for us to test whether our sample over or under-represents specific subgroups relative to the population of anglers because the race-ethnicity of an angler is not reported in the fishing license data we use as a sampling frame for our analysis.

Table 3. Summary of racial-ethnic composition of sample

Race-ethnicity	Population N=3,050,901	Sample n=2,121
White	85.50%	94.24% (1999)
Black or African American	3.21%	0.75% (16)
Asian or Asian American	6.06%	2.16% (46)
American Indian and Alaska Native	2.36%	4.19% (89)
Native Hawaiian and Other Pacific Islander	0.82%	0.56% (11)
Hispanic or Latino	12.13%	2.49% (52)
Eastern European	NA	0.84% (18)

Note: The first column reflects percentages based on the total population (adults and youth under 18 years of age); the second column of percentages is based on our sample of adult licensed anglers (youth under 18 years excluded).

Table 4 shows the counts of the sample reporting fish consumption based on distance from Portland Harbor. We also report counts of the sample reporting resident fish consumption.

Table 4. Fish consumption frequencies by driving distance to Portland Harbor

Interval	Respondents by Interval ^a	Respondents reporting any Fish Consumption from Portland Harbor	Respondents reporting resident fish consumption from Portland Harbor
0 to 30 minutes	707	198	13
31 to 60 minutes	739	149	8
61 to 90 minutes	360	38	3
91 to 120 minutes	237	19	1
120 Plus minutes	133	6	None
Total	2176	410	25

^aExcludes 38 respondents who reported they did not know if they had consumed fish from Portland Harbor. Excludes 5 individuals reporting they had consumed migratory fish from Portland Harbor but could not recall how frequently.

Using the results presented in table 4 we estimate there are 50,200 households with a licensed angler consuming fish from Portland Harbor and 2,753 households with a licensed angler consuming resident fish. In the survey we also ask respondents how many people over and under 18 years of age are living in their residence. To generate and estimate the total number of people who consume fish from Portland Harbor on a regular basis we multiply the number of licensed anglers by the reported average household size. Table 5 reports these totals; all together we estimate there are 143,069 people consuming fish from Portland Harbor. However, most of this is migratory fish consumption; we estimate that 7,845 people consume resident fish from Portland Harbor as reported in Table 6.

Table 5. Estimated total individuals consuming fish from Portland Harbor

Driving distance to Portland Harbor	Households with a licensed angler	Estimated share of households consuming	Estimated households consuming	Estimated Adults consuming	Estimated children consuming	Total
0 to 30 minutes	95,636	28.0%	26,783	58,924	17,409	76,333
31 to 60 minutes	41,647	20.2%	8,397	18,474	5,458	23,932
61 to 90 minutes	37,390	10.6%	3,947	8,683	2,565	11,248
91 to 120 minutes	22,837	8.0%	1,831	4,028	1,190	5,218
120 Plus minutes	198,854	4.5%	8,971	19,736	5,831	25,567
Total	396,365	12.6%	49,929	109,844	32,454	142,298

Table 6. Estimated total individuals consuming resident fish from Portland Harbor

Driving distance to Portland Harbor	Households with a licensed angler	Estimated share of households consuming	Estimated households consuming	Estimated Adults consuming	Estimated children consuming	Total
0 to 30 minutes	95,636	2.0%	1,894	4,166	1,231	5,397
31 to 60 minutes	41,647	1.1%	451	992	293	1,285
61 to 90 minutes	37,390	0.8%	312	685	203	888
91 to 120 minutes	22,837	0.4%	96	212	63	275
120 Plus minutes	198,854	0.0%	-	-	-	-
Total	396,365	0.694%	2,753	6,056	1,789	7,845

Among licensed anglers who report consuming fish, the average angler consumes approximately 12 grams of Portland Harbor fish per day on average, which corresponds to just over approximately 2.1 servings of fish per month. Based on average consumption levels, over 86% of consumption is derived from migratory fish with less than 14% being resident fish. Salmon is by far the most commonly consumed fish from Portland Harbor, accounting for approximately 72% of overall consumption. Table 7 shows counts of the types of fish which respondents reported consuming, and their corresponding average consumption rates for respondents reporting consumption of any fish from Portland Harbor.

Table 7. Types of fish being consumed from Portland Harbor

Fish type	Number of people reporting any consumption	Unweighted average grams per day
Salmon (Chinook, Coho, Sockeye) - Migratory	359	8.018
Sturgeon - Migratory	93	1.033
Steelhead (aka Rainbow Trout) & Cutthroat Trout - Migratory	62	0.786
Shad - Migratory	2	0.282
Halibut - Migratory	1	0.003
Bass (Smallmouth, Largemouth, Spotted) - Resident	12	1.259
Catfish (Bullhead, Channel, White) - Resident	11	0.208
Eel, Perch, Suckerfish - Resident ^a	4	0.085
Crappie (Black, White) - Resident	4	0.008
Brown Trout - Resident ^a	2	0.003
Walleye - Resident ^a	2	0.059
Common Carp - Resident	1	0.003
		11.749

The levels of consumption are similar to that reported in “Estimated Per Capita Fish Consumption in the United States³” prepared by the Environmental Protection Agency and used as part of the Portland Harbor Superfund Remedial Investigation, which reported 17.5 grams/day, 50 grams per day and 142 grams/day for the 90th, 95th and 99th percentiles, respectively. In table 8 we report the 90th, 95th and 99th percentiles of fish consumption for (I) migratory and resident fish consumption combined among licensed anglers reporting *any* fish consumption from Portland Harbor; (II) resident fish consumption among licensed anglers reporting *any* fish consumption from Portland Harbor; (III) migratory and resident fish consumption combined among licensed anglers reporting *resident* fish consumption from Portland Harbor; and (IV) resident fish consumption among licensed anglers reporting *resident* fish consumption from Portland Harbor.

Notably, the consumption distribution in column (IV) of table 8 combined with the count data reported in table 7 imply that there are approximately 78 people consuming 146 g/day or more of resident fish; 314 people consuming between the 35 and 146 g/day; and 392 people consuming between the 22 and 35 g/day. These estimated counts reflect our estimate that less than 1% of all anglers licensed to fish in Oregon have in the past year consumed resident fish from Portland

³ “Estimated Per Capita Fish Consumption in the United States.” Environmental Protection Agency, August 2002.

Harbor; and that approximately 5% of licensed anglers reporting any fish consumption from Portland Harbor have in the past year consumed resident fish from Portland Harbor.

Table 8. Distributions of Portland Harbor fish consumption

Percentile	Consumption for those reporting any fish consumption from PH		Consumption for those reporting resident fish consumption from PH	
	Migratory and resident fish consumption (g/day)	Resident fish consumption only (g/day)	Migratory and resident fish consumption (g/day)	Resident fish consumption only (g/day)
	(I)	(II)	(III)	(IV)
90th	30	0	57	22
95th	54	0.93	113	35
99th	139	22	146	146

IV. QUALITATIVE RESEARCH

In this section we describe preliminary results from the on-going qualitative component of our fish consumption study. In the telephone survey several cultural groups may have been under-represented relative to the underlying population of anglers, although there is no way for us to test this statistically. To supplement the information gathered in the telephone survey we collected data on five cultural groups in Portland that are likely to be fishing in the Portland Harbor area: African American, Asian American, Hispanic/Latino, Native American and Russian/Slavic. We also collected a limited amount of information on the homeless community. Under a contract with The Brattle Group, the Survey Research Lab (SRL) at Portland State University has performed qualitative research consisting of key informant interviews, focus groups, written surveys, web surveys and intercept surveys for the relevant sub-populations.

Once again, the aim of this qualitative research was to further document the existence of fish consumption among subpopulations that may have been underrepresented in the telephone survey. The results thus far are consistent with consumption levels observed in the telephone survey. Respondents to this qualitative research are non-random because we targeted people who were likely to be consuming fish from Portland Harbor. Therefore, we cannot use the results to estimate the number of licensed anglers within a cultural group among non-respondents who consume fish from the Harbor. For the same reason, the results of this qualitative research should

in no way be considered representative of the population of Portland Harbor fish consumers. Despite these disadvantages, we recognized that using qualitative research methods might avail us to information that was not obtained in the telephone survey, and that this information might be useful even if not generalizable. The qualitative component of the study is still on-going; however, we are able to summarize initial findings by group.

African American

The qualitative research for the African American community consisted of key informant interviews, a focus group, and written, web and intercept surveys. The majority of participants in the focus group hosted by the Urban League of Portland reported they did not eat fish from Portland Harbor, however, at least half the group clearly indicated that they knew other people in the community who eat fish from Portland Harbor. Key informant interviews and intercept surveys documented that African Americans do consume fish from Portland Harbor. Respondents to the qualitative research reported that African American anglers catch the following fish for food: bass, blue gill, sturgeon, steelhead, ring tail, crappie, catfish, trout and perch. They noted crappie and bass were identified as popular fish. The following fish were explicitly identified as not being caught for consumption: lamprey, mountain whitefish, and carp.

Results from the key informant interviews were largely consistent with the types of fish consumed. Unlike the focus group participants, five of the six respondents to these key informant interviews reported catching and eating resident fish from Portland Harbor, although four of these said that did not do so very often. The other key informant said that he did not catch fish from Portland Harbor, but that friends sometimes brought him fish from there. He indicated that it was random how often he would receive fish in this way.

Among the six key informants fishing in Portland Harbor, locations that were acknowledged for fishing include north of Cathedral Park, Swan Island and Sauvie Island. Respondents suggested that some people from the African American Community may fish in Portland Harbor on a regular basis; one suggested one to two times a month and another suggested as much as three to four times a week. The respondents also suggested that frequency would depend on the time of the year and the weather.

Regarding alternative fishing sites, respondents indicated part of Sauvie Island outside of the designated Portland Harbor Remediation Site and the Columbia River. They also reported the Willamette River at Canby, Yamhill River, Pendleton, Lepage Park, Clackamas River, Pudding

River, Prineville, Richmond, Estacada and Scappoose. Despite listing numerous fish locations, respondents in the focus group agreed that it is harder now than in the past to find productive fishing spots nearby Portland. They reported problems with fewer fish and poor water quality at a number of locations. Other respondents identified distance as an obstacle to fishing for people in the African American community, especially younger generations. In the past one could go fishing in the Willamette River or Swan Island, but now it is easier to purchase fresh fish from the grocery store than it is to travel away from Portland Harbor to catch fish.

Regarding fish traditions, participants in both the survey and key informant interviews reported it was common to share fresh caught fish with family, friends and neighbors. The most common cooking methods reported in our qualitative research included deep-frying and baking. Respondents reported they usually do not eat the skin except for some fish, and they reported that they generally do not consume non-fillet parts of the fish such as the head or internal organs.

In a discussion about fishing regulations, respondents felt that it was common for others in the community to over-fish but they did not specify if ‘community’ meant the African American community or the Portland community. All participants present at the focus groups said they followed fishing regulation because it was not worth getting caught in violation. Five of the six respondents said that African American anglers in Portland Harbor were careful to have current licenses and tags; one respondent suggested that as many as half of African American anglers do not have licenses. Work with and analysis of fish consumption patterns among the African American community is on-going.

Hispanic/Latino

A focus group with 16 participants was hosted by the Hispanic Metropolitan Chamber of Commerce; the focus group discussion was held in Spanish. The discussion revealed a variety of opinions about fish consumption in the Hispanic/Latino community, which may also reflect the diversity of those present at the focus group (Cubans, Mexicans and Salvadoreans). Participants in the focus group were regular anglers, and many reported that they had been fishing in Portland Harbor in the past. Several anglers indicated that Kelly Point Park was where they usually went to fish, and that they felt comfortable eating their catch from there. Many agreed that this was where they usually went to fish. When asked specifically about consumption of fish from Portland Harbor several participants said they only catch and release in Portland Harbor because of the advisories against eating fish from Portland Harbor. However, there were comments

throughout the focus group which suggested that some people may consume fish from the Harbor.

Regarding fish caught from places other than Portland Harbor, the focus group participants reported eating bass, catfish, salmon and sturgeon. One person reported eating perch and another reported eating carp.

In terms of preparation methods the majority of people reported frying and baking their fish. Two individuals reported putting fish in soup. One individual each reported eating fish ceviche style, roasted and smoked. The majority of people said they did not eat the skin, eyes, bones or organs of the fish they caught; however, one individual said they sometimes use the sturgeon head to make soup. The preparation methods discussion was a general question that was not limited to Portland Harbor.

Towards the end of the focus group discussion some participants expressed frustration with the state of the Harbor and asked what was to be done about contamination near Swan Island.

At the conclusion of the focus group participants self-completed a one page written survey on fish consumption patterns. Contrary to the focus group discussion the majority of people reported eating fish from Portland Harbor. However, throughout the focus group discussion people considered Kelly Point Park as part of Portland Harbor (which is not part of Portland Harbor in this study) so it not clear whether reported consumption levels are attributable to Portland Harbor or elsewhere in the lower Willamette mainstem. In either case, consumption levels for all respondents fell within the range of consumption found in the telephone survey. On-going work will support clarifying consumption patterns in the Hispanic/Latino community.

Native American

Based on three key informant interviews we documented that Native Americans in the Portland Area consume fish from Portland Harbor; salmon and sturgeon were reported as the most popular fish to eat. Additional web and phone surveys confirmed that Native American consume fish from Portland Harbor; again these response cannot be translated into total counts. We also learned that there are many other common fishing areas surrounding Portland, for example, the Columbia and Deschutes Rivers were noted as well the Bonneville Dam, the Willamette River in Oregon City and the Clackamas River. It was reported that some Native Americans prefer to fish at their own tribal fishing grounds where they do not need to pay for angler licenses and there are

no limits on the number of fish one can catch. The same respondent indicated they do not fish in or eat fish from Portland Harbor because the Willamette is seen as dirty. Another respondent suggested that she fishes regularly at Portland Harbor out of convenience.

Another notable comment was that many Native American have been raised off reservations in urban areas, and that these Native Americans do not eat as much fish as those raised on reservations. As a general comment, the respondent said that tribal members living on reservations eat more fish than those living off reservations.

Regarding fish preparation methods, respondents suggest frying and baking are common cooking methods. Canning, drying, making jerky and smoking were also reported as traditional or common fish preparation methods. Respondents said that it was not uncommon for people to consume the non-fillet parts of the fish such as the head, eyes or brain; however, two of the three respondents said they did not eat these parts. One respondent noted that fish heads and eyes were traditionally considered a delicacy, but this is not as common today. Bones will sometimes be eaten in canned salmon, and some people enjoy fried salmon skin. Fish is not typically eaten raw unless they are eating sushi. Eggs are not commonly eaten, but are used as bait for trout.

When asked about fishing regulations, respondents felt strongly that anglers they know in their communities are following fishing regulations. Consistent with this, respondents said that if Native Americans, at least ones they know, fish off their ceded lands, then they are careful to have current fishing licenses and to follow regulations when fishing in the Willamette River. Work with and analysis of fish consumption patterns among the Native American community is on-going.

Russian/Slavic

Two key informant interviews summarized fishing and fish consumption patterns of the Russian community in Portland. Both informants indicated that fishing is popular in the Russian community. They suggested it is somewhat common to fish in the Portland Harbor, and those who live close to fishing access points in Portland Harbor fish more. One respondent reported sturgeon, carp, catfish, and crappie are common to catch and eat. Another respondent reported catching and eating trout, mountain whitefish and sturgeon from Portland Harbor a few times a year. The respondent also reports that other anglers may fish there once or twice a week, and that older anglers who are retired fish more often than younger anglers.

Regarding fish preparation, cooking methods include frying, baking, boiling for soup, drying and salting. Respondents suggested that some people eat the heads and eyes, and that others will fry the fish and eat both the skin and fillet. One respondent indicated that people may eat other internal parts of the fish, if it is a large fish such as sturgeon. Caviar is eaten with salt, and both bluegill or crappie may be cooked before drying for jerky.

We also inquired about adherence to fishing regulations. One respondent estimates that 10 to 20% of Russians may fish without a license, and that these anglers are likely to fish late at night or early in the morning. Another respondent estimates that 99% of Russian anglers have a fishing license and are careful to follow regulations. Work with and analysis of fish consumption patterns among the Russian/Slavic community is on-going.

Asian American

A focus group was held on October 20th, 2012 with two Vietnamese community groups. Work with and analysis of fish consumption patterns among the Asian American community is on-going.

Homeless/Transient Community

Members of the homeless/transient community were approached along the banks of Portland Harbor. We completed two telephone surveys with people who self-identified as homeless. We also contacted a homeless center in Portland, which reported that although some of the people in Portland who are homeless do fish, the majority are unable to maintain the equipment in their belongings to carry with them all the time. Work with and analysis of fish consumption patterns among the Homeless/transient community is on-going.

V. CONCLUDING REMARKS

Our analysis estimates that the number of people consuming resident or migratory fish from Portland Harbor inclusive of anglers' families is approximately 143,000. Those consuming resident fish are estimated to be approximately 7,800. Our sample is represented by members of various race-ethnicities including the Asian, Eastern European, Hispanic and Native American communities. Consistent with anecdotal evidence, larger shares of some of these groups reported fish consumption from Portland Harbor than the rest of the population. For example, only 19% of non-Eastern European, non-Native American whites reported fish consumption from Portland

Harbor, while 38% of Eastern European licensed anglers reported consumption.

There are some important assumptions that should be considered when evaluating the results of the telephone survey. First, our survey does not specifically survey youth anglers so we do not have self-reported fish consumption measures for youth. However, based on survey questions about household composition, we are able to form a count estimate of the number of children (people under 18) who are consuming fish from Portland Harbor. Second, our survey offers no insight on the fish consumption patterns of unlicensed anglers. Instead, we collect data on non-compliance warnings and citations issued from the Oregon State Police, who is responsible for enforcing regulations set by the Oregon Department of Fish and Wildlife. We use this data to estimate the number of anglers fishing without a license is no more than 13.5% of anglers. Third, there may be sample selection bias in our survey. Licensed anglers who are willing to respond to a telephone survey maybe different from licensed anglers who are not willing to respond to a telephone survey. Differences between these groups may produce differences in fish consumption that we have not accounted for in our analysis.

If more conclusive evidence is required for the unlicensed community of anglers, then we recommend a study designed to provide a comprehensive understanding of fish consumption patterns among the population consuming fish caught by the unlicensed anglers.

Map 1. Distribution of zip code centroids represented in sample

