**Human Health Focus Group**
**Oregon Fish Consumption Rate Project**
**November 14, 2007**
**10:00a.m. to 4:00p.m.**
**DEQ Headquarters Conference Room 11**
**Call in Number: 1-877-214-5010, conference code 898168**

## DRAFT AGENDA

**10:00** Welcome/ Introductions

**10:15** Update on Progress to Date and Future Expectations of Group
- Any thoughts post-EQC meeting?

**10:45** Human Health Focus Group Report
- Issues remaining
- Refinements
- Next Steps

**12:00** Break for Lunch

**1:00** Continue discussions on HHFG Report

**2:30** Break

**2:45** Wrap-Up
- Next steps toward finalizing the Report
- Next/final meeting: December 17

**4:00** Adjourn

# Draft Report

# Human Health Focus Group
# Oregon Fish and Shellfish Consumption Rate Project

**December 2007**

# Table of Contents

## I. Introduction

Comment: Look for more common language that we've used in other documents. This section needs to be smoother. Do we need more background?

The Oregon Fish and Shellfish Consumption Rate Project (FCR) is a collaborative effort of the Oregon Department of Environmental Quality (DEQ), the Environmental Protection Agency (EPA), and the Confederated Tribes of the Umatilla Indian Reservation (CTUIR) to review Oregon's fish consumption rate, which is one variable used to calculate water quality criteria that are protective of human health.

The Human Health Focus Group (HHFG) is a technical group of experts with experience in the areas of toxicology, risk assessment, public health, biostatistics, and/or epidemiology. The HHFG was formed to advise DEQ on the human health issues related to this project (specific issues outlined below). In their work, the HHFG was charged to address only the science and not the policy components of the issues they discussed

## II. Human Health Focus Group members

| Name | Affiliation |
|---|---|
| Dave McBride | Washington State Department of Health |
| Sue MacMillian | URS Corporation |
| John Rothlein, PhD | Oregon Health & Science University |
| Ken Kauffman | Oregon Department of Human Services |
| Elaine Fastman, PhD | University of Washington |
| Pat Cirone, PhD | Retired Federal Scientist, Affiliate of University of Washington |

### A. Selection of Human Health Focus Group members

The members of the HHFG were selected from nominations received from the project's Core Team. The Core Team is a group of about 40 individuals and organizations that are either directly affected by the outcome of this project or have expressed significant interest in the past. Nominations were also made by DEQ, EPA, and the CTUIR to provide a broader array of technical experts from which to choose. A total of 26 nominations were received and the 6 members listed above were the final members selected. The selection of HHFG members was done collaboratively between DEQ, EPA, and the CTUIR.

### B. Meeting schedule and minutes

The HHFG has held 9 meetings between May 2007 and December 2007 to discuss the issues detailed in this report. Most of these meetings were in person all day meetings held in Portland, Oregon at the DEQ Headquarters building. All of their meeting minutes and agendas can be found on the DEQ website at: http://www.deq.state.or.us/wq/standards/fishfocus.htm.

## III. Issues addressed

The following issues were addressed by the HHFG:

1) Considering the available local, regional and national information on fish consumption, what is the scientific evidence Oregon should rely on in selecting a fish consumption rate to use in setting water quality standards?

2) How should salmon be considered in selecting a fish consumption rate and/or calculating criteria?

3) To what extent are populations who consume more than the current fish consumption rate of 17 5 grams/day at a greater risk for health impacts?

## IV. Issue #1

**Considering the available local, regional and national information on fish consumption, what is the scientific evidence Oregon should rely on in selecting a fish consumption rate to use in setting water quality standards?**

### A. Discussion

This section is meant to capture an overview of the HHFG's discussion and is not meant to be an exhaustive narrative of every point raised by HHFG members. Detailed meeting minutes are available on the DEQ website. Please note that all findings of the HHFG are listed at the end of the discussion for each issue addressed.

**1)** Surveys reviewed

In addressing question #1, DEQ along with input from the HHFG compiled a list of nine fish consumption surveys that were the most regionally relevant for Oregon and the limit of what could be reviewed in the time allotted. The list of surveys, along with the general characteristics of the surveys can be found in Appendix 1 of this report. Given more time and resources, there was a desire among members to review other studies on the angling populations of other States, and even international fish consumption surveys. There was simply not time for a more extensive literature review. Additional fish consumption surveys that were relevant to the group's discussion but were not thoroughly reviewed are listed in Appendix 2. These surveys could potentially be used by Oregon when choosing a fish consumption rate.

**2)** Survey methodology

Appendix 1 lists the survey methodology of each study reviewed. Methodologies include personal interviews, dietary recalls, and creel surveys. Each of these methodologies has its advantages and disadvantages. The personal interview surveys reviewed by the HHFG all had members of the population being interviewed conducting the interviews themselves. This approach helps enhances the trust of the interviewee and the effectiveness of communication during the interview. Personal interviews are often pilot tested to enhance the relevance of the questionnaire. Cash incentives, a comfortable setting, fish models to estimate portion size, and a prescheduled interview time are also considered advantages to the personal interview.

Creel surveys are field interviews of anglers at the site they are fishing. Many creel surveys include the inspection of the angler's catch, which can increase their accuracy.

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The HHFG held 6 meetings to address the 3 questions outlined above.

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Creel survey results are subject to the locations, seasons, dates, and times of the interview. Language and literacy may present difficulties during an interview. Since interviews are based upon when the interviewer chooses to visit the angling site, interviewees are not prepared for the interview and may be less likely to participate. The interviewee may also not trust the stranger conducting the interview. Finally, rates may only be approximate when models aren't used for accuracy.

The HHFG only reviewed one dietary recall survey. This national food intake survey, conducted by the US Department of Agriculture, performed an interview of the 24 hour dietary recall of the participant on two con-consecutive days. Advantages of the survey methodology are that is that it is statistically representative of the US overall population, it has a good design for per-capita consumption estimates, the interviewer administration enhances its accuracy, and it was administered on non-consecutive days, which avoids correlated consumption data. Some limitations include short term data collection makes estimation of individual consumption imprecise as well as an individual's variation in consumption over time. The percentage of seafood consumers is biased low, consumer only rates are biased high, there was limited representation of smaller high consuming groups (Native Americans), and the per-capita rates underestimate consumer only rates (Kissinger, 2007)

**Deleted:** The interview/questionnaire method was used by five of the nine surveys reviewed. Additionally, there were three creel surveys and one dietary recall survey. More of the discussion on methodology is captured in the ranking of the studies below.

3) Populations surveyed

A detailed breakdown of populations and survey sample sizes can be found in Appendix 1. Of the studies reviewed, the populations surveyed included:

- Confederated Tribes of the Umatilla Indian Reservation, OR
- Confederation Tribes of the Warm Springs Indian Reservation, OR
- Confederation Tribes and Bands of the Yakama Indian Nation, WA
- Suquamish Indian Tribe of the Port Madison Indian Reservation, WA
- Tulalip Tribes, WA
- Squaxin Island Tribe, WA
- Nez Perce Tribe, ID
- Anglers of the Columbia Slough, OR
- Anglers of Sauvie Island, OR
- Anglers of Lake Whatcom, WA
- Anglers of Lake Roosevelt, WA
- Asian and Pacific Islanders, WA
- United States General Population, National Food Intake Survey

The HHFG discussed a number of populations that were underrepresented in their review. Within any population there are different groups based on gender, age and sex, such as children, adolescents, adult men, adult women, women of child bearing age, nursing mothers, elders, and individuals with health problems that may be fish consumers. People's bodies function differently which leads some people like children, women of child bearing age, and nursing moms to be particularly susceptible to the negative health effects of toxic pollutants. Some of the populations of people the HHFG felt were underrepresented were:

**Deleted:** of people

**Comment:** Joan- this section should be expanded. Refer to CA Chemicals in Fish report

- General Oregon Population
- Adolescents
- Eastern European Community and other racial and ethnic populations
- Anglers
- Elders

Deleted: Vegetarian Fish Eaters

The population interviewed is often referred to as the "target population". The HHFG noted that there were numerous "target populations" in the studies they reviewed. They stated that a greater level of protection should not be targeted to one specific population, but instead afforded to all high fish consuming populations.

Finally, the HHFG discussed the applicability of the populations surveyed with those populations that exist in Oregon. Overall, the HHFG felt that all of the populations surveyed reflected fish consumption patterns in Oregon with slight exception of the Puget Sound Tribes. The Puget Sounds Tribes surveyed were eating marine/estuarine finfish and shellfish species that may not be available in Oregon waters. Among all Tribal population data, however, there were similar patterns of high consumption. This means the Puget Sound consumption patterns were still helpful data, since they were characteristic of other Tribal patterns regardless of the species present.

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Comment: Jordan - Should this relationship be expanded upon? There can be 2 types of comparisons. 1) a comparison of the patterns of fish consumption between populations and 2) the comparison of FCRs between populations based on fish species eaten. Some might say that people eat what is available to them. What more can be said about this? Maybe. How does the WA tribal data compared to the CRITFC data help draw conclusions about other Oregon tribes or high consuming populations (Asian and Pacific Islanders)?

4) Consumers only

Fish consumption surveys include people who eat fish and people who don't eat fish. Often, people who don't eat fish are considered "non-consumers". Those that do eat fish are considered "consumers". The amount of non-consumers will vary depending on the population being interviewed. For instance, of the 500 respondents in *A Fish Consumption Survey of the Umatilla, Nez Perce, Yakama, and Warm Springs Tribes of the Columbia River Basin* (CRITFC, 1994), about 91 percent of them were fish consumers. It is common among the Tribal populations reviewed in this report to have a very high percentage of fish consumers in their population.

Oregon's current fish consumption rate of 17.5 grams/day is calculated on a per capita basis for the entire United States population. A per capita fish consumption rate is calculated using the data from consuming and non-consuming populations. All non-consumers are recorded as having a consumption rate of 0 grams/day. When averaging in all the 0 grams/day with the rates of the consumers, the resulting fish consumption rates represent the averages across an entire population of consumers and non-consumers.

A survey's methodology plays a large factor in determining the number of consumers and non-consumers. For instance, in EPA's 2002, *Estimated Per Capita Fish Consumption in the United States* (EPA, 2002), fish consumption data was collected using a non consecutive 2-day dietary recall. Anyone who didn't eat fish on either of the 2 recall days was considered a non-consumer. This methodology has the potential to underestimate the number of consumers in a population. Furthermore, anyone who did eat fish on either of the two days would be considered a consumer. The data for an

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individual consumer was then assumed to that person's rate of consumption for every day of the year. This assumption results in a grams/day fish consumption rate for consumers only that overestimates the actual consumption patterns.

The HHFG discussed this issue in detail and determined that using per capita fish consumption rates are not representative of people who actually eat fish. Oregon's human health water quality criteria are developed to specifically protect individuals who consume fish, which would make the consumers only rates most representative of a fish consuming population. Finally, the HHFG does recognize that some methodologies produce overestimated consumer only rates as explained above.

5) Seafood species consumed

There are a variety of fish and shellfish species represented in the studies reviewed. Fish and shellfish species can be classified as marine, estuarine, or freshwater based upon the habitat they are born, reproduce, grow, and die in. Some species of fish or shellfish can spend portions of their life in multiple aquatic environments. Pacific salmon are anadromous fish that hatch in freshwater, migrate to the ocean and then return to freshwater to spawn and die

The seafood species consumed by recreational and subsistence fishing populations are dependent upon where those populations live and fish. The availability of fish and shellfish is a major factor influencing the types of seafood consumed by populations who harvest for consumption purposes. For example, tribal members interviewed in the CRITFC survey, reported eating resident trout, squawfish, sturgeon, suckers, walleye, and whitefish. They also consumed anadromous salmon, lamprey, shad, smelt, and sturgeon. They did not report eating any shellfish or pelagic (open ocean) finfish species.

In contrast, the Tulalip and Squaxin Island Tribes of the Puget Sound Region reported eating pelagic fish (cod, pollock, sablefish, rockfish, etc.), bottom fish (halibut, sole, flounder, sturgeon), anadromous fish (salmon, steelhead, smelt) and shellfish (clams, cockles, mussels, oysters shrimp, crab, scallops, etc.). All of these Tribes were consuming that which was available to them in their given harvest locations. Although direct comparisons of the fish and shellfish species consumed between the Columbia River Tribes and the Puget Sound Tribes are difficult, an overall comparison of consumption patterns among Tribal fishers is relevant. More information on the comparison of Tribal fish consumption rates can be found in sub-section 8 below, "Fish consumption rate ranges".

6) Ranking studies

The HHFG assigned a rank to each fish consumption survey they reviewed based on their study design, methodology, statistical and scientific certainty, and relevance of the survey to Oregon fish consumers. Tables 1 and 2 below describe the meaning of each ranked level and the how each survey was ranked. It's important to clarify that the HHFG was not asked to recommend a fish consumption rate, but rather a body of literature Oregon should rely on when choosing a fish consumption rate. To choose a

**Comment:** Pat – these are conflicting statements about consumer only data

**Comment:** Joan – we should use Lon K's slide 12 graph demonstrating the difference in rates between consumers and non-consumers

Joan – maybe discuss EPA CSFII consumer only data in detail here. EPA reported that nationally among the 84.1% consumers of fish and shellfish not including canned tuna over the past 12 months more than a quarter (37.5%) reported they are sport fish caught by themselves or someone they knew.

**Comment:** Pat – Not True. Did the HHFG discuss this?

**Comment:** Dave- suppressed rates should also be discussed

Reported fish consumption rates may be depressed due to several factors including the loss of a fishery through habitat destruction, the perception that a waterbody is polluted or that fish that reside in polluted (perceived or not) waters are unfit to consume. Furthermore, unintended consequences of regional, state, or national fish advisories on specific fish species have been shown to decrease overall fish consumption rates not linked to that specific advisory.

**Deleted:** Salmonids

**Comment:** Jordan – does the group want to comment on the direction I've laid out here?

**Deleted:** Many of the surveys do a good job of categorizing the consumption of species from different aquatic environments. The HHFG recognizes that depending on how Oregon decides to treat Pacific Salmon, certain fish consumption data sets may be more useful than others. Finally, and as mentioned earlier, the Puget Sound Tribes were also consuming many marine species that would not be technically included in Oregon's fish consumption rate, since they are not found in Oregon waters.¶

**Deleted:** decided to assign ranks to each of the studies they reviewed to determine which ones Oregon should rely on when choosing a fish consumption rate

rate is policy decision – to establish the scientific evidence Oregon should rely upon to choose that rate is technical decision.

| **Table 1.** Ranking Levels | |
|---|---|
| **Level 1** | ▪ **Do not rely upon**<br>▪ Informational but has flaws and limitations |
| **Level 2** | ▪ **Consider but with some uncertainty**<br>▪ Quality survey, valuable information, lacks reliable quantification of consumption rates |
| **Level 3** | ▪ **Rely upon**<br>▪ Quality survey, valuable information, has reliable quantification of consumption rates |

**Comment:** Pat – need more focus on the RELEVANCY of the survey

**Deleted:** Do not rely upon

**Comment:** I'm not sure our reasoning for not relying upon Level 1 and 2 survey is sound. All of these studies have limitations. It might be more appropriate to qualify the limitations rather than just discount the use of the study. For instance, after reviewing these studies again, I might argue that the Columbia Slough study is just as useful as the EPA national study. The Slough study represents varied local populations but underestimates consumption rates because of it's methodology. Similarly, the EPA national study has limitations in the applicability of the rates because of methodology and does not represent a local population. Aren't they both useful (with limitations) for Oregon?

| **Table 2.** Ranked Surveys | |
|---|---|
| **Survey** | **Ranking** |
| A Fish Consumption Survey of the Umatilla, Nez Perce, Yakama, and Warm Springs Tribes of the Columbia River Basin (CRITFC, 1994) | Level 3 |
| Estimated Per Capita Fish Consumption in the United States (EPA, 2002) | Level 3 |
| A Fish Consumption Survey of the Tulalip and Squaxin Island Tribes of the Puget Sound Region (Toy, et al., 1996) | Level 3 |
| Fish Consumption Survey of The Suquamish Indian Tribe of The Port Madison Indian Reservation, Puget Sound Region (The Suquamish Tribe, 2000) | Level 3 |
| Asian and Pacific Islander Seafood Consumption Study (Sechena, et al., 1999) | Level 3 |
| Lake Whatcom Residential and Angler Fish Consumption Survey (Whatcom, 2001) | Level 3 |
| Columbia Slough and Sauvie Island Fish Consumption Survey (Slough, 1996) | Level 2 |
| Re-evaluation of CRITFC data- A thesis by Neil A. Sun Rhodes (Rhodes, 2006) | Level 2 |
| Anglers who frequently Fish Lake Roosevelt (Roosevelt, 1997) | Level 1 |

7) Explanation of survey ranking

Below is a discussion of each survey's strengths and limitations. This is not an exhaustive list, but rather the main points of discussion that were generated when ranking the studies.

**CRITFC, 1994 – Level 3**

Strengths:

- Peer reviewed.
- Random selection of survey participants from all 4 Tribes.
- Sample population includes Oregonians.
- Surveyed participants 24 hour recall, weekly, monthly, seasonal and 20 year average fish intake.
- A variety of different fishing locations, types of fish, and preparation methods were documented.
- Includes children
- Detailed breakdown of results and good documentation of the methodology, and statistics performed.

Comment: Pat – NO....need to verify

Comment: Pat – NO...need to verify

Deleted: treatment of outliers,

Limitations:

- Survey was conducted during a low fish consumption season (October-February) which may underestimate consumption rates.
- The outliers were not categorized using any statistical methods but rather just considered "unreasonably high".
- The number of consumer may be over-represented if non-consumers just chose not to participate in the survey
- Dietary recall diet was not re-analyzed and compared to the interview results
- Body weight not recorded.
- Child data only reflects one child per household.

Comment: Pat – NO...need to verify

**EPA, 2002 – Level 3**

Strengths:

- Peer reviewed.
- Large sample size reflecting the US general population.
- Surveys children (0-6) and adolescents (6-14).
- Good summary tables of data analyzed.
- A useful survey for tracking national trends

Limitations:

- Mostly store bought fish bought by participants
- Originally designed as a nutritional study so cooked fish, and recipes including fish, were converted to uncooked weight.
- Over half of all participants were non-consumers.
- Consumer only data overestimates the consumption rates because of the survey methodology used.

Comment: Pat – need to verify

Joan – this is a significant limitation. We should clarify what percentage of fish was store bought versus caught. This supports the reasons why we should also include other angler studies that may be more relevant.

Comment: Pat and Joan – this needs clarification

**Toy, et al., 1996 – Level 3**

Strengths:

- Peer reviewed
- Regionally relevant and randomly selected participants.
- Includes children.
- Strong statistical analysis of outliers
- Large number of fish and shellfish species represented

Deleted: <#>Trends well with the CRITFC study.¶

- Records respondent's body weight.
- Methodology modeled from the CRITFC survey.

Limitations:

- There are a significant number of marine finfish and shellfish species that would not be included in Oregon's fish consumption rate.

**The Suquamish Tribe, 2000 – Level 3**

Strengths:

- Peer reviewed.
- Regionally relevant and randomly selected participants.
- Includes children.
- Trends well with CRITFC study.
- Every respondent consumed fish.
- Strong statistical analysis of outliers.
- Large number of fish and shellfish species represented.
- Records respondent's body weight.
- Strong methodology modeled off of the CRITFC survey.

Limitations:

- There are a significant number of marine finfish and shellfish species that would not be included in Oregon's fish consumption rate.

**Sechena, et al., 1999 – Level 3**

Strengths:

- Peer reviewed.
- Regionally relevant for the Pacific Northwest as it describes seafood consumption patterns of a diverse array of Asian and Pacific Islanders from King County in Washington State.
- Good documentation of seafood preparation and parts consumed.
- Records respondent's body weight.

Limitations:

- Around 80% of all seafood consumed by the 202 adult participants was store bought and not self harvested, which creates uncertainties in the fish's origin.
- A portion of the respondents were re-interviewed and the results were dramatically different, although the group results were not dramatically different. This indicates unreliable individual consumption estimates but reliable community data.
- There are a significant number of marine finfish and shellfish species that would not be included in Oregon's fish consumption rate.

**Whatcom, 2001 – Level 3**

Strengths:

- Peer reviewed.
- Regionally relevant for a Pacific Northwest lake fishing community located near an urban center.
- Good representation of residential lake fish species.

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**Comment:** Jordan – we need to clarify that the study is useful for comparisons of consumption patterns but not directly relevant to species specific consumption in Oregon.

**Comment:** Pat – what about child data.

**Comment:** Pat – aren't there other weaknesses?

**Comment:** Jordan – we need to clarify that the study is useful for comparisons of consumption patterns but not directly relevant to species specific consumption in Oregon

**Comment:** Pat – discuss relevance to Oregon

- Good study design with 3 different angling target populations.
- Some children data.
- Provides information on the effect of fish advisories on consumption patterns.

Limitations:

- The 4 week recall diet limited the ability to fully quantify fish consumption because of the low amount of people that consumed fish during that period.
- Many residents and anglers perceived fish as unsafe to consume without knowledge of contaminant levels.

**Slough, 1996 – Level 2**

Strengths:

- Relevant study because it was conducted in 2 fishing locations of Portland, Oregon's metropolitan area.
- Good information on different fishing populations around Portland such as Eastern Europeans, Asians, Hispanics, and African Americans.
- Well documented fish preparation methods.
-

Limitations:

- Anglers had difficulty in estimating the quantity of fish consumed.
- Only fish that were measured and weighed at the time of the survey were included in the consumption data.
- Only 30% of the total fish weight was considered edible regardless of the preparation method reported.
- Small sample size.

**Rhodes, 2006 – Level 2**

Strengths:

- This study was a re-evaluation of the CRITFC data that placed a greater emphasis on children, women of child bearing age, and elders.
- All strengths of CRITFC, 1996 apply to this study as well

Limitations:

- Not peer reviewed.
- No new data was presented.
- All limitations of CRITFC, 1996 apply to this study as well.
- Additionally, this work was a done as a Master's Thesis, which makes the peer review and reliability of the work questionable.

**Roosevelt, 1997 – Level 1**

Strengths:

- Regionally relevant for a Pacific Northwest lake fishing community
- Good representation of residential lake fish species.
- Good sample size for creel survey.

Limitations:

**Comment:** Pat – peer reviewed?

**Comment:** Jordan – this comment was added by Pat. I'd like some clarification on it.

**Comment:** I think this needs a little more clarification about why the information is not reliable.

**Comment:** Pat – Peer reviewed?

- Survey questions were changed between the years of study to obtain more accurate information on the number and species of fish consumed rather than just the number of fillets consumed, which was asked during the first survey year.
- Consumption information collected along with creel data, making survey too lengthy.
- Survey's not adequate for determining fish meal size, which make the fish consumption rate estimates inaccurate.

8) Fish consumption rates

Appendix 3 lists fish consumption rates from the 9 studies reviewed by the HHFG. *In this section, the HHFG might want to comment on the ranges of rates presented in whatever type of table you choose to present. Trends between the high consuming studies can be discussed, childrens rates can be compared. Additionally, there could be text noting the other angler studies that were not reviewed in detail but could provide some useful context for Oregon when deciding upon their FCR.*

B. Findings for Issue #1

- Based on the fish consuming populations represented in the surveys, a greater level of protection should be afforded to all people who consume fish.
- A review of the fish consumption rate studies, including regional data, indicate that: there are multiple and diverse fish consuming populations, populations are consuming fish at a rate higher than 17 5 g/day, and that 17.5 g/day is not reflective of the high fish consumers in Oregon.
- Consumer only rates are most representative of a fish consuming population (limitations in the methodology for calculating consumer only rates should be taken into account)
- Level 3 surveys should be used as the basis for choosing a fish consumption rate for Oregon (Table 2), while recognizing that there are other relevant surveys that could be useful but due to time and resource constraints, could not be reviewed by the HHFG.

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Comment: Pat – did we reach this conclusion?

V. Issue #2

**How should salmon be considered in selecting a fish consumption rate and/or calculating criteria?**

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**A. Discussion**

1) Accounting for contaminants in salmon and other marine fish

EPA based the national default fish consumption rates on freshwater and estuarine finfish and shellfish when revising the national default fish consumption rates[1]. This is because, traditionally, WQS apply to discharges in fresh and estuarine waters- not in deep marine waters.

[1] 65 FR 66469. Federal Register Notice: Revisions to the Methodology for Deriving Ambient Water Quality Criteria for the Protection of Human Health (2000). Pp. 65 FR 66444-66482.

EPA's habitat classification of Pacific salmon (chum, coho, king, pink, and sockeye) as "marine" is a unique situation. EPA classified the habitat of salmon based on commercial landings data provided by the National Marine Fisheries Service for the period of 1989-1991[2]. As the landings of Pacific salmon were reported from the marine environment, Pacific salmon were classified as "marine" and excluded from the national default fish consumption rates

To ensure that exposure to contaminants in salmon and other marine fish is accounted for in the criteria, EPA applies the Relative Source Contribution (RSC) variable to some of its criteria. The RSC is a variable applied to reference dose (RfD) based criteria. The RfD represents a threshold of exposure: exposure up to or below the threshold is assumed to be safe. Once the threshold is exceeded, it is unclear if an individual is protected. The purpose of the RSC is to ensure that exposure to the RfD-based criteria allowed by the criteria, when combined with all other water and non-water sources (e.g. marine fish, drinking water, and inhalation) will not exceed the threshold[3]. Given the inability to predict future changes in exposure patterns, unknown sources of exposures, and potential for some populations to experience greater exposures than indicated by available data, utilizing the entire RfD does not ensure adequate protection[4].

The classification of salmon as "marine" and use of the RSC is what EPA provides in its guidance. States and authorized Tribes can make alternative assumptions to specifically account for salmon intake.

2) Pacific salmon as part of the diet

Pacific Salmon are a component of diet in many of the studies reviewed by the Human Health Focus Group:

- A Fish Consumption Survey of the Umatilla, Nez Perce, Yakama and Warm Springs Tribes of the Columbia River Basin (CRITFC, 1994);
- Re-evaluation of CRITFC data- A thesis by Neil A Sun Rhodes (Rhodes, 2006);
- Estimated Per Capita Fish Consumption in the United States (EPA, 2002);
- A Fish Consumption Survey of the Tulalip and Squaxin Island Tribes of the Puget Sound Region (Toy et al., 1996);
- Fish Consumption Survey of the Suquamish Indian Tribe of the Port Madison Indian Reservation, Puget Sound Region (The Suquamish Tribe, 2000);
- Asian and Pacific Islander Seafood Consumption Study (Sechena et al, 1999);

As these fish are being consumed by various populations in Oregon, they need to be accounted for when developing Human Health Water Quality Criteria to protect fish consumers.

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[2] 65 FR 66469. Federal Register Notice: Revisions to the Methodology for Deriving Ambient Water Quality Criteria for the Protection of Human Health (2000). Pp. 65 FR 66469- 66470.

[3] 65 FR 66473. Federal Register Notice: Revisions to the Methodology for Deriving Ambient Water Quality Criteria for the Protection of Human Health (2000) Pp 65 FR 66444-66482.

[4] EPA, 2000. *Methodology for Deriving Ambient Water Quality Criteria for the Protection for Human Health* EPA 833-B-00-004. P. 4-5

3) Accounting for salmon in the human health criteria

**Include Salmon in the Fish Consumption Rate**

As noted previously, salmon were identified in most of the fish consumption studies reviewed by the Focus Group. As the Human Health Water Quality Criteria are intended to protect fish consumers, it should account for all types of fish being consumed. This can be done by including salmon in the fish consumption rate.

Comment: Jordan – overall, I think there needs to be a discussion about the application of DEQ's human health water quality criteria. Simply, we only apply our criteria in fresh and estuarine water. A reduction in standards will only affect those fish living in the those waters. So, the application of our standards will have little to no effect on the pollutants in marine fish. So, although we can recognize that people eat certain fish actually applying that rate for the purposes of HH water quality criteria needs to be carefully thought about.

We can discuss.

The bases for including salmon in the fish consumption rate are salmon: is a significant part of the diet that should be accounted for, are harvested in freshwater systems of Oregon, and exposed to toxins when in these freshwater systems. The details of these points are explained in the following.

Oregon-specific data exists that contradict EPA's basis for excluding salmon from the fish consumption rate. EPA's excluded salmon from the fish consumption rate as they were caught in marine systems[5]. A review of fishing locations for salmon identified in the only Oregon-specific fish consumption study indicates multiple fishing sites within the freshwater system[6].

The Human Health Focus Group did not do a thorough review of all data identifying sources of contaminants in salmon. They also did not review specific studies identifying where the major source of exposure for salmon to contaminants occurs (e.g. in the marine systems vs. freshwater/estuarine systems). However, a study by Johnson et al. (2007) of Chinook salmon in the Columbia River detected the following toxics in fish tissue: PCBs, DDT and, to a small extent, aromatic hydrocarbons, chlordanes, aldrin, diledrin and mirex [7,8]. These data demonstrate exposure to toxics occurring during the freshwater portion of the Pacific salmon life-stage.

Comment: Jordan – what about the other side of the story...to fairly present the scientific facts?

As salmon are a major component of the diet, are caught locally and exposed to waters of the State for part of their lifecycle- they must be accounted for in the Human Health Water Quality criteria. As discussed in the next section, there is more scientific certainty including salmon (and other marine fish) in the fish consumption rate, when compared to developing RSCs for all the RfD-based criteria.

**Utilizing the RSC to Account for All Sources of Exposure**

The purpose of the RSC is to account for all other sources of exposure to a given RfD-based contaminant- water and nonwater sources (e.g. dermal exposure, inhalation, drinking water, non-local/marine fish). This concept is applied in other programs

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[5] 65 FR 66469. Federal Register Notice: Revisions to the Methodology for Deriving Ambient Water Quality Criteria for the Protection of Human Health (2000). Pp 65 FR 66469- 66470.

[6] CRITFC, 1994. *A Fish Consumption Survey of the Umatilla, Nez Perce, Yakama and Warm Springs Tribes of the Columbia River Basin.* Technical Report 94-3, Appendix 9 and Appendix 24.

[7] Johnson, LL et al., 2007. Persistent organic pollutants in outmigrant juvenile Chinook salmon from the Lower Columbia Estuary, USA. Science of the Total Environmental. 374: 342-366.

[8] Johnson, LL et al., 2007. Contaminant exposure in outmigrant juvenile salmon from Pacific Northwest estuaries of the United States. Environmental Monitoring and Assesment. 124: 167-194.

outside of Water Quality Standards, for example in EPA's pesticides and Superfund programs. Like EPA, Oregon's current criteria account for all marine fishes (including Pacific salmon) using the RSC variable.

Comment: Jordan – this is confusing

Oregon currently applies the RSC to the following chemicals in its Human Health Water Quality Criteria[9]:

- Antimony
- Methylmercury
- Thallium
- Cyanide
- Chlorobenzene
- 1,1, Dichloroethylene
- Ethylbenzene
- Toluene
- 1,2 Trans Dichloroethylene
- 1,2 Dichlorobenzene
- 1,4 Dichlorobenzene
- Hexachlorocyclo-pentadiene
- 1,2,4 Trichlorobenzene
- Gamma-BHC
- Endrin

Comment: Jordan – need to clarify whether the RSC is applied or just listed and not used.

The RSC is not applied to the other RfD-based criteria. The Human Health Focus Group considered ways in which Oregon could consider salmon and other marine fish in its criteria in light of the limited application of the RSC.

The nine reviewed fish consumption surveys provide a wide array of information about local, regional and national fish consumption patterns. This includes data on the types and percentages of fish being consumed: freshwater, estuarine, marine, commercial, angler caught, etc. This data set provides Oregon with information on the types and amounts of fish being consumed by Oregonians, including marine fish and salmon.

The RSC variable takes in to account exposure to a contaminant from all other sources: air sources (inhalation, dermal), other water sources (drinking water), etc. EPA provides guidance on calculating RSC values outside of its own default values (see Appendix 4). This process requires significant and robust data sets on all sources of exposure a population has to each individual chemical. Data on all these other sources of exposure do not exist for Oregon, so it would not possible to calculate Oregon-specific RSC values for those chemicals where EPA has not developed any.

As Oregon has scientifically defensible data set regarding the types and amount of fish being consumed, it would be possible to include those fishes (salmon and marine species) in the fish consumption rate. This would ensure that all fish being consumed are being accounted for in the Human Health Water Quality Criteria- carcinogens

[9] *See Appendix A for more information on the existing RSC values*

(which RSCs are not applied to) and RfD-based criteria. Developing Oregon-specific RSC values for all of the remaining RfD-based compounds would be difficult as a robust data on all other sources of exposure does not exist. Therefore it would be more scientifically certain to include salmon and other marine fish in the fish consumption rate than developing RSC's for all of the remaining criteria.

**Addressing Salmon in the RSC if they are Included in the Fish Consumption Rate**
The RSC variable includes all sources of exposure, including marine fish. The Human Health Focus Group considered the feasibility of recalculating Oregon's existing RSC values if salmon (and other marine fish) were included in the fish consumption rate.

Oregon's current criteria are based on EPA's recommended guidance values, so including salmon in the fish consumption rate could result in salmon being 'double counted' in the RSC. However, for the majority of RSC applied to Oregon's existing criteria, the primary source of exposure is not marine fish but other sources: e.g. inhalation, drinking water (see Appendix 5). EPA provides guidance on calculating RSC values outside of its own default values (see Appendix 4). A review of this decision tree indicates that, depending on the data set upon which the FCR is based, the contribution of salmon could be subtracted out from the methylmercury RSC variable. Adequate data do not exist to alter the other RSC values if salmon were included in the fish consumption rate.

Comment: Jordan – needs a better intro to the mercury discussion

4. Evaluation of options

**Including salmon and marine fish within the fish consumption rate:**

- Salmon are part of the diet in most of the reviewed studies;
- Data exists demonstrating that salmon are being harvested in the freshwaters of Oregon, where Water Quality Standards apply;
- Juvenile salmon are exposed to and accumulating contaminants while rearing in the freshwater/estuarine waters of Oregon;
- A more robust data set exists demonstrating the exposure of Oregonians to salmon and marine fish than other sources of exposure (e.g. inhalation, dermal, drinking water);
- Accounting for salmon and marine fish in the fish consumption rate is a scientifically certain way to account for all species of consumed fish in the Human Health Water Quality Criteria;
- It also ensures that consumption of salmon and marine fish is accounted for both carcinogenic and non-carcinogenic compounds;
- Depending on how 'salmon' were defined in each fish consumption study, teasing out *Pacific* salmon data from all other fish types could be difficult.

*Challenges*

- It could result in double counting salmon and other marine fish in the RSC variables.

**Developing new RSC variables for all remaining RfD-based criteria values:**

- EPA's "Decision Tree" (Appendix 4) outlines methods for developing RSC variables to account for marine fish;

- EPA does provide default RSC values that can be used where data on total exposure are absent;

*Challenges*

- The RSC variable is only applied to RfD-based criteria, so accounting for salmon and marine fish only in the RSC means that consumption of these fishes are not considered in the carcinogen-based criteria;
- Oregon does not have sufficient data to develop Oregon-specific RSC values for all of the RfD-based criteria.

**Revising Oregon's existing RSC variables:**

- Oregon's existing RSC variables are based on EPA's recommended values published in its guidance[10, 11];
- Many of the RSC variables are used to account for exposures outside of fish consumption (Appendix 5);

*Challenges*

- Data on all other exposures sources for chemicals with existing RSCs are not available, making it impossible to determine what percentage of the RSC is fish consumption vs. inhalation vs. dermal exposure, etc;
- Although the RSC for methylmercury is based exclusively on marine fish, revising this to account for salmon/marine fish will depend on what data set Oregon basis its FCR on and how the fish species are classified (e.g. including rainbow and steelhead trout in the definition of "salmon").

Comment: Jordan – these are not all the options.

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## VI. Issue #3

*To what extent are populations who consume more than the current fish consumption rate of 17.5 grams/day at a greater risk for health impacts?*

### A. Discussion

1) Calculating human health water quality criteria

DEQ has numeric human health water quality criteria for 130 toxic pollutants. To set the criteria, or limits, of these pollutants in Oregon's surface waters, DEQ uses a level of acceptable risk for people exposed to toxics though the consumption of fish and water. Additionally, the criteria account for the risk of cancer versus non-cancer causing pollutants differently. Figure 1 below lists the equation and variables used to calculate human health water quality criteria.

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[10] EPA, 2002. National Recommended Water Quality Criteria: 2002 Human Health Criteria Calculation Matrix. EPA-822-R-02-012

[11] EPA, 2003. National Recommended Water Quality Criteria for the protection of Human Health. 68 FR 75507-75515

*Cancer*

$$AWQC = \frac{(Risk/q1^*) \cdot BW \cdot 1000\ (ug/mg)}{DI + FI \cdot BCF}$$

*Non-cancer*

$$AWQC = RFD \cdot RSC \cdot 1000\ ug/kg \cdot \left[ \frac{BW}{DI + FI \cdot BCF} \right]$$

AWQC = Ambient Water Quality Criteria (ug/l)
BW = Body Weight (kg)
DI = Drinking water Intake (L/day)
FI = Fish Intake (kg/day)
BCF = Bioconcentration Factor (L/kg)
RFD = Reference Dose (mg/kg/day)
RSC = Relative Source Contribution
Risk = Acceptable cancer risk level ($10^{-6}$ in Oregon)
q1* = Cancer slope factor

**Figure 1.** Equations for Calculating Human Health Water Quality Criteria (Water + Organism)

2) Cancer risk

In the context of the Clean Water Act, the EPA has established the acceptable incremental cancer risks for any population to be between 1 extra incidence of cancer in 10 thousand people to 1 extra incidence of cancer in 1 million people. In 2004, DEQ chose the acceptable cancer risk to be 1 in 1 million. Using the equations in Figure 1, the excess cancer risk of anyone consuming more than 17.5 grams/day of fish and shellfish would exceed the 1 in 1 million level of cancer risk that DEQ has established. One can calculate the extent of the cancer risk by simply replacing 17.5 grams/day with the actual consumption rate and solve for the cancer risk variable.

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Comment: Joan provide an example

In summary, people who eat more than 17 5 grams/day of fish and shellfish will be at a greater cancer risk than the 1 in 1 million acceptable level DEQ has established. The extent of that risk can be calculated and varies by chemical due to the different toxicities of each chemical.

3) Non-cancer risk

In the context of the Clean Water Act, EPA policy is that the reference dose should not be exceeded for non-cancer causing chemicals. The reference dose is the level of exposure to a chemical below which non-cancer adverse effects are not expected. Using the equations in Figure 1, anyone consuming more than 17.5 grams/day of fish and shellfish would exceed the reference dose. To evaluate the extent of risk for different levels of fish consumption, it is possible to calculate a Hazard Quotient (HQ) for any level of exposure. Any HQ over 1 is considered unsafe or has the potential for adverse health effects. The magnitude of this potential can be inferred from the degree to which this value is exceeded. The more a hazard quotient exceeds a value of one, the greater potential for adverse health effects. The HHFG recognized that although a Hazard Quotient can be calculated, it is not a reliable indication of the extent of someone's risk. The toxicity of any given chemical will affect the extent of risk. For example, if "pollutant A" has a HQ of 10 and "pollutant B" has a HQ of 100, "pollutant A" is not necessarily less harmful than "pollutant B".

In summary, people who eat more than 17.5 grams/day of fish and shellfish will exceed the reference dose, or the level at which there are no expected adverse health effects. The extent of that risk is dependent upon the toxicity of the individual chemical and cannot be easily quantified.

4) Sensitive populations and toxicity

The HHFG discussed populations that are more sensitive to the toxicity of certain pollutants. These populations include children, adolescents, women of childbearing age, nursing mothers, and the elderly. The human health water quality criteria are calculated using a body weight of a 70kg adult male (Figure 1). This exposure factor does not account for the lighter body weights of populations such as children and adolescents.

Additionally, the toxicity of any given pollutant (cancer or non-cancer causing) is one of the variables used to calculate the human health water quality criteria (Figure 1). In many cases, the toxicity of chemicals is derived from laboratory studies of animals. In extrapolating the results of these studies to humans, sensitive populations are, in many cases, not accounted for.

There were varied opinions among the HHFG about the over or under protectiveness of both the exposure and toxicity factors used to calculate human health water quality criteria (Figure 1). Discussion of the other exposure (besides the fish consumption rate) and toxicity factors was limited to the context of characterizing the increased risk people faced by eating more than 17.5 grams/day of finfish and shellfish. A detailed discussion about the accuracy of certain toxicity factor and appropriateness of the exposure factors (besides the fish consumption rate) did not take place.

5) Chemical specific risk

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Comment: Jordan – Dave added some language to this paragraph. It seems to contradict what I have written in the last sentence. Opinions?

Comment: Pat – provide an example

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Comment: Is this right?

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Human health water quality criteria are calculated for individual chemicals. The calculated risk of any chemical does not take into account additive or synergistic effects of other chemicals. The HHFG discussed that in many circumstances, especially through the consumption of contaminated fish, people are exposed to numerous chemicals at once. If any of these chemicals have the same toxicological endpoints, the exposed individual is at an even greater risk than what was calculated for negative health effects.

6) Findings for Issue #3

- Populations who consume greater than 17.5 g/day are at a greater risk of health impacts for both cancer effects and non-cancer effects- which is especially concerning for vulnerable populations (women of child-bearing age, children).

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## VII. References


CRITFC, 1994. *A Fish Consumption Survey of the Umatilla, Nez Perce, Yakima, and Warm Springs Tribes of the Columbia River Basin*. Columbia River Intertribal Fish Commission. CRITFC Technical Report No. 94-3. Portland, Oregon.

EPA. 2002. *Estimated per Capita Fish Consumption in the United States*. US Environmental Protection Agency. EPA-821-C-02-003.

Kissinger, 2007. *Overview of Seafood Consumption Survey Methodology, Studies & Results.* Powerpoint presentation given at fish consumption Workshop #2, May 16th. http://www.deq.state.or.us/wq/standards/docs/toxics/overviewstudies.pdf

Rhodes 2006. *Fish Consumption, Nutrition, and Potential Exposure to Contaminants Among Columbia River Basin Tribes*. Masters of Public Health Thesis, Oregon Health and Science University.

Roosevelt 1997. *Consumption Patterns of Anglers Who Frequently Fish Lake Roosevelt*. Washington State Department of Health.

Sechena, et al., 1999. *Asian & Pacific Islander Seafood Consumption Study*. King County, Washington. EPA 910/R-99-03.

Slough, 1996. *Technical Memorandum on the Results of the 1995 Fish Consumption and Recreational Use Surveys - Amendment No 1*. City of Portland, Bureau of Environmental Services. Report written by Adolfpson Associates, Inc.

The Suquamish Tribe, 2000. *Fish Consumption Survey of the Suquamish Indian Tribe of the Port Madison Indian Reservation, Puget Sound Region*. The Suquamish Tribe 15838 Sandy Hook Road, Post Office Box 498, Suquamish, WA 98392.

Toy, et al., 1996. *A Fish Consumption Survey of the Tulalip and Squaxin Island Tribes of the Puget Sound Region*. Tulalip Tribes, Department of Environment, 7615 Totem Beach Road, Marysville, WA 98271.

Whatcom, 2001. *Lake Whatcom Residential and Angler Fish Conumption Survey*. Washington Department of Health, April 2001.

Appendix 1: Summary table of Surveys Reviewed

| *Survey Name* | *CRITFC Fish Consumption Study(1994)* | *Re-evaluation of 1994 CRITFC Fish Consumption Study (2006)* | *EPA's Estimated Per Capita Fish Consumption in the United States (2002)* | *Tulalip and Squaxin Island Tribes Fish Consumption Study (1996)* | *Suquamish Tribe Fish Consumption Study (2000)* | *Columbia Slough and Sauvy Island Fish Consumption Survey (1995)* | *Asian and Pacific Islander Seafood Consumption Study (1999)* | *Lake Whatcom Angler Study (2001)* | *Lake Roosevelt Angler Study (1997)* |
|---|---|---|---|---|---|---|---|---|---|
| *Survey Methodology* | interview/questionnaire and dietary recall | interview/questionnaire and dietary recall | dietary recall | interview/questionnaire | interview/questionnaire | creel survey | interview/questionaire | creel survey with a 4 week recall | creel survey |
| *Description* | Fish consumption survey including information on the amount of fish harvested from the Columbia River and its tributaries. 513 adults and 204 children were surveyed. Children were between 0 and 6 years of age. No adolescents were surveyed. Random selection from Indian Health Service of enrolled members on or near reservation. Participants were compensated $40/person. | Reanalyzed the data from the 1994 CRITFC study focusing on children, women of child-bearing age and elders | stratified random; low income; no ethnic or Indian specific interviews | Seafood consumption survey including information on whether or not adults harvested fish & shellfish from Puget Sound. 190 adults and 69 children were surveyed. Children were between 0 and 6 years of age. No adolescents were surveyed.Randomly selected tribal members | Seafood consumption survey including information on whether or not adults harvested fish & shellfish from Puget Sound. 92 adults and 31 children were surveyed. Children were between 0 and 6 years of age. No adolescents were surveyed. Randomly selected tribal members. | Survey of local anglers at Sauvie Island and Columbia Slough; 20 sample days over one month period | Seafood consumption survey characterizing fish and shellfish consumption by Asian Pacific Islanders residing in King County, including information on the quantity of self-harvested seafood. 202 adults were surveyed. No children or adolescents were surveyed. Participants were compensated by $25 check or grocery store gift certificate. | Study targeted people living near the lake, boat anglers, and people fishing from the shore. | Conducted over 2 fishing seasons to determine consumption patterns of anglers who repeatedly fish the lake. Surveyed anglers returning from trips at boat launches. |
| *Cost* | $300,000 | see CRITFC, 1994 | N/A | N/A | ~$150-250K | N/A | ~$750K | | |
| *Population Interviewed* | 744 called; 125 per tribe; Representing:yakama 3872; nez perce 1446; umatilla 818; warm springs 1531 | Re-evaluation focused on Women who gave birth in the past 5 years, elders aged 55 years (+), and children age <5 years | 21000; Represents the general US population (281 million people) | 150 Tulalip; 120 Suquaxin Island; Represents 2 tribes 2 tribes = 14 Puget Sound Tribes;Tulalip 1398;Squaxin Island 500 | Represents 831 people | 91 anglers (ethnicity includes E. Europeans, Hispanics, Asians, African Americans and Native Americans) | 202 Asian Pacific Islanders within King County, Washington; 1st or 2nd generation 18+ years of age; consumers only | 194 residential interviews, 38 boat anglers, and 10 shore anglers. | 448 survey's collected from primarily 2 adult households. 97% Caucasian, 2.4% Native American. |
| *Number of Children* | 204; (0-6 years) | 200; (0-5 years old) | 2000 in 1996 (0-10 years old); add 4000 in 1998 (add 3 year old girls in 1998) | 69 (0-6 years old) | 31 (0-6 years old) | N/A | N/A | N/A | 29% of respondents had children in the house. |
| *Number of Adults* | 513 (>18 years of age) | see CRITFC, 1994 | 15000 (>18 years of age) | 190 | 92 | | 202 (at or >18 years of age) | 242 | 448 |
| *age range* | 58% 18-39;31% 40-59; 9.9% 60 | see CRITFC, 1994 | N/A | N/A | N/A | N/A | N/A | N/A | 60% of angler over 50 years old. 90% male. |

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**Appendix 2.**

## Additional Fish Consumption Surveys for Consideration


Degner RL, Adams CM, Moss SD, Mack SK (1994) *Per Capita Fish and Shellfish Consumption in Florida*. Florida Agricultural Market Research Center, Food and Resource Economics Department, Institute of Food and Agricultural Sciences, University of Florida. Gainesville, FL: Industry Report 94-2. Submitted to Florida Department of Environmental Protection. August 1994.

Fiore BJ, Anderson HA, Hanrahan LP, Olson LJ, Sonzogni WC (1989) Sport fish consumption and body burden levels of chlorinated hydrocarbons: A study of Wisconsin anglers. *Archives of Environmental Health* **44**:82-88.

Javitz, H. (1980) Seafood consumption data analysis. SRI International. Final report prepared for EPA Office of Water Regulations and Standards. EPA Contract 68-01-3887.

MBC Applied Environmental Sciences. 1994. Santa Monica Bay Seafood Consumption Study. Final Report. Costa Mesa, CA.

Puffer, H.W., Azen, S.P.; Duda, M.J.; Young, D.R. (1981) Consumption rates of potentially hazardous marine fish caught in the metropolitan Los Angeles area. EPA Grant #R807 120010

SFEI. 2000. San Francisco Bay Seafood Consumption Study. San Francisco Estuary Institute, Richmond, CA.

West, P.C.; Fly, M.J.; Marans, R.; Larkin, F. (1989) Michigan sport anglers fish consumption survey. A report to the Michigan Toxic Substance Control Commission. Michigan Department of Management and Budget Contract No. 8720141.

West, P.C.; Fly, J.M.; Marans, R.; Larkin, F.; Rosenblatt, D. (1993) 1991-92 Michigan sport anglers fish consumption study. Prepared by the University of Michigan, School of Natural Resources for the Michigan Department of Natural Resources, Ann Arbor, MI. Technical Report No. 6. May.

Wolfe, R.J.; Walker, R.J. (1987) Subsistence economies in Alaska: productivity, geography, and development impacts. Arctic Anthropology 24(2):56-81.

| | Group | Subgroup | Consumer/ Non Consumer | Seafood Source | Species included in consumption rate evaluation | Statistic (grams/day) | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Mean | Median | Percentile | | | |
| | | | | | | | | 75th | 90th | 95th | 99th |
| 1 | Tulalip Tribe[y] | Children (0-5 years old) | Consumer | All | Anadromous & resident finfish & shellfish | 3.6 | 1.2 | 4.5 | 11.2 | | |
| 2 | Squaxin Tribe[y] | Children (0-5 years old) | Consumer | All | Anadromous & resident finfish & shellfish | 12.5 | 7.7 | 18.2 | 31.3 | | |
| 3 | Suquamish Tribe[u] | Children (9 months to 6 years old) | Consumer | All | Anadromous & resident finfish & shellfish | 24 | 12 | | 57 | | |
| 4 | Columbia River Tribes[n] | Children (0-5 years old) | Consumer | All | Anadromous $ resident fish | 19.6 | | ~22 | ~40 | ~68 | ~129 |
| 5 | Columbia River Tribes - Reevaluation of data[bb] | Children (0-5 years old) | Consumer | All | Anadromous $ resident fish | 26.7 | 16.2 | | 64.8 | 81 | 162 |
| 6 | General Population[q] | Children (3-5 years old) | Nonconsumer | All | Resident finfish & shellfish from fresh and estuarine environments | 2.19 | | NA | 0.05 | 12.17 | 52.46 |
| 7 | General Population[q] | Children (3-5 years old) | Nonconsumer | All | Anadromous & resident finfish & shellfish from fresh, estuarine, and marine environments | 7.7 | | NA | 32.56 | 51 | 100 |
| 8 | General Population[r] | Children (3-5 years old) | Consumer | All | Anadromous & resident finfish & shellfish from fresh, estuarine, and marine environments | 74 | 64 | NA | 149 | 184 | 363 |
| 9 | General Population[r] | Children (3-5 years old) | Consumer | All | Resident finfish & shellfish from fresh and estuarine environments | 40 | 23 | NA | 95 | 129 | 205 |
| 10 | Lake Whatcom (WA) Fisherman[x] | Children | Consumer | Lake Whatcom (WA) | Resident fish | | 3.6 | | | | |
| 11 | Columbia River Tribes[s] | Women who have breastfed (36% of survey respondents) | Consumer | All | Anadromous $ resident fish | 59.1 | | ~58.5 | ~112 | ~174 | ~278 |

| | Group | Subgroup | Consumer/ Non Consumer | Seafood Source | Species included in consumption rate evaluation | Statistic (grams/day) | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Mean | Median | Percentile | | | |
| | | | | | | | | 75th | 90th | 95th | 99th |
| 12 | General Population[s] | Women (15-44 years old) | Consumer | All | Anadromous & resident finfish & shellfish from fresh, estuarine, and marine environments | 108 | 77 | NA | 221 | 315 | 494 |
| 13 | General Population[t] | Women (15-44 years old) | Consumer | All | Resident finfish & shellfish from fresh and estuarine environments | 75 | 36 | NA | 172 | 273 | 502 |
| 14 | Tulalip Tribe[w] | Adult (males) | Consumer | All | Anadromous & resident finfish & shellfish | 76 | 53 | | 212 | 247 | |
| 15 | Tulalip Tribe[w] | Adult (females) | Consumer | All | Anadromous & resident finfish & shellfish | 68 | 34 | | 187 | 218 | |
| 16 | Tulalip Tribe[a] | | Consumer | All | Anadromous & resident finfish & shellfish | 72 | 45 | 85 | 186 | 244 | 312 |
| 17 | Tulalip Tribe[a] | | Consumer | Harvested anywhere | Anadromous & resident finfish & shellfish | 63 | 37 | 80 | 159 | 236 | 311 |
| 18 | Tulalip Tribe[a] | | Consumer | Harvested from Puget Sound | Anadromous & resident finfish & shellfish | 54 | 30 | 74 | 139 | 194 | 273 |
| 19 | Tulalip Tribe[a] | | Consumer | All | Resident finfish & shellfish | 36 | 18 | 41 | 116 | 132 | 168 |
| 20 | Tulalip Tribe[a] | | Consumer | Harvested anywhere | Resident finfish & shellfish | 32 | 14 | 40 | 103 | 116 | 157 |
| 21 | Tulalip Tribe[a] | | Consumer | Harvested from Puget | Resident finfish & shellfish | 31 | 14 | 39 | 90 | 113 | 157 |
| 22 | Suquamish Tribe[b] | Adults (16 or older) | Consumer | All | Anadromous & resident finfish & shellfish | 214 | 132 | | 489 | NA | NA |
| 23 | Suquamish Tribe[c] | Adults (16 or older) | Consumer | Harvested from Puget Sound | Anadromous & resident finfish & shellfish | NA | 111 | NA | 534 | 785 | NA |
| 24 | Suquamish Tribe[c] | Adults (16 or older) | Consumer | Harvested from Puget | Resident finfish & shellfish | NA | 65 | NA | 380 | 680 | NA |
| 25 | Columbia River Tribes[q] | Adult | Consumer | All | Anadromous & resident fish | 63 | 40 | 60[e] | 113[i] | 176[g] | 389 |

| | Group | Subgroup | Consumer/ Non Consumer | Seafood Source | Species included in consumption rate evaluation | Statistic (grams/day) | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Mean | Median | Percentile | | | |
| | | | | | | | | 75th | 90th | 95th | 99th |
| 26 | Columbia River Tribes[m] | Adult | Nonconsumer | All | Anadromous & resident fish | 58.7 | ~40 | ~56.7 | ~113 | 170 | 389 |
| 27 | Columbia River Tribes[l] | Adult | Consumer | All | Resident fish | ~43 | | ~41 | ~82 | ~124 | ~284 |
| 28 | Asians & Pacific Islanders[aa] | Adults (18 or older) | Consumer | All | Anadromous & resident finfish & shellfish | 132 | 100 | | 274 | | |
| 29 | Asians & Pacific Islanders[h] | | Consumer | All | Anadromous & resident finfish & shellfish | NA | 78 | NA | 236 | 306 | NA |
| 30 | Asians & Pacific Islanders[h] | | Consumer | Harvested anywhere | Anadromous & resident finfish & shellfish | NA | 6.9 | NA | 49.1 | 76.3 | NA |
| 31 | Asians & Pacific Islanders[h] | | Consumer | Harvested from King County | Anadromous & resident finfish & shellfish | NA | 5.8 | NA | 25.5 | 57.1 | NA |
| 32 | Asians & Pacific Islanders[h] | | Consumer | Harvested anywhere | Resident finfish & shellfish | NA | 7.1 | NA | 54.2 | 72.3 | NA |
| 33 | Asians & Pacific Islanders[h] | | Consumer | Harvested from King County | Resident finfish & shellfish | NA | 6.6 | NA | 33.4 | 57.3 | NA |
| 34 | General Population[j] | Adults (18 or older) | Nonconsumer | All | Resident freshwater/estuarine finfish & shellfish[j] | 7.5 | 0 | NA | 17.4 | 50 | 143 |
| 35 | General Population[k] | Adults (18 or older) | Nonconsumer | All | Anadromous & resident finfish & shellfish from fresh, estuarine, and marine environments | 20 | 0 | NA | 75 | 111 | 216 |
| 36 | General Population[l] | Adults (18 or older) | Consumer | All | Anadromous & resident finfish & shellfish from fresh, estuarine, and marine environments | 127 | 99 | NA | 248 | 334 | 519 |

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| | Group | Subgroup | Consumer/ Non Consumer | Seafood Source | Species included in consumption rate evaluation | Statistic (grams/day) | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Mean | Median | Percentile | | | |
| | | | | | | | | 75th | 90th | 95th | 99th |
| 37 | General Population[i] | Adults (18 or older) | Consumer | All | Resident finfish & shellfish from fresh and estuarine environments | 81 | 47 | NA | 199 | 278 | 505 |
| 38 | Columbia Slough Fisherman[w] | Adult | Consumer | Columbia Slough | Resident finfish & shellfish from fresh and estuarine evironments | | 24 | 36 | | | |
| 39 | Sauvie Island Fisherman[w] | Adult | Consumer | Sauvie Island | Anadromous & resident finfish & shellfish from fresh and estuarine evironments | | 4 | 6 | | | |
| 40 | Lake Whatcom (WA) Fisherman[x] | Adult | Consumer | Lake Whatcom (WA) | Resident fish | 6 | | | | | |
| 41 | Lake Roosevelt(WA) Fisherman[y] | Adult | Consumer | Lake Roosevelt (WA) | Resident fish | 42 | | | | | 90[z] |

[a]Values computed from Toy et al. 1996 study data (Kissinger 2003).

[b]Values g/kg/day for "all seafood" taken from Table T-3 of the Suquamish Survey (Suquamish 2000) and converted to g/day by multiplying by the average body weight for men and women of 79 kg

[c]Values computed by ShiQuan Liao of the Mountain Whisper Light Statistical Consulting company for the Suquamish Tribe (Liao 2003)

[d]Values compiled from Table 10 "Number of Grams per Day Consumed by Adult Fish Consumers" of the Columbia River Intertribal Fish Commission Study (CRITFC 1994)

[e]A value of 60 g/day was derived by linearly interpolating between the consumption rate/cumulative percentiles bracketing the 75th percentile (48.6 g/day, 65.1%) and (64.8 g/day, 79.1%)

[f]A value of 113 g/day was derived by linearly interpolating between the consumption rate/cumulative percentiles bracketing the 90th percentile (97.2 g/day, 88.5%) and (130 g/day, 91.6%)

| Group | Subgroup | Consumer/ Non Consumer | Seafood Source | Species included in consumption rate evaluation | Statistic (grams/day) | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Mean | Median | Percentile | | | |
| | | | | | | | 75th | 90th | 95th | 99th |

[g]A value of 176 g/day was derived by linearly interpolating between the consumption rate/cumulative percentiles bracketing the 95th percentile (170 g/day, 94.4%) and (194 g/day, 97%)

[h]Values computed from 1999 EPA Asian Pacific Islander seafood consumption survey data (Kissinger 2005). Kissinger (2005) converted mixed cooked and raw wet weight consumption rate information from the 1999 publication into a wet weight consumption rate.

[i]Values taken from EPA 2002 Section 5.1.1.1, Table 4: Uncooked fish consumption estimates, U.S. Population – Finfish and Shellfish, Individuals Age 18 and Older. Values from the "freshwater/estuarine" section of the table are used. Earlier derivations of the 90th and 99th percentile values were used in developing Ambient Water Quality Criteria protective of human health (EPA 2000). The values presented here differ slightly from the 90th and 99th percentile values of 17.5 and 142.4 g/day respectively that were used in the methodology.

[j]Pacific salmon were assigned to consumption of marine species rather than estuarine species (SEE Section 2.1.1 of EPA 2002 for an explanation).

[k]Values taken from EPA 2002 Section 5.1.1.1, Table 4: Uncooked fish consumption estimates, U.S. Population – Finfish and Shellfish, Individuals Age 18 and Older. Values from the "all fish" section of the table are used. These values were used by EPA Region 10 in developing tribal seafood consumption rates for risk assessment when existing tribal data are judged to be inappropriate.

[l]Values taken from EPA 2002 Section 5.2.1.1, Table 4: Uncooked fish consumption estimates, U.S. Population – Finfish and Shellfish, Individuals Age 18 and Older. Values from the "all fish" section of the table are used. It has been suggested that EPA Region 10 may find these values to be useful in developing estimates of tribal subsistence consumption rates when existing tribal data are deemed to be inappropriate. The methodology of the "Continuing Survey of Food Intake by Individuals" (USDA 2000) developed consumer only numbers by extracting data on individuals who consumed seafood on one or more of the two days individuals were surveyed. It has been proposed that subsistence seafood consumers are likely to consume seafood daily, and that the CSFII methodology is an appropriate way to develop subsistence consumption rate estimates.

[m]Values compiled from Table 7 "Number of Grams per Day of Fish Consumed by Adult Respondents (Fish consumers and non-fish consumers) combined - Throughout the year" of the Columbia River Intertribal Fish Commission Study (CRITFC 1994)

[n]Values compiled from Tables 10, 18 and 19 from CRITFC 1994. The average consumption rate for Pacific Northwest Salmon was estimated to be 20 grams/day. That was subtracted from the average for all fish for consumers only to result in 43 grams/day as the average fish consumption for adult consumers only for resident fish. The ratio of .73% (all fish/resident) was then applied to the other percentiles. All values are estimates.

[o]The mean values was taken from Table 16 and all other percentiles were estimated from Table 15 in CRITFC 1994. All calculated values are estimates.

[p]The mean values was taken from Table 24 and all other percentiles were estimated from Table 24 in CRITFC 1994. All calculated values are estimates.

[q]All values taken from EPA 2002 Section 5.1.1.1, Table 5

[r] All values taken from EPA 2002 Section 5.2.1.1, Table 5

[s] All values taken from EPA 2002 Section 5.2.1.1, Table 3

[t] All values taken from EPA 2002 Section 5.2.1.1, Table 1

[u] All values calculated using 16.8 as the average body weight of children and applying that body weight to values in Table T-14 in Suquamish 2000

| Group | Subgroup | Consumer/ Non Consumer | Seafood Source | Species included in consumption rate evaluation | Statistic (grams/day) | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Mean | Median | Percentile | | | |
| | | | | | | | 75th | 90th | 95th | 99th |

[v] All values were calculated using an average child BW of 15.2 kg (from Table A1) and the consumption rates Toy et al., 1996, Table A9

[w] All values taken from Adolphson 1996, Table 4, page 20. Values were converted to grams/day from kg/person/year.

[x] All values taken from Dave McBride's summary of the Lake Whatcom 2001 study. Adult average consumption of 225 g/meal was used along with a median children rate of 131 g/meal. 10 meals were assumed per year

[y] All values taken from Dave McBride's summary of the Lake Roosevelt 1997 study.

[z] All values taken from Dave McBride's summary of the Lake Roosevelt 1997 study. 90g/day was labelled as "high end consumers" and placed in the 99th percetile column for that reason.

[aa] All values taken from Sechena, et al, 1999, Table R-1. A body weight of 70 kg was used to calculate grams/day.

[bb] All values taken from Rhodes 2006, Table 32.

## References


Columbia River Intertribal Fish Commission. 1994. A Fish Consumption Survey of the Umatilla, Nez Perce, Yakima, and Warm Springs Tribes of the Columbia River Basin

EPA. 1999. Asian & Pacific Islander Seafood Consumption Study in King County Washington. EPA Region 10, Office of Environmental Assessment, Risk Evaluation Unit. EPA 910/R-99-03.

EPA. 2000. Methodology for Deriving Ambient Water Quality Criteria for the Protection of Human Health. Office of Water, Office of Science and Technology. EPA-822-B-00-004

EPA. 2002. Estimated per Capita Fish Consumption in the United States.

Kissinger, L. 2003. Development of Tulalip and Squaxin Tribe Seafood Ingestion Rates for Puget Sound Tribal Seafood Risk Analysis Based on Individual Interview Results

Kissinger, L. 2005. Application of Data from an Asian and Pacific Islander (API) Seafood Consumption Study to Derive Fish and Shellfish Consumption Rates for Risk Assessment

Liao, S. 2003. Development of Suquamish Tribe Seafood Ingestion Rates for Puget Sound Tribal Seafood Risk Analysis Based on Individual Interview Results

Suquamish Tribe. 2000. Fish Consumption Survey of the Suquamish Indian Tribe of the Port Madison Indian Reservation, Puget Sound Region

Toy, K; N.L. Polissar, S. Liao, G. Mittelstaedt. 1996. A Fish Consumption Survey of the Tulalip and Squaxin Island Tribes of the Puget Sound Region.

U.S. Dept. of Agriculture, Agricultural Research Service. 2000. 1994-1996, 1998 Continuing Survey of Food Intakes by Individuals.


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| Group | Subgroup | Consumer/ Non Consumer | Seafood Source | Species included in consumption rate evaluation | Statistic (grams/day) | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Mean | Median | Percentile | | | |
| | | | | | | | 75th | 90th | 95th | 99th |


Adolphoson 1996. Technical Memorandum on the Results of the 1995 Fish Consumption and Recreational Use Surveys - Amendment No. 1. City of Portland, Bureau of Environmental Services.

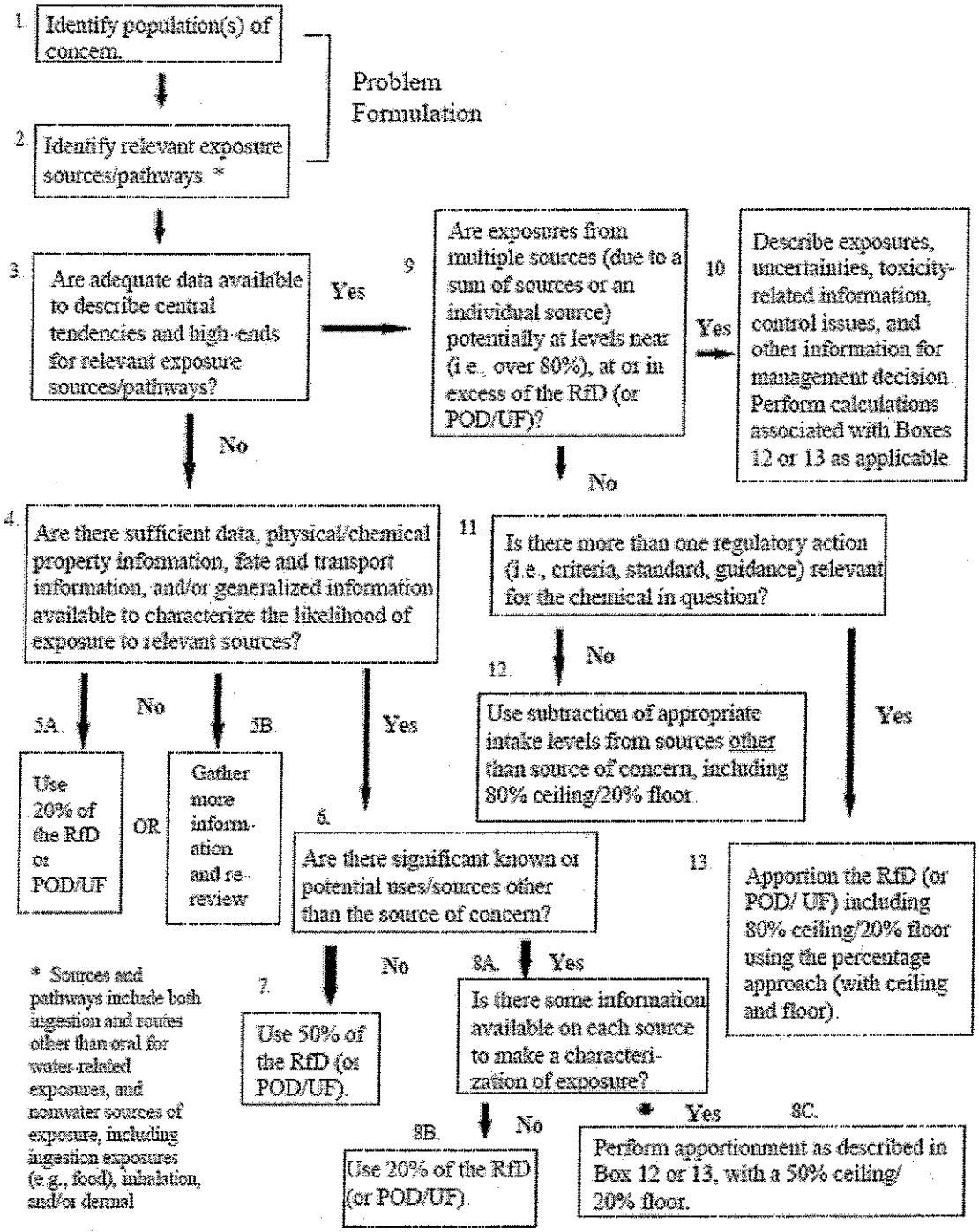
Lake Whatcom 2001. Lake Whatcom Residential and Angler Fish Conumption Survey. Washington Department of Health, April 2001.

Lake Roosevelt 1997. Consumption Patterns of Anglers Who Frequently Fish Lake Roosevelt. Washington State Department of Health, September 1997.

Sechena, et al 1999. Asian and Pacific Islander Seafood Consumption Study. (EPA 910/R-99-003)

Rhodes 2006. Fish Consumption, Nutrition, and Potential Exposure to Contaminants Among Columbia River Basin Tribes. Masters of Public Health Thesis, Oregon Health and Science University.

# Appendix 4: EPA's Decision Tree for Developing RSC[1]




[1] EPA, 2000. Methodology for Deriving Ambient Water Quality Criteria for the Protection of Human Health. EPA 822-B-00-0004. P. 4-8.

# Appendix 5: Basis for RSC Variables (*Draft- Work in Progress)*

| Compound | EPA's Recommended RSC[1, 2] | Sources of Exposure | Citation |
|---|---|---|---|
| Antimony | 40% | Drinking Water Contribution= 40% Diet Contribution=50% Inhalation Contribution=10% | Drinking Water: National Primary Drinking Water Regulations (7/17/1992) 57 FR 31784 |
| Methylmercury | 2.7 x $10^{-5}$ mg/kg BW/day (subtracted from RfD) | Accounts for marine fish consumption | EPA Methylmercury Criterion Document (1/2001) EPA 823-R-01-001 |
| Thallium | 20% | | |
| Cyanide | 20% | Available data on dietary exposure are inadequate, so apply the default value of 20% RSC | Drinking Water: National Primary Drinking Water Regulations (7/17/1992) 57 FR 31784 |
| Chlorobenzene | 20% | | |
| 1,1 Dichloroethylene | 20% | Detected in several sources (i.e. air, and wells contaminated with other solvents). | EPA Health Advisory for 1,1-Dichloroethylene of Office of Drinking Water (3/31/1987) |
| Ethylbenzene | 20% | Primary source of exposure is from the air, although contaminants in drinking water can be quite high for wells near leaking gasoline storage tanks and drinking waters taken from surface waters. | Technical Fact Sheet on Ethylbenzene for the National Primary Drinking Water Regulations. http://www.epa.gov/safewater/dwh/t-voc/ethylben.html |
| Toluene | 20% | Based on available data, the major source of toluene exposure is from air; occurs in low levels in drinking water, food and air. Where actual exposure data are not available, 20% RSC is assumed. | EPA Health Advisory for Toluene of Office of Drinking Water (3/31/1987) |

| Compound | EPA's Recommended RSC[1, 2] | Sources of Exposure | Citation |
|---|---|---|---|
| 1,2 Transdichloroethylene | 20% | | |
| 1,2 Dichlorobenzene | 20% | Detected in multiple sources (i.e. ground water, surface water, air), however there are insufficient data to determine where the major route of environmental exposure. | EPA Health Advisory for Ortho-, Meta-, and Para-Dichlorobenzenes of Office of Drinking Water (3/31/1987) |
| 1,4 Dichlorobenzene | 20% | Detected in multiple sources (i.e. ground water, surface water, air), however there are insufficient data to determine where the major route of environmental exposure. | EPA Health Advisory for Ortho-, Meta-, and Para-Dichlorobenzenes of Office of Drinking Water (3/31/1987) |
| Heachlorocyclo-pentadiene | 20% | | |
| 1,2,4 Trichlorobenzene | 20% | | |
| Gamma BHC | 20% | | |
| Endrin | 20% | Human exposure appears to most come from food or an occupational source. Monitoring data demonstrates it continues to be a contaminant from air, water, sediment, soil, fish, and other aquatic organisms. | Technical Fact Sheet on Endrin for the National Primary Drinking Water Regulations. http://www.epa.gov/safewater/dwh/t-soc/endrin.html |

[1] EPA, 2002. National Recommended Water Quality Criteria: 2002 Human Health Criteria Calculation Matrix. EPA-822-R-02-012.

[2] EPA, 2003. National Recommended Water Quality Criteria for the protection of Human Health. 68 FR 75507-75515.

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# HHFG Report - Major issues to Address:

Compiled by Jordan Palmeri

1. How should we consider the additional FCR surveys?
    - Is Appendix 2 complete and useful?
    - Should we cite any rates from these surveys in a table?

2. Consumer only data
    - discuss how certain methodologies overestimate rates

3. Survey Rankings and Relevancy
    - We need to better define the criteria for each ranking level?
        - Do they include the studies credibility and relevancy?
    - Do members still agree with each survey ranking – given the refined ranking criteria?
    - How can we convey the relevancy of a survey to Oregon?

4. What quantitative comparisons does the group want to make about the data, if any?
    - Appendix 3- how does the group want to present the data (simpler tables?)

5. Relative Source Contribution
    - Need to add the application of water quality standards perspective
    - Need to present all the facts on uptake issue if mentioned at all
    - Add to the RSC options
        - Flush out pros and cons of each option

6. Toxicity and Risk
    - Do we need an example for the cancer risk?
    - Example for non-cancer risk?
    - More background on toxicity?

7. Any other caveats or limitations we need to say/list so we can wrap this report up as being what the group could accomplish in the time alloted?

| Michigan Sport Angler | Subgroup | Consumer/non | Source | Species | Mean | Median | 75th app | 90th app | 95th app | 100 |
|---|---|---|---|---|---|---|---|---|---|---|
| | Licensed sport anglers | Con and non* | Sport only | | 16 7 | | 20 | 61 2 | 81 6 | 48 9 |
| | | | Commercial | | | | | | | |
| | | | Sport and commercial | | 26 5 | | 35 | 73 4 | 102 4 | |
| | | | Sport only-rural | | 22 8 | | | | | |
| | | | Sport only-urban | | 14 6 | | | | | |
| | | | Total-rural | | 32.2 | | | | | |
| | | | Total-urban | | 26 8 | | | | | |
| | | | | | | | | | | |

1991-92 Michigan Sport Angler Fish Consumption Study, 1993, University of Michigan Schoolof Natural Resources. Technical Report #6.
Final report to Michigan Great Lakes Protection Board.
West PC, Fly, JM, Marans, R, Larkin, F, Rosenblat, D.

Design:
Stratified cohort year round
7-day recall
Mail in survey
2651 respondants
*Less than 1 % non-consumers
Additionl breakout- Sport only consumption for Mean white pop 16.3 and 23.3 for minority pop.