



SCHOOL OF PUBLIC HEALTH
UNIVERSITY *of* WASHINGTON



Health Impact Assessment
Proposed Cleanup Plan for the
Lower Duwamish Waterway Superfund Site

Technical Report

June 13, 2013

Assessment and Recommendations

Effects of the proposed cleanup plan on
Subsistence Fishing Populations

Technical report

This technical report supports our overall HIA reports, produced in three stages: *Advance HIA Report* (May 2013), *HIA Public Comment Report* (June 13, 2013), and *Final HIA Report* (due July 2013).

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Introduction

How will the Duwamish Superfund Cleanup Affect Health among Urban, Non-Tribal, Subsistence Fishers?

The Lower Duwamish Superfund Cleanup has the potential to affect local non-tribal, subsistence¹ fishing populations during the cleanup and for many years to follow. Ongoing cleanup activities may impact fishing activities in the region, even outside the Lower Duwamish Waterway by displacing fishers to other locations. Additionally, the cleanup plan is unlikely to achieve the objective of protecting the health of people who consume fish and shellfish from the Waterway. Following the cleanup, human cancer risk from consumption of resident fish and shellfish is not likely to fall below the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) and Washington State Model Toxics Control Act (MTCA) excess cancer risk threshold of 1 in 100,000 for people consuming fish at the rates reported for tribal² and Asian Pacific Islander populations. Additionally, the hazard quotient for non-cancer risk may remain above the CERCLA and MTCA threshold of 1 (United States Environmental Protection Agency, 2013). In an attempt to protect individuals from such residual health risks, the cleanup plan includes non-engineered institutional controls (described in a later section of this report). Seafood consumption advisories, outreach, and education programs are likely to decrease fishing and shellfishing activity and the consumption of resident fish and shellfish, although incompletely. The potential resultant decrease in fish consumption and fishing activities could produce negative health impacts among the area's fishing populations due to food insecurity and loss of cultural and social activities. Furthermore, perceptions of safety after completion of the active cleanup and shoreline and habitat restoration could lead to an *increase* in fishing and consumption of contaminated fish and shellfish, potentially leading to ongoing or increased exposure to contaminants. To assess these potential unintended health consequences, this report describes:

- Existing conditions among urban, non-tribal subsistence fishing populations;
- Likelihood of potential health effects;
- Recommendations to maximize beneficial health outcomes and minimize harmful health outcomes in this population.

¹ The term "subsistence fishing" is used to describe this population for this assessment. This term is somewhat ambiguous. Schumann and Macinko have suggested that its definition must be context-driven (2007). In the context of the present assessment, subsistence fishing is defined as non-sport fishing performed to provide food occasionally or frequently for the fishers or their friends and families.

² Effects of the cleanup on tribal populations are discussed in the Tribal Impacts Technical Report.

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Methods

Information about the potentially affected populations was gathered for this report through a review of peer-reviewed documents and other resources, consultation with community advisors, interviews with key informants, and conducting focus groups with fishers (Table 1).

Table 1. Methods

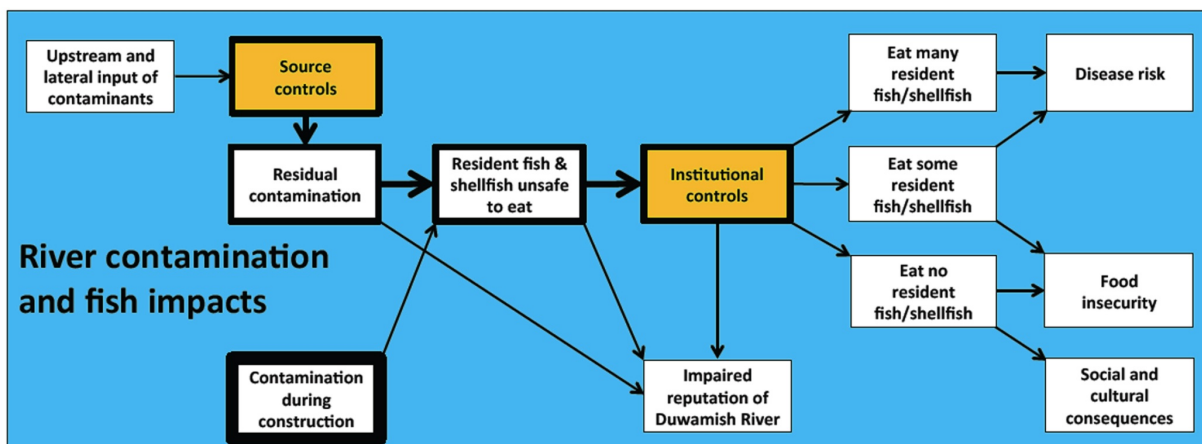
Method	Purpose	Source
Literature Review	<ul style="list-style-type: none"> • Describe the proposed cleanup plan and potential health outcomes; • define subsistence fishing; • identify key studies around fishing and seafood advisories, fishing practices, and reasons for fishing; and • establish a conceptual framework to guide community-based research. 	Peer-reviewed literature; gray literature; Lower Duwamish Waterway-specific publications, such as the proposed plan
Community Analysis	<ul style="list-style-type: none"> • Characterize important cultural considerations in the potentially affected communities, • assess the barriers and facilitators to participation in community-based research project, and • evaluate the cultural-relevance and appropriateness of interview and focus group guides 	Representatives from the potentially affected communities, such as directors or community-based organizations.
Key Informant Interviews	<ul style="list-style-type: none"> • Revise and develop conceptual framework to guide focus groups, • engage community members as partners in the research, and • identify opportunities to recruit focus group participants 	Individuals with knowledge of and connections to the various urban, non-tribal, subsistence fishing communities
Focus Groups	<ul style="list-style-type: none"> • Test and revise conceptual framework; • compare findings from local fishing communities to those identified in literature review; and • identify community discourse around fishing and seafood advisories, fishing practices, and reasons for fishing. 	Urban, non-tribal, subsistence fishers recruited using a “snowball” technique

Conceptual Framework

Existing literature from local studies and studies from other regions provided the basis for a conceptual framework which helped frame each stage of the research. Interviews and focus groups with local fishers allowed for an exploratory evaluation of the conceptual framework, providing a better understanding of the many factors local fishers identify as important in the reasons they fish and their decisions about fishing locations (Figure 1).

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Figure 1. Conceptual Framework



Literature Review

Little current information exists about the local urban, non-tribal, subsistence fishing population. Numerous studies have investigated fishing and seafood advisory effectiveness and characterized urban fishing practices in other urban areas (for example, see Burger, 2002). These studies are valuable in beginning to understand people's reasons for fishing and the potential unintended health effects of the cleanup. Findings from examination of peer-reviewed literature, gray literature, and cleanup-related documents are presented in this report.

In addition to a literature review, a community-based research project was carried out to gain a better understanding of Seattle's fishing communities. This research project included a community analysis, key informant interviews, and focus groups with fishers.

Community Analysis

A small group of community advisors with extensive knowledge about some of the local non-tribal subsistence fishing communities were recruited for this Health Impact Assessment. The community advisors served as unofficial spokespeople for communities that commonly practice subsistence fishing, and included representatives from local Vietnamese, Filipino, Japanese, Cambodian, and low-income communities. The community advisors were not fishers themselves, though some assisted with identifying key informants and focus group participants. These advisors helped ground this project in a culturally-appropriate context by identifying potential barriers to and facilitators of community engagement; providing insight into the values, needs, and existing resources of the various diverse fishing communities; and reviewing key informant interview and focus group guides.

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Key Informant Interviews and Focus Groups

Detailed data analysis of this research is still in process (as of 6/10/13). Eligible key informants were members of the potentially affected communities, and either fished or knew people who fished in local urban waterways. Interviews with key informants began with a short survey to gather demographic information. Demographic information collected included gender, country of origin, primary language spoken, English language speaking and writing proficiency, and approximate distance between residence and the Lower Duwamish Waterway. In addition to demographic surveys, semi-structured interviews included open-ended questions about reasons for fishing, cultural and traditional significance of fishing in the community, and other areas to better inform the focus group discussions. Key informants were also asked about proposed Institutional Controls and possible alternates to fishing advisories.

Adults who fish in local urban waterways were eligible to participate in focus groups. Focus group participants were recruited using a “snowball” technique. Due to this sampling strategy, many of the focus groups were fairly homogenous and most of the participants were Asian immigrants. The focus groups involve larger group discussions about beliefs, values, and behaviors associated with fishing and fish consumption (see Focus Group Guide).

The focus groups were recorded and are in the process of being transcribed for further analysis. In-depth analysis has not yet been completed, so only initial findings and major themes are included in this report. Where appropriate, these findings are highlighted with this icon:

Local Snapshot



The results from qualitative analysis of the focus group discussions will be incorporated into subsequent versions of this report.

Baseline Characteristics

Who is currently fishing on the Duwamish?

Urban Subsistence Fishing in the United States

Limited information is available about subsistence fishing specifically along the Lower Duwamish Waterway, so it is helpful to consider findings from the many other studies that have characterized the diverse nature of subsistence fishers in other regions in the United States. Many of these studies have paid particular attention to the often underestimated importance of subsistence fishing in urban areas (Burger, 2002). Nationally, higher urban fishing and fish consumption rates tend to occur among older, lower-income and unemployed individuals, immigrant populations, and people of color (Burger, 2002; Environmental Health News, 2012; Perez et al., 2012; Schlyer, 2012). Urban subsistence fishers commonly share their catches with friends and family members (Kalkirtz, Martinez, & Teague, 2008; Perez et al., 2012); therefore, while they may not fish, pregnant women and children are also likely to be exposed to contaminated fish from urban waterways. This is important to note because children and pregnant women may be disproportionately vulnerable to health effects of contaminants in fish and shellfish (Washington Dept of Health, 2012a).

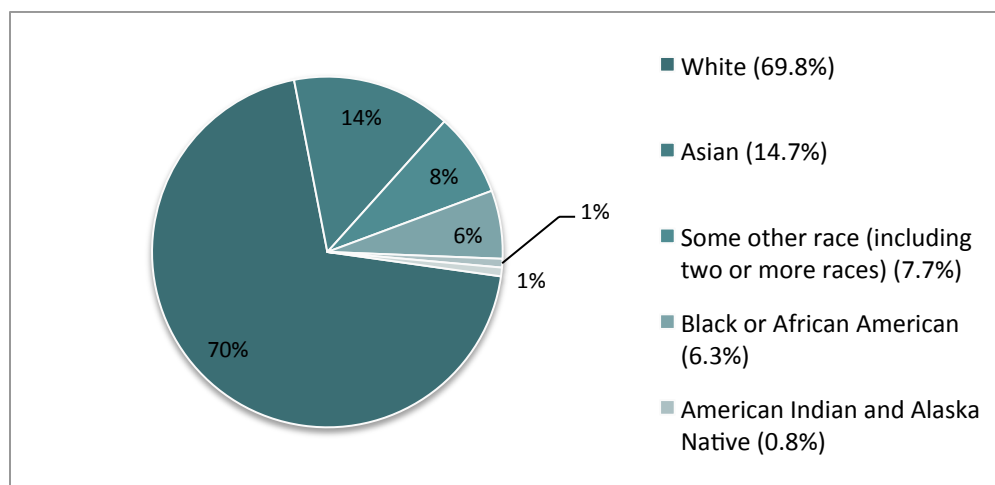
Urban Subsistence Fishing in King County

Similar to the information available in other regions, the local populations of non-tribal, urban subsistence fishers and their families and friend networks, represent a diverse and poorly characterized range of individuals from many disparate communities.

Most of the current information about subsistence fishing in local urban waters pertains to Asian and Pacific Islander communities. Fishing and shellfish harvesting reflect cultural, lifestyle and dietary traditions for many Asian and Pacific Islander (API) Americans and immigrants (Washington Dept of Health, 2003). Locally, Seattle's largest non-white racial group is Asian (Figure 2), and the highly diverse API community is one of the fastest growing racial groups in the city (U.S. Census, 2010). Nearly 15% of King County residents are Asian, compared to less than 5% at the national level. Similarly, the proportion of Native Hawaiians and other Pacific Islanders in King County is four times as large as the proportion in the United States as a whole (0.8% compared to 0.2%) (American Community Survey, 2011).

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Figure 2. Race in King County



(Source: U.S. Census; 2011 American Community Survey 1-Year Estimates)

Sechena et al. (1999) characterized seafood consumption patterns among Cambodian, Chinese, Filipino, Hmong, Japanese, Korean, Laotian, Mien, Samoan, and Vietnamese populations in King County. Researchers surveyed 202 first- and second-generation API adults. They reported nearly universal consumption of seafood among these ethnic groups, with shellfish composing almost half (46%) of all seafood consumed. Up to 21% of the fish and shellfish consumed were self-caught rather than purchased from vendors or restaurants, with the majority of harvesting taking place within King County. Among some groups, bottom fish were obtained more often from fishing activities, rather than from vendors. The large quantity of shellfish and bottom fish caught and consumed from potentially contaminated waterways makes the API community of particular interest in this assessment, given that relatively higher levels of chemicals can accumulate in shellfish and bottom fish, as compared with salmonids or pelagic species.

Initial discussions with API community advisors and focus group participants for this Health Impact Assessment have shed additional light on these communities locally. While the large, updated Filipino Community Center and food bank with bi-weekly elders' lunches serves Seattle's Filipino and Hmong communities, the local Vietnamese community has no community center or centralized elders services. Many individuals from these communities are plagued with transportation barriers, unemployment, and disproportionate health burdens. Consistent with national and local studies, community advisor interviews and focus group discussions have also suggested that fishing and fish consumption are important traditionally and

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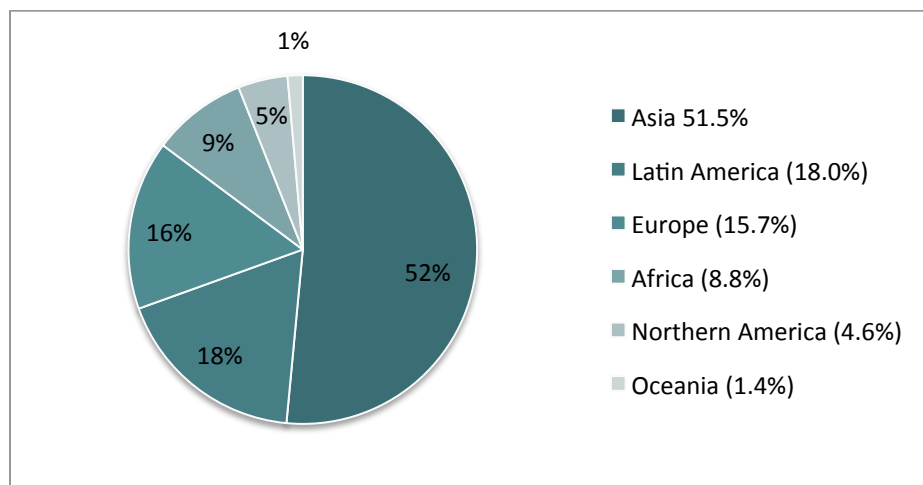


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culturally for many local API populations.

Individuals from other diverse immigrant and non-immigrant populations also fish in local urban waters, including the Duwamish River. King County's large and growing immigrant population includes many distinct groups, in addition to the API immigrants discussed above. In King County, around 1 in 5 individuals (20%) are foreign-born, compared to only 13% at the state and national levels (American Community Survey, 2011). Compared to the U.S. as a whole, more foreign-born individuals in King County reported their region of birth as Europe, Asia, Africa, Oceania, and North America; people in King County were less likely to report Latin America as their region of birth than in the U.S. as a whole (Figure 3).

Figure 3. World Region of birth of foreign born population (King County)



(Source: US Census; 2011 American Community Survey 1-Year Estimates)

Compared to the total population, King County's foreign-born population is:

- over twice as likely to have earned less than a high school diploma (20.3% vs. 8.3%)
- over three times as likely to speak a language other than English at home (83.5% vs. 26.3%);
- more likely to have no health insurance coverage (22.8% vs. 12.3%); and
- more likely to fall below the poverty level (16.9% vs. 11.3% for individuals over 18 years of age) (US Census; 2011 American Community Survey).

In a study by Public Health-Seattle King County (Tolley, 2010), researchers collected information about fishing activities through conversational surveys with 35 individuals fishing at public fishing piers along the Duwamish River. Through their surveys, researchers identified fishing practices among African American, White, Vietnamese, Filipino, Cambodian, Laotian, Hispanic, Thai, and Mongolian individuals,

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nearly half (49%) of whom primarily spoke a language other than English. The survey also asked fishers about sharing their catch and found that this highly diverse fishing population likely includes susceptible persons outside of those actually fishing on the river, including children and women of child-bearing age. Sharing was commonly reported, and shares were likely to include bottom fish, crab, and shellfish.

The report notes that, while the purpose of the study was to evaluate the effectiveness of fishing advisories, fishers who avoided fishing along the Duwamish River because of existing advisories were clearly excluded from the surveyed population (Tolley, 2010). Additionally, it is likely that fishers will travel to different locations based on perceptions of current fishing conditions, and those who do not currently fish in the cleanup area may change their habits if they perceive that fish in the Lower Duwamish Waterway are safe for consumption following the cleanup. Additional studies would enhance understanding of the potential future Duwamish River fishing populations by including individuals who rely on other local, urban fishing locations as well.

King County's low-income, food-insecure populations also consume fish from the Lower Duwamish Waterway, regardless of race/ethnicity. One study evaluating levels of fish consumption found that nearly all (96%) of 199 clients surveyed at two Seattle food banks within three miles of the Duwamish River consumed fish, with 40% reporting fish or shellfish harvesting for food (Schmidt, 2011). Participants in this study who fished or harvested shellfish also tended to report higher seafood consumption rates overall than other participants, and typical fish consumption rates (median IQI) were substantially higher than the EPA default value for the general population (30-151 g/day). Schmidt identified the highest seafood harvesting rates among Caucasian and Native American food bank clients (60%), but African Americans, Asians, and Hispanics also reported fishing activities (22-43%). Some participants (8% overall) fished in the Duwamish River, and a small proportion of these reported catching rockfish and other resident fish in particular. Again, this suggests that the non-tribal, urban subsistence fishing population is not only diverse, but also potentially affected by food security issues.

The local subsistence fishing population also includes urban American Indians and Alaska Natives (AI/AN). Historically, regional Tribes have depended on harvesting and consumption of fish and shellfish for traditional and cultural purposes. While existing conditions and potential health effects among Tribal populations will be described in another section of this Health Impact Assessment, much less data exists for the urban AI/AN population of subsistence fishers. According to the Seattle Indian Health Board's Urban Indian Health Institute (2009), urban AI/AN are often excluded from both local neighborhood assessments as well as Indian health community data. Urban AI/AN may live in various

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areas across King County, rather than congregating in specific neighborhoods. Additionally, they may represent many distinct, diverse tribes. Therefore, while little data exists about this community, the urban AI/AN population may be part of King County's subsistence fishing population (Schmidt, 2011; Key Informant Interviews).

Why are people fishing in urban waters?

Interviews with subsistence fishers across the country have identified a variety of reasons for fishing and shellfishing. In other regions across the United States, many fishers rate recreation and relaxation as the most important reasons for fishing (Beehler, Mcguinness, & Vena, 2012; Joanna Burger, 2002; Kalkirtz et al., 2008). For these individuals, fishing activities provide a source of exercise and contact with nature in urban environments. Others, especially many immigrant communities, fish for social and cultural reasons (Kalkirtz et al., 2008). Traditional diets among many API populations rely heavily on fish and shellfish. In addition to the cultural and traditional significance of fishing and fish consumption, seafood also provides valuable nutrients, such as unsaturated fats (including omega-3 polyunsaturated fatty acids), protein, and vitamins (Oken et al., 2012; Roos, Wahab, Chamnan, & Thilsted, 2007; Washington Dept of Health, 2003). These nutrients are especially important for residents of neighborhoods with inadequate access to fresh meat, fruit, and vegetables (Kalkirtz et al., 2008). As a convenient source of nutrients and a free or inexpensive meal, fish and shellfish harvesting appeals to many food-insecure individuals. Furthermore, even people who are aware of potential negative health effects associated with consumption of contaminated fish may be likely to share their catch with people in need (Schlyer, 2012). Ultimately, an individual's reasons for fishing reflect a mix of cultural, traditional, and lifestyle factors.

Trends in King County parallel those identified in other regions of the nation. Sechena et al. (1999) found that API immigrants and refugees occasionally fished out of economic necessity and largely considered harvesting and consumption of fish and shellfish to be "healthy activities that reflect a homelike lifestyle."

According to API community advisors for this HIA, fish and shellfish are important components of traditional diets, and fishing represents a culturally relevant and acceptable form of recreation. To date, Focus Group Participants have also identified recreation and exercise as important reasons for fishing, as well as relaxation and stress-relief, family time, and contact with nature. Additionally, the

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nearly universal fish consumption and high rates of fishing among food bank clients in the study by Schmidt and colleagues (2011) suggests that food insecurity may be a factor locally, as well. However, some API focus group participants actually identified catching fish as secondary to the act of fishing and spending the day outside.

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What factors influence where people fish?

Factors influencing fishers' decisions about fishing locations vary across the diverse fishing communities. Focus groups with Latino anglers in New York identified transportation as important; those who lived within walking distance of fishing locations were able to fish whenever they liked, while those who did not had to rely on friends and family, public transportation, or bicycle routes (Beehler et al., 2012). Similarly, Kalkirtz et al. (2008) found that anglers relied on the Detroit River despite contamination, because it was near their homes.

Decisions about fishing locations are influenced by many factors, but convenience, cultural traditions, perceptions of safety and quality of fishing locations, and availability of desired fish tend to rank the highest among key informants and focus group participants.

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Convenience and accessibility may lead some people to the Duwamish River for fishing. Reliance on public transportation and walking limits the distance many urban fishers can travel to fish, especially among recent immigrant, low-income, and food-insecure communities. However, only one focus group participant to date has said she is unable to travel to other fishing locations because of transportation barriers.

Cultural and traditional significance of the river may also play a role in influencing where people fish. For one American Indian key informant, for example, the Duwamish River has been a traditional fishing location in her family for many generations. In one focus group with API fishers, some participants suggested that seeing other people from their community fishing or hearing from friends or family about fishing locations influenced their decisions.

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Decisions about fishing locations are also influenced by perceived safety and quality. The key informant mentioned above also explained that water quality, physical safety of fishing locations, and quality and quantity of fish harvested also impact her decisions on where to fish. Focus group participants described undesirable fishing locations as places with visible garbage, tires, or bicycles along the shoreline or in the water, or areas where oil was visible on the water surface. In one focus group with Mien fisherwomen, the women explained that some fishing locations were avoided because they were perceived as dangerous or high-crime areas. Favorable fishing locations were identified by focus group participants as those with the species of fish they wished to catch, and those with enjoyable views and people-watching opportunities.

Where are people fishing now? What are the conditions there?

In addition to the many people who fish in the Lower Duwamish Waterway, people are also known to fish in other local waterways. Key informants and focus group participants have identified other popular fishing locations, including:

- Along the I-90 and WA-520 floating bridges
- Seward Park
- Near the mouth of the Cedar River (Lake Washington)
- Green Lake
- Elliott Bay
- Des Moines
- Tukwila (Green River)
- Alki Beach
- Snohomish County and other waterbodies outside King County.

These areas are also affected by state and local fishing advisories, as discussed below.

What factors will influence where people might fish during and after cleanup?

Factors influencing future decisions about fishing locations during and after the cleanup are likely to be similar to the current factors already described. People will continue to choose to fish in locations that

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are convenient and accessible, culturally and traditionally important, perceived to be safe (from both physical and contamination threats), and provide sources of suitable fish and shellfish. During or after the cleanup, if fishing locations along the Duwamish River become either more or less convenient, or if they are perceived to provide either less or greater protection from chemical and other hazards, then people may choose to decrease or increase their fishing activities accordingly. During active cleanup, barges and other signs of cleanup activities may increase impressions of contamination or lead people to believe the river is less safe, resulting in decreased fishing. Conversely, improved shoreline areas after cleanup may increase perceptions of quality and safety, or people may believe that the cleanup has decreased fish tissue contamination to acceptable levels. These changes in perception could potentially result in increased fishing activity following active cleanup. It is impossible to predict which factors will be most influential; however, some fishers will likely continue to visit the Duwamish River.

What alternatives are there to fishing the Duwamish River?

Alternatives to fishing in the Duwamish River include two distinct possibilities: continued fishing and shellfish harvesting activities in other locations, or discontinuation of fishing activities. Individuals with access to transportation and knowledge of other fishing locations may choose to travel to different areas to fish and harvest shellfish, such as the Green River, Alki Beach, Lake Washington, or Elliott Bay. However, this alternative would be fundamentally inappropriate and irrelevant for communities with traditional or cultural ties to the Duwamish River. Other individuals may lack time, transportation, or money necessary to change fishing locations. Ultimately, consideration of these alternatives must be informed by the complex mix of cultural, traditional, and lifestyle factors that influence fishing activities and fish consumption.

What are the chemical or other hazards associated with alternative fishing locations?

Fishers who avoid fishing in the Duwamish River and travel to other nearby urban fishing sites may still face potentially harmful levels of contaminants in fish and shellfish. All alternative regional fishing locations are affected by a statewide mercury advisory recommending no consumption of recreationally-caught Northern Pikeminnow and limited consumption of Largemouth and Smallmouth Bass. Many also have water body-specific advisories in place, including for shellfish from all King County shorelines and rockfish, English sole, and other flat fish in Elliott Bay. These advisories will be discussed in greater detail in the Institutional Controls section below. Fish and shellfish in Puget Sound and Lake

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Washington are contaminated with mercury and PCBs, and advisories exist for many resident fish and some salmon species (Washington Dept of Health, 2012b).

The 2007 Puget Sound Update technical report provides water contaminant level data in Elliott Bay and the Duwamish River taken from various locations during 2005 (Table 2) (Puget Sound Partnership).

Table 2. 2005 water column PCB congener sampling locations in Puget Sound

Station/Depth	Total PCBs (pg/L)			
	Aug-05	Sep-05	Nov-05	Dec-05
Inner Elliott Bay (15 meters)	66	152	151	131
Duwamish River – Harbor Island (1 meter)	1,800	1,100	616	2,050
Duwamish River – Harbor Island (salt wedge)	1,810	No Data	261	679/524*
Duwamish River – 16th Ave. S. (1 meter)	1,430/1,620*	1,160	474	1,130
Duwamish River – 16th Ave. S. (salt wedge)	3,120	1,720	185	1,340
Green River (surface)	248	814	933/113*	83

*Field replicate samples

(Source: Puget Sound Partnership. (2007). Chapter 4. Toxic Contamination. Puget Sound Update (pp. 129–194).

The EPA’s ambient water quality criteria for PCBs designed to protect human health is 64 pg/L (Lower Duwamish Waterway Group, 2010). This value was calculated using an estimated fish consumption rate of 17.5g/day (United States Environmental Protection Agency, 2002). This rate is likely much lower than the actual rate of fish consumption among local subsistence fishers. In her study of fish consumption among food bank clients, Schmidt (2011) identified a median seafood consumption rate of 60g/day. Sechena et al. (1999) reported average overall seafood consumption rates of 1.891 g/kg/day. For the average male in that study (body weight = 70kg), this translates to a seafood intake rate of over 130g/day. Water column levels of PCBs tended to be lower at the Elliott Bay sampling site than the sites along the Duwamish and Green River, but these levels clearly still represent a health risk for people who consume resident fish and shellfish.

PCB levels in fish and shellfish tissues across Puget Sound show a similar trend. Data from a 2003 Public Health Assessment of the Lower Duwamish Waterway completed by the Washington Department of Health suggests that the farther fishers travel to distant, non-urban fishing locations, the lower their potential exposure associated with consumption of fish and shellfish. The assessment reported that rockfish from Elliott Bay near Harbor Island contained higher levels of total PCBs (292 ppb) than rockfish from other areas of Puget Sound (11.5 ppb), including non-urban areas such as the Deschutes, Nisqually, Skagit, and Nooksack rivers (Washington Dept of Health, 2003). For fishers with little access to

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transportation or those with traditional or cultural ties to the Duwamish River, travel to these areas would likely be impracticable. Consequently, the fishers who continue to fish in contaminated urban waterways, and the people with whom they share their catches, may experience continued exposure to toxicants through consumption of contaminated fish from other water bodies.

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Institutional Controls

As discussed above, the proposed cleanup is not expected to decrease cancer and non-cancer risk associated with unrestricted consumption of fish and shellfish below acceptable levels (United States Environmental Protection Agency, 2013). Because of this, the cleanup plan relies on ongoing institutional controls in an effort to reduce exposure to contaminants. The EPA defines institutional controls as “non-engineered instruments, such as administrative and legal controls, that help minimize the potential for human exposure to contamination” (United States Environmental Protection Agency, 2012a). Institutional controls include seafood and fishing advisories currently in place, as well as community outreach and education programs. Ultimately, these controls place the responsibility for changing activities and practices on the fishers themselves.

What seafood advisories are currently in place?

State and local guidelines and advisories exist for water bodies in Washington. The EPA issues nationwide advisories and makes state information publicly available online (United States Environmental Protection Agency, 2012b). In addition, the Washington State Department of Health (DOH) evaluates chemical contamination of store-bought and recreationally-caught fish and provides advice to help consumers make healthy choices (Washington Dept of Health, 2012b). This advice comes in the form of a Healthy Fish Guide, available in English and Spanish; fish advisories by water body, including the Duwamish River; information for vulnerable populations; methods to prepare, cook, and select fish to reduce exposure to contaminants; and information about the health benefits of fish. However, Scherer et al. (2008) found that roughly one quarter of all advisories fail to include messages about the nutritional benefits of fish consumption.

The DOH water body-specific advisories include the Duwamish River, which has 14 advisories plus one statewide mercury advisory (Washington Dept of Health, 2012b). The current advisories recommend:

- No consumption of resident fish, including starry flounder, English sole, perch, and rockfish;
- No consumption of shellfish, including clams, crabs, mussels, and oysters;
- No more than 2-3 meals per week of Chum, Coho, Pink, and Sockeye salmon;
- No more than 1 meal per week of Chinook salmon; and
- No more than 2 meals per month of Blackmouth (resident Chinook) salmon.

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Similar advisories exist for nearby water bodies, including a broad advisory for Puget Sound salmon that includes Elliott Bay. Additionally, signs along the Duwamish River attempt to inform fishers of these advisories at some fishing locations in a variety of languages, including English, Spanish, Chinese, Korean, Vietnamese, Cambodian, Laotian, and Russian (Figure 4). A Lower Duwamish Waterway Superfund Site Fact Sheet, in English, Spanish, or Vietnamese, is also available on the DOH website, along with a Duwamish River Seafood Meal Warning in multiple languages, which includes images of fish and shellfish to be avoided and preparation recommendations to decrease exposure to contaminants.

Generally, what is known about advisory effectiveness?

The term “effective” as it applies to the evaluation of seafood advisories is complicated and highly subjective. The National Environmental Justice Advisory Council (2001) outlined four functional parts of typical advisories, including informing affected groups about contamination and health effects, encouraging avoidance of contaminated fish, and suggesting alternate practices to maintain fish consumption. The fourth potential function of advisories, capacity building and empowerment of affected groups, is very rarely included. “Effectiveness”, then, can be discussed in greater detail for each of these functional parts.

Informing Affected Groups

The first function of advisories, informing affected groups about contamination and health effects, can be evaluated based on effectiveness of communicating information in culturally appropriate, understandable ways (National Environmental Justice Advisory Council, 2001). A review of studies across the country demonstrated that many traditional advisories are ineffective in this regard. Despite awareness of advisories, many fishers and fish consumers do not understand the extent of

Figure 4. Duwamish Warning Sign

Source: Washington Dept of Health. (2012). *About the Fish Advisories Program* :: Washington State Dept. of Health. Fish. <<http://www.doh.wa.gov/>>



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contamination or associated health effects. For example, fishers frequently believe that immediate sickness from bacterial food poisoning, rather than long-term effects from exposure to carcinogenic or endocrine disrupting contaminants, constitute the most serious threats (Fisher et al., 2010; Key Informant Interviews; Focus Groups). Other studies have found that, regardless of posted advisories, many fishers assume that they can detect contaminated water and fish with their senses. Contaminated water, many assume, would appear cloudy with nearby debris and junk (Beehler, Mcguinness, & Vena, 2012; Fisher et al., 2010). Fish without discolored flesh, deformities, or sores are frequently considered safe to eat (Burger, Staine, & Gochfeld, 1993; Fisher et al., 2010; Kalkirtz, Martinez, & Teague, 2008). In another study, a fisherman reported seeing a posted advisory at one site and subsequently assumed that sites without advisory signs posted must be safe (Fisher et al., 2010). Lastly, numerous studies have found that knowledge of fishing advisories correlates with ethnicity and age, suggesting that advisories frequently fail to be culturally-appropriate and understandable (Shilling, White, Lippert, & Lubell, 2010; Silver et al., 2007). Ultimately, these findings suggest that subsistence fishers' cultures must be considered in the development and communication of effective advisories.

Encouraging Avoidance of Contaminated Fish and Suggesting Alternatives

The second function of advisories, encouraging avoidance of contaminated fish, cannot be evaluated so simply. Many populations value fishing and fish consumption for traditional, cultural, economic, and religious reasons (outlined in greater detail in another section of this report). Thus, an advisory that "effectively" leads to a decrease in fishing and fish consumption may overlook these complexities, and can even "perpetuate cultural discrimination" (National Environmental Justice Advisory Council, 2001). The third function of advisories, suggesting alternate practices for fishing and fish consumption, presents an even more complicated problem and may neglect the many culturally-significant values associated with these activities. Clearly, an evaluation of advisory efficacy based on degree of changed fishing practices alone would be inadequate and culturally inappropriate for most affected populations.

Capacity Building and Empowerment of Affected Groups

The fourth and most often overlooked function of advisories may be the most important in defining effective advisories. Through involvement in the various stages of risk assessment and risk management, affected communities can inform fishing advisories and help ground related work within a relevant cultural context. Based on the analysis presented above, it appears likely that without actions

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to support capacity-building and empowerment, efforts to protect affected populations from contamination in fish and shellfish will continue to fall short.

Ultimately, an evaluation of seafood advisory effectiveness should assess the inclusion of culturally-appropriate and relevant sharing of information about contamination, the ability of individuals to continue culturally and traditionally important practices including harvesting and consumption of fish at traditional locations, and the extent of capacity building, empowerment, and engagement of affected fishing populations.

How effective are existing seafood advisories?

The seafood advisories currently in place for the Duwamish River, described earlier, do not fully address the complex cultural context surrounding fishing and fish consumption in the region. First, the advisories often do not effectively communicate the risks associated with contamination.

One key informant who reported fishing in the Duwamish River stated that she believed consuming contaminated fish would lead to food poisoning symptoms and suggested that contamination could be observed in the coloring of fish and shellfish. Misperceptions around contamination and health effects of consuming contaminated fish were also prevalent among focus group participants. Many focus group participants associated an oily sheen with contamination, or suggested that they expected an area to be contaminated if there was garbage or debris along the shore. Focus group participants frequently described contaminated fish as those with missing or decomposing flesh. Others believed that contaminated fish would be weaker and are easier to catch than less contaminated fish. Most participants were unfamiliar with specific contaminants or the concept of bioaccumulation.

Local Snapshot



Additionally, the current advisories primarily discourage fish consumption and do not offer alternative means of fishing or consuming fish. As discussed above, this approach is problematic in that it does not address the varied and complex reasons for fishing. Furthermore, decreased fish consumption alone is not a useful marker of an advisory's effectiveness, since decreased fish consumption may come at the cost of reduced cultural and traditional activities. Lastly, community empowerment and capacity-building are not components of the existing advisories. Local studies have found a diverse population of individuals who fish and consume fish and shellfish from the Duwamish River and other local water

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bodies (Schmidt, 2011; Tolley & Public Health of Seattle & King County, 2010b) Since many cultural, traditional, and economic factors drive fishing and fish consumption, future approaches should attempt to understand and engage these affected populations.

Figure 5. Fishing on the Duwamish River Source: Google Maps Street View
(Accessed March 6, 2013)



What are the proposed institutional controls?

Seafood consumption advisories will remain during and after active cleanup of the Duwamish River. The Lower Duwamish Waterway Group (2012) identified other likely measures in addition to traditional advisories, including public outreach and education efforts to raise awareness and encourage avoidance of contaminated fish. They describe a community-based social marketing approach based on the Palos Verdes Shelf program's Fish Contamination Education Collaborative (FCEC), which focuses more on behavior change and less simply on awareness, which may also be incorporated into new institutional controls (FCEC, 2012). The FCEC incorporates outreach, education, and preparation guidelines for fish contaminated by the Palos Verdes Shelf Superfund Site. Through partnership with state and federal agencies, community based organizations, and local health departments, the FCEC offers education to anglers and families in nearby communities.

The proposed plan for the Lower Duwamish Waterway cleanup outlines informational devices, including advisories, outreach and education, and monitoring and notification efforts (United States Environmental Protection Agency, 2013).

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In general, how effective are these types of institutional controls?

Ultimately, future institutional controls will not be effective if they simply attempt to increase awareness and decrease exposure, without accounting for culturally significant values and beliefs associated with fishing and fish consumption. Public outreach and education programs like the Palos Verdes model may successfully reach many people from diverse fishing communities, raise awareness, and lead to some degree of changed behavior, but these outcomes may come at the steep cost of reduced fish consumption and loss of cultural traditions. Follow-up surveys from the Palos Verdes' FCEC program found that the intervention led to an overall increase in contamination awareness and safer cooking habits (Groner, 2007). However, it is also important to note that the proportion of women who reported no fish consumption increased following the outreach and education program. No other evaluations of the FCEC program have been published, so it is difficult to know to what extent changed fishing activities and fish consumption levels may have impacted the affected communities' health and their cultural traditions.

What culturally appropriate alternatives to institutional controls are available?

As outlined by the National Environmental Justice Advisory Council (2001) and discussed above, institutional control advisories, offsets, and other strategies to reduce exposure to contaminated fish tissue should include

- informing affected groups about contamination and health effects,
- encouraging avoidance of contaminated fish,
- suggesting alternate practices to maintain fish consumption, and
- capacity building and empowerment of affected groups.

Potential strategies to achieve these goals have been identified through a review of existing technical and non-technical literature and through discussions with key informants and focus group participants.

Informing Affected Groups about Contamination and Health Effects

Information about contamination and health effects would be better communicated using a multimedia approach. Traditional approaches, including brochures, guidebooks, and web-based advisories do not reach all affected communities, especially low-income, immigrant, or older populations (Fisher et al., 2010). Studies in other regions have found that knowledge is better shared through methods including

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classroom discussions and face-to-face approaches (Burger & Waishwell, 2001; Burger et al., 2003; Derrick, 2008), diagrams and images (Fitzpatrick-Lewis, Yost, Ciliska, & Krishnaratne, 2010), and avoidance of technical language (Chess, Burger, & McDermott, 2005). Seeking out culturally-relevant means of communication, such as newsprint and other news media, may be more appropriate for some populations (Beehler et al., 2012; Kalkirtz et al., 2008; Silver et al., 2007).

Efforts to communicate information about advisories and messages about safe and healthful alternative options also need to account for knowledge, beliefs, and cultural, social and economic needs of fishers (Joanna Burger & Gochfeld, 2006; Joanna Burger, 2002; Derrick, Miller, & Andrews, 2008; Kalkirtz et al., 2008; Perez et al., 2012). This can be accomplished through consultation with community-based organizations and an interactive process to develop, test, and revise outreach materials (Burger et al., 2003; Jardine, 2003; Jardine et al., 2003) and deliver messages (Sechena et al., 1999; Shilling et al., 2010).

In a study near a Superfund Site in Georgia, researchers developed a multimedia risk communication strategy for fishers and fish consumers using community-based participatory methods (Derrick et al., 2008). With the help of a Community Advisory Board that included members of the affected community, the researchers produced an outreach and education program that included a PowerPoint and verbal presentation, visual demonstration, and printed materials. Pre- and post-intervention interviews showed increased knowledge about contamination in fish and methods to reduce exposure. The reported average number of fish meals per month *increased* from 1.2 pre-intervention to 1.8 post-intervention, while the quantity of highly contaminated bottom-fish consumed decreased overall. The participants in this study were all African American, and no discussion of the traditional or cultural significance of these changes was included in the report. However, the inclusion of community members in the intervention process likely reduced the magnitude of potential negative impacts.

Encouraging Avoidance of Contaminated Fish and Suggesting Alternate Practices to Maintain Fish Consumption

Findings from focus group discussions and key informant interviews suggest that there is a need for innovative, novel approaches to minimize harms and maximize benefits of fish consumption in these communities. The EPA's 2013 Environmental Justice Analysis of the proposed cleanup describes possible "offsets," such as fish trading and sustainable aquaculture projects, suggested to mitigate the potential

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health consequences of residual contamination and institutional controls. Focus groups with local fishers suggest that acceptance and cultural appropriateness of offsets will vary between and within populations. For example, fish trading was generally met with doubtful responses among focus group participants, who wondered where and how they would trade fish. Many also remarked that there was a sense of pride in catching a fish that would be lost if that fish was traded. Other strategies were somewhat more acceptable.

Local Snapshot



Some existing programs that could serve as models or starting points include SeaShare, community-supported fisheries, and urban fishing ponds.

SeaShare, a nationally recognized non-profit organization, distributes donated seafood meals throughout Feeding America's national network of food banks (SeaShare, 2012). The seafood products packaged in the meals include canned and frozen products as well as bycatch. SeaShare is the only regional organization allowed to accept bycatch, or unintentionally-caught fish that would otherwise be required by law to be thrown back.

Community-supported fisheries (CSFs) mirror the community-supported agriculture model. No CSFs currently exist near Seattle, but across the country CSFs connect regional fishers with consumers, offering fishers a sense of security and steady source of income and provide participating community members with a regular supply of reduced-cost fish and shellfish. Locally, a CSF could represent an alternative option to consuming contaminated fish or shellfish from the Duwamish River.

Urban fishing ponds across the country provide opportunities to engage in healthful fishing practices for fishers who may be transportation-limited, including low-income, young, or disabled people. In Wisconsin, for example, urban fishing ponds are cooperatively managed and intensely regulated (Wisconsin DNR, 2013).

Urban fishing ponds were generally well-supported in focus groups with local fishers. In one focus group, fishers suggested creating multiple small, visually-appealing ponds stocked with desirable fish. They proposed a low annual fee to access the ponds with the possibility of decreased cost or free access to low-income fishers.

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In addition to the potential options presented above, local fishers in one focus group recommended distributing maps of fishing locations along with information about contamination and types of fish available and safe for consumption. Maps could be created and distributed in partnership with members of the affected communities. This would ensure the materials account for differing levels of numeracy and literacy and maintain cultural-appropriateness, while also empowering local fishers and building capacity within the fishing communities.

Local Snapshot



Reasons for fishing and fish consumption vary by population, so it is unlikely that a single option would be universally appropriate. Rather, innovative alternatives could be developed in combination with educational and outreach programs and community engagement and empowerment.

Capacity Building and Empowerment

Approaches that engage community members can benefit members of the impacted communities as well as health professionals and researchers. Community empowerment is a valuable outcome when these strategies involve capacity building within the community, offer equitable opportunities for participation and engagement, and promote community ownership of the outcomes. Furthermore, community engagement methods allow researchers to gain indispensable inside perspectives, generate research that is both externally and internally valid, and inform more sustainable interventions (Lazarus, Duran, Caldwell, & Bulbulia, 2012).

Burger, Gochfeld and Fote (2013) recently described a community-based participatory research project in New Jersey. In their study, Burger and colleagues engaged stakeholders, including fishers, angler associations, marina owners, and scientists at all stages of the research. The research goals identified by individual fishers were reducing risk from chemical contaminants in fish while maintaining fishing lifestyles and fish consumption and gaining knowledge of contamination levels in specific fish species. To reach these goals, local fishers assisted the researches with defining and developing the research plan, sampling methods, and sampling locations, and were kept well-informed throughout the research process. Ultimately, Burger and colleagues found that this level of engagement improved the quality and relevance of the research to the local fishing communities.

Summary of Focus Group Findings

Translation, transcription, and detailed analysis of the focus group discussions are currently underway, and results from this analysis will be included in a future report. At this time, general themes can be reported:

- Focus group participants identified cultural, traditional, and economic reasons for fishing. Reasons for fishing vary by community, and range from catching fish as a source of food to spending time with friends and family to stress-relief and contact with nature. Many participants valued the act of fishing over actually catching a fish.
- Most participants traveled to many urban fishing locations, choosing locations that were culturally-important, accessible, convenient, safe, and visually appealing.
- Many participants were concerned about contamination in fish, but misconceptions were common. Some participants worried that eating contaminated fish would cause food poisoning. Many believed that they could detect contaminated water and fish using their senses. Few participants had seen or read posted fishing advisories.
- Innovative alternatives to institutional controls should encourage continued healthful fishing and fish consumption practices. Reactions to alternative suggestions varied, and different methods will be more culturally-appropriate and effective for different communities.

These concepts reinforce and add to the findings from the review of key studies. The following assessment of the expected health impacts of the cleanup is based on the literature review, community analysis, key informant interviews, and focus groups.

Local Snapshot



Expected Health Impacts

How could the health of fishers and their families be impacted during and after the cleanup?

Decreased Fishing and Fish Consumption

Institutional controls during and following the cleanup will attempt to minimize exposure to harmful contaminants by encouraging less consumption of resident fish and shellfish among subsistence fishers in the Duwamish River. In addition, visible signs of the cleanup may discourage fishing practices and use of the river. Confusing or ambiguous advisories aimed at sensitive populations may lead to a decrease in fish consumption as a whole (Scherer et al., 2008). For those individuals who decrease their fish and shellfish consumption, health burdens associated with contaminant exposure will likely be minimized. However, reductions in fishing and fish consumption may be impractical among many subsistence fishers, and discontinuation of these practices may impose other health burdens on these populations (Shilling et al., 2010).

Negative impacts associated with decreased fishing and fish consumption could include:

- food and nutritional insecurity; and
- disruption of social and cultural traditions.

Food and Nutritional Insecurity: In various regions of the United States, fishing has been identified as an important source of food (Beehler et al., 2012). Local studies have similarly found that fishing and shellfish harvesting provide a free and culturally-relevant food source for API-American and immigrant communities and low-income, food-insecure populations (Community Advisors and Key Informant Interviews; Schmidt, 2011). The negative health effects of reduced fish consumption, such as cardiovascular disease, can potentially outweigh the expected benefits gained from compliance with seafood advisories (Rheinberger & Hammitt, 2012). People who rely on fish as a culturally appropriate means of obtaining a seasonally-consistent source of omega-3 fatty acids are thus particularly threatened by efforts to discourage fish consumption (Kalkirtz et al., 2008). To maintain traditional diets and consumption of vitamins and nutrients, others may choose to replace self-harvested fish with store-bought fish.

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Considering the cost of seafood from vendors and markets, decreased availability of self-caught fish could increase financial burdens on the many low-income and food insecure fishers. This may lead some people to supplement their diets with unhealthy inexpensive alternatives, potentially increasing their risk of obesity, diabetes, cardiovascular disease, and other negative health outcomes.

Disruption of Social and Cultural Traditions: Fishing is a social and culturally-important activity for many populations and often serves as a means of passing knowledge from generation to generation (Kalkirtz et al., 2008).

When asked about reasons for fishing, key informants and focus group participants have emphasized family traditions, relaxation and spending time with nature, interaction with family and friends, and exercise. One key informant related a story about fishing with her grandfather, describing, “I was raised around fishing.... I remember when I was smaller than my daughter my earliest memory was of us going fishing.”

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To encourage the members of these communities to reduce their fishing activities is to encourage them to give up important recreational activities and culturally-significant traditions. Among people who fish for cultural, traditional, and recreational reasons, discontinuation or reduction of these activities may result in the degradation or loss of health or health-favorable activities, increasing stress and anxiety and impairing well-being.

Exposure to Chemical Contaminants

During and after the cleanup, some people who now fish on the Duwamish River may decide to fish in alternate locations, including other local urban waters. It is also likely that other fishers will continue to fish in the Duwamish River, because of convenience, preferences or limited transportation options. The cancer and non-cancer risks of continued fishing are described in the EPA’s 2007 *Human Health Risk Assessment*. Non-cancer risks can include cardiovascular and other diseases, and neurological and developmental problems.

Continued Exposure through Consumption of Contaminated Fish from other Water Bodies: Some fishers with access to transportation may choose to fish in other locations rather than

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discontinuing fishing altogether. However, fish and shellfish in nearby waterways may still present potential exposure pathways.

When asked to identify their fishing locations on a map of Seattle, focus group participants pointed out various local waterways. Popular fishing locations identified besides the Duwamish River were Lake Washington (including near the two floating bridges, Seward Park, and near the mouth of the Cedar River), Green Lake, and Elliott Bay. Focus group participants reported walking, busing, driving, and carpooling to access these fishing locations. Only one participant said she would not be able to travel to other waterways to fish, so it is likely that some people will continue to consume fish from other waterbodies.

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Continued Exposure through Increased Consumption of Contaminated Fish from the Duwamish River: In addition, perceptions about the quality of fish in the Duwamish River may change following active cleanup; people may believe that the cleanup has brought contaminant levels in resident fish and shellfish to levels safe for consumption. Consequently, fish consumption may even intensify, potentially increasing exposure.

Table 3. Health Effect Characterization Summary³

Health Impact	Direction	Likelihood	Magnitude	Severity	Distribution
Food and nutritional insecurity	Adverse	Likely	Limited to Moderate	Medium	Disproportionate harm to low-income and food-insecure people
Disruption of social and cultural traditions	Adverse	Likely	Limited to Moderate	Medium	Disproportionate harm to people who fish for social, cultural and traditional reasons
Exposure to chemical contaminants	Adverse	Very Likely	Limited to Moderate	Medium to High	Disproportionate harm to lower income and non-English speaking people, and people who fish for social, cultural or traditional reasons

³ These terms are defined and methods for characterizing health effects are described in the **Methods Technical Report**.

Recommendations⁴

These are preliminary recommendations based on the literature review and initial analysis of key informant interviews and focus groups. Finalized recommendations will be included in the Final Report.

1. Institutional controls should go beyond restrictive and informational actions, such as advisories to avoid contaminated fish. Interventions should emphasize positive alternatives, such as identifying, encouraging and providing options for safe fishing and healthful fish consumption.

Advisories have repeatedly proven to have limited effect on the targeted fishing practice, locally on the Duwamish River and elsewhere. Efforts to dissuade fishing on the Duwamish River may have the best chance to be truly effective and least discriminatory if people are provided other, healthier options that will directly address and satisfy the reasons that they harvest or consume fish or shellfish.

2. There is a clear need for innovative thinking about how to discourage fishing (for resident fish and shellfish) on the Duwamish River and how to promote safe and healthful fishing alternatives. Possible options to explore in consultation with fishing communities include:

- **Explore some of the “offsets” identified in the EPA *Environmental Justice Analysis for the Duwamish River cleanup*.**

Our focus groups with local fishers suggest that acceptance and cultural appropriateness of offsets will vary between and within populations. Some of the listed options might appeal to some fishing populations, but we found mixed or negative responses to some of the options.

- **Provide a sufficient and reliable supply of fish to food banks in the communities where current and prospective fishing populations are located.**

One survey of local food bank clients found 40% of client families fished for food, including 8% who fished in the Duwamish River. Providing a reliable source of fish for these lowest income and food insecure populations through programs such as SeaShare may alleviate at least their dietary drivers for fishing, and may give them flexibility to be more selective in choosing locations when they fish for other reasons (e.g., cultural tradition, family recreation, etc.).

⁴ No single recommendation should be expected to entirely address the unique needs of any of the region’s diverse fishing populations. Rather, recommendations could be considered in combination with these or other innovative ideas. Similarly, many recommendations may be culturally inappropriate for local tribes (see Tribal Technical Report).

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- **Establish community supported fishery (CSF) programs—analogue to community supported agriculture (CSA) programs—in communities where fishing populations are located.**

As with CSA programs, CSFs allow members to purchase shares of fish and other seafood caught by local fishers. These shares provide members with a regular source of lower-cost fish and shellfish, and directly benefit local fishers with financial support.

- **Build and maintain urban fishing ponds near the affected fishing communities.**

Reasons for fishing vary between populations. Many people fish for cultural and recreational reasons in addition to fishing for an inexpensive source of food. Other states have developed urban fishing ponds to provide safe, local fishing locations for urban or land-locked communities. Allowing people to keep and consume the fish they catch would encourage continued fish consumption while maintaining fishing activities. Catch-and-release ponds would also allow for continued opportunities for exercise, nature contact, and socializing. Urban fishing ponds were generally well-supported by focus group participants, who agreed that these locations should be aesthetic and relatively natural environments to maximize the appeal for fishers.

- 3. Efforts to promote safe or safer fishing practices should acknowledge that the target audience is more than just people who currently fish on the Duwamish River. The target audiences include people who *might* fish on the Duwamish in the future. Any intervention effort should include plans to periodically reassess if all appropriate populations are being served.**

A cleaner river after active cleanup may eventually attract people who do not currently fish on the river, either because of misperception that resident fish are then safe or because fishing there is a best or better option in a limited set of options. It is important to note that some minority or immigrant populations that are presently small in number in the Seattle area are projected to grow, and the composition of the urban fisher population may change over time.

- 4. All efforts to provide information, communicate advisories, and promote safe and healthful alternative options should be culturally appropriate and relevant for each target audience, and should be designed to help individuals make informed choices.**

Current and prospective future fishers on the Duwamish River are highly diverse in terms of race, ethnicity, nationality and language. Their reasons for fishing and fish consumption are equally diverse. There are probably no interventions that will broadly address the perspectives and needs of all groups,

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without tailoring the intervention for individual groups. Methods to ensure that individuals have the information and awareness to make informed choices could include:

- **Distribute maps to fishing communities that identify regional fishing locations, the associated advisories or concerns about contamination, and the types of fish available to catch that are safe for consumption.**

Fishers could more easily choose safer, less contaminated fishing locations if they have clear descriptive information on other local fishable waters. These maps and other materials would need to account for the different languages and levels of literacy and numeracy in the diverse fishing communities. This could be accomplished by involving members of affected communities in developing, reviewing, and distributing these materials.

- **Incorporate community engagement efforts to develop outreach and educational strategies around fish advisory awareness.**

The methods used for the Palos Verdes Shelf Superfund cleanup site represent one good community-participation model to consider. We emphasize, however, that the most valuable lessons to learn from this model relate to community engagement and participation, and not the primary focus on fish advisories. This model could be useful for some populations but not others.

- **Partner with fishing community members to develop specifically tailored risk communication interventions.**

The community-engagement model used in Georgia by Derrick and colleagues (2008) is a good example of an effective approach to developing a culturally-tailored risk communication strategy to increase knowledge of contamination and fish advisories and improve ability to make informed choices.

- 5. All efforts to provide information, communicate advisories, and promote safe and healthful alternative options should engage and empower members of fishing populations so they can participate meaningfully in all stages of any prospective interventions, from initial conception and planning through implementation and follow-up monitoring for success.**

The methods used by Burger and colleagues (2013) in New Jersey provide an excellent model for effectively engaging community members as research partners in planning and implementing research, evaluating and interpreting findings, and developing and disseminating risk communication information.

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Community-based participatory methods can best ensure that interventions will account for the knowledge, beliefs, and cultural, social, and economic needs of fishers and their families. Although these methods are more time and resource intensive than traditional agency or “expert” driven approaches, they are more likely to ensure success.

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References

- Beehler, G. P., Mcguinness, B. M., & Vena, J. E. (2012). Characterizing Latino Anglers' Environmental Risk Perceptions, Sport Fish Consumption, and Advisory Awareness. *Medical Anthropology Quarterly*, 17(1), 99–116.
- Burger, J, Staine, K., & Gochfeld, M. (1993). Fishing in contaminated waters: knowledge and risk perception of hazards by fishermen in New York City. *Journal of Toxicology and Environmental Health*, 39(1), 95–105.
- Burger, J, & Waishwell, L. (2001). Are we reaching the target audience? Evaluation of a fish fact sheet. *The Science of the Total Environment*, 277(1-3), 77–86.
- Burger, Joanna. (2002). Consumption Patterns and Why People Fish. *Environmental Research*, 90(2), 125–135.
- Burger, Joanna, & Gochfeld, M. (2006). A framework and information needs for the management of the risks from consumption of self-caught fish. *Environmental Research*, 101(2), 275–85.
- Burger, Joanna, Gochfeld, M., & Fote, T. (2013). Stakeholder Participation in Research Design and Decisions: Scientists, Fishers, and Mercury in Saltwater Fish. *EcoHealth*.
- Burger, Joanna, McDermott, M. H., Chess, C., Bochenek, E., Perez-Lugo, M., & Pflugh, K. K. (2003). Evaluating risk communication about fish consumption advisories: efficacy of a brochure versus a classroom lesson in Spanish and English. *Risk Analysis*, 23(4), 791–803.
- Chess, C., Burger, J., & McDermott, M. H. (2005). Speaking Like a State: Environmental Justice and Fish Consumption Advisories. *Society & Natural Resources*, 18(3), 267–278.
- Derrick, C. G., Miller, J. S. a, & Andrews, J. M. (2008). A fish consumption study of anglers in an at-risk community: a community-based participatory approach to risk reduction. *Public health Nursing*, 25(4), 312–8.
- Environmental Health News. (2012). Warnings about contaminated fish fail to reach people most at risk. *Pollution, Poverty, People of Color*. Retrieved October 14, 2012, from <http://www.environmentalhealthnews.org/ehs/news/2012/fish-advisories-and-environmental-justice>
- FCEC. (2012). Fish Contamination Education Collaborative. Retrieved January 4, 2013, from <http://www.pvsfish.org/>
- Fitzpatrick-Lewis, D., Yost, J., Ciliska, D., & Krishnaratne, S. (2010). Communication about environmental health risks: a systematic review. *Environmental Health : A Global Access Science Source*, 9(1), 67.
- Fisher, CLB; Westphal, LM; Longoni, M. (2010). Fish consumption risk perception among anglers in an industrial urban area. Proceedings of the 2009 Northeastern Recreation Research Symposium (pp. 48–56). Retrieved from <http://www.treesearch.fs.fed.us/pubs/35625>

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- Groner, S. (2007). *Fish Contamination Education Collaborative: Fish Consumption, Attitudes & Beliefs Survey Analysis*. Retrieved from http://www.pvsfish.org/pdf/partner_documents/june/StephenGroner6-12-07.pdf
- Jardine, C. G. (2003). Development of a Public Participation and Communication Protocol for Establishing Fish Consumption Advisories. Editor's Note: This article was intended for publication in the April 2003 Risk Communication Special Issue, but was not included due to an edit. *Risk Analysis*, 23(3), 461–471.
- Jardine, C., Hrudey, S., Shortreed, J., Craig, L., Krewski, D., Furgal, C., & McColl, S. (2003). Risk management frameworks for human health and environmental risks. *Journal of Toxicology and Environmental Health. Part B, Critical reviews*, 6(6), 569–720.
- Kalkirtz, V., Martinez, M., & Teague, A. (2008). *Environmental Justice and Fish Consumption Advisories on the Detroit River Area of Concern*. University of Michigan.
- Lazarus, S., Duran, B., Caldwell, L., & Bulbulia, S. (2012). Public Health Research and Action : Reflections on Challenges and Possibilities of Community-Based Participatory Research. *Public Health - Social and Behavioral Health* (pp. 309–324).
- Lower Duwamish Waterway Group. (2010). *Remedial Investigation Report*. Retrieved from http://www.epa.gov/region10/pdf/sites/ldw/remedial_investigation_7-9-2010.pdf
- Lower Duwamish Waterway Group. (2012). *Final Feasibility Study*. Retrieved from http://www.ldwg.org/Assets/FS/Final_2012-10-31/LDW_Final_FS_Executive_Summary_October_31_2012_ADA.pdf
- National Environmental Justice Advisory Council. (2001). *Fish Consumption and Environmental Justice. A Report developed from the National Environmental Justice Advisory Council Meeting of December 3-6, 2001*. Retrieved November 14, 2012, from http://www.epa.gov/environmentaljustice/resources/publications/nejac/fish-consump-report_1102.pdf
- Oken, E., Choi, A. L., Karagas, M. R., Mariën, K., Rheinberger, C. M., Schoeny, R., Sunderland, E., et al. (2012). Which fish should I eat? Perspectives influencing fish consumption choices. *Environmental Health Perspectives*, 120(6), 790–8.
- Perez, H., Sullivan, E. C., Michael, K., & Harris, R. (2012). Fish consumption and advisory awareness among the Philadelphia Asian community: a pilot study. *Journal of Environmental Health*, 74(8), 24–28.
- Puget Sound Partnership. (2007). Chapter 4. Toxic Contamination. *Puget Sound Update* (pp. 129–194). Retrieved from http://www.psparchives.com/publications/puget_sound/update/07update/sections/07_update-toxics.pdf

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- Rheinberger, C. & Hammitt, J. (2012) Risk Trade-Offs in Fish Consumption: A Public Health Perspective. *Environmental Science and Technology*, 46(22), 12337-46.
- Roos, N., Wahab, M. A., Chamnan, C., & Thilsted, S. H. (2007). The role of fish in food-based strategies to combat vitamin A and mineral deficiencies in developing countries. *The Journal of Nutrition*, 137(4), 1106–9.
- Scherer, A. C., Tsuchiya, A., Younglove, L. R., Burbacher, T. M., & Faustman, E. M. (2008). Comparative analysis of state fish consumption advisories targeting sensitive populations. *Environmental Health Perspectives*, 116(12), 1598–606.
- Schlyer, K. (2012). Fishing the Forgotten River in the Nation’s Capital. *National Geographic Daily News*. Retrieved from <http://news.nationalgeographic.com/news/2012/07/120723-fishing-anacostia-river-washington-dc/>
- Schmidt, A. (2011). *An Evaluation of Fish Consumption and Environmental Concern in Low Income and Food Insecure Populations in Seattle (Thesis)*.
- Schumann, S., & Macinko, S. (2007). Subsistence in coastal fisheries policy: What’s in a word? *Marine Policy*, 31(6), 706–718.
- SeaShare. (2012). About SeaShare. Retrieved March 26, 2013, from <http://www.seashare.org/>
- Sechena, R., Nakano, C., Liao, S., Lorenzana, R., Truong, S., & Fenske, R. (1999). *Asian and Pacific Islander Seafood Consumption Study (EPA 910/R-99-003)* (Vol. 007, pp. 1–75).
- Shilling, F., White, A., Lippert, L., & Lubell, M. (2010). Contaminated fish consumption in California’s Central Valley Delta. *Environmental research*, 110(4), 334–44.
- Silver, E., Kaslow, J., Lee, D., Lee, S., Lynn Tan, M., Weis, E., & Ujihara, A. (2007). Fish consumption and advisory awareness among low-income women in California’s Sacramento-San Joaquin Delta. *Environmental Research*, 104(3), 410–9.
- Tolley, C., & Public Health of Seattle & King County. (2010a). *Duwamish River Angler Awareness of Fish Advisory Evaluation Report*.
- Tolley, C., & Public Health of Seattle & King County. (2010b). *Duwamish River Angler Awareness of Fish Advisory Evaluation Report* (pp. 1–67).
- United States Environmental Protection Agency. (2012a). Institutional Controls (ICs). *Superfund*. Retrieved January 4, 2013, from <http://www.epa.gov/superfund/policy/ic/>
- United States Environmental Protection Agency. (2012b). Fish Consumption Advisories - General Information. *Water: Fish Advisories*. Retrieved November 3, 2012, from <http://water.epa.gov/scitech/swguidance/fishshellfish/fishadvisories/general.cfm>

Duwamish Superfund Health Impact Assessment
Urban, Non-tribal, Subsistence Fishers Impacts Technical Report

United States Environmental Protection Agency. (2013). *Proposed Plan Lower Duwamish Waterway Superfund Site*. Retrieved March 1, 2013, from http://www.epa.gov/region10/pdf/sites/ldw/pp/ldw_pp_022513.pdf.

Urban Indian Health Institute, S. I. H. B. (2009). *Visibility Through Data: Health Information for Urban American Indian and Alaska Native Communities*. Seattle. Retrieved from http://www.uihi.org/wp-content/uploads/2010/05/VisibilityThroughData_FinalMay2010.pdf

Washington Dept of Health. (2003). *Public Health Assessment* (pp. 1–143). Retrieved from http://www.epa.gov/region10/pdf/sites/ldw/doh_health_assessment_sept2003.pdf

Washington Dept of Health. (2012a). Fish Advice for Women and Children. *Fish*. Retrieved January 11, 2013, from <http://www.doh.wa.gov/CommunityandEnvironment/Food/Fish/WomenandChildren.aspx>

Washington Dept of Health. (2012b). Fish Consumption Advisories :: Washington State Dept. of Health. *Fish*. Retrieved November 3, 2012, from <http://www.doh.wa.gov/CommunityandEnvironment/Food/Fish/Advisories.aspx>

Wisconsin Department of Natural Resources Bureau of Fisheries Management. (2013). *Guide to Wisconsin Hook and Line Fishing Regulations 2013-2014* (p. 22).

Focus Group Guide



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Begin with mapping exercise, then move to discussion:

1. What does fishing mean to you (*prompt: what are some of the reasons that you fish – inexpensive food source, exercise, culture, etc.?*)?
2. Do you have cultural or traditional reasons for fishing?
3. What makes an area a good place to fish (*prompt: Why do you choose to go where you currently fish? close to where you live, types of fish, quality of fish, etc.*)?
4. How important is the location of the place you fish in your decision to fish there?
5. How far do you travel to reach your fishing site(s), and how do you travel to get there?
6. What types of fish do you like to catch throughout the year?
7. What do you do with the fish you catch (*prompt: Do you share the fish with friends or family? Eat the fish yourself? Sell the fish? Release the fish back into the water?*)?
8. What do you know (or what have you heard) about eating fish contaminated with chemicals (*Do you think that eating contaminated fish is a major health risk? Do you believe that certain fish are less dangerous to eat than others? How do you try to avoid contamination in fish?*)?
9. Are you concerned about eating contaminated fish?
10. [Explain that people currently fish in the Duwamish River, and fish in the Duwamish River will continue to be unsafe to eat during the cleanup and after the cleanup. The EPA wants to find ways to discourage people from eating contaminated fish from the Duwamish River. What do you think about these possible ways to keep people safe from contaminated fish:
 - a. Trading a clean fish for each contaminated a person catches?
 - b. Giving people coupons or vouchers to buy clean fish?
 - c. Driving people who want to fish to a place where fish are less contaminated?
 - d. Adding salmon (which are usually safer to eat) to the River?
 - e. Making a fish pond nearby where people can catch clean fish?

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11. Can you think of any methods that would be better (more appropriate)?
12. Do you have any additional comments or questions about these issues, or is there anything else you would like to share?