

Idaho Fish Consumption Rate and Human Health Water Quality Criteria—Discussion Paper #2

General Population versus Targeted Subpopulation



**State of Idaho
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Introduction

In developing a fish consumption rate survey, the Idaho Department of Environmental Quality (DEQ) could choose to conduct a broad, all-encompassing general population survey looking at all adult Idahoans or choose to restrict the survey to a particular subpopulation of Idahoans, such as those DEQ believes are high consumers of fish. A survey that targets a specific subpopulation of people differs in many ways from a survey that is designed for an entire populace.

A general population survey may be thought of as similar to a census and would include fish consumers and nonconsumers, anglers and nonanglers, Native Americans and other minority groups, and men and women. A survey of this nature uses a probability sample, where everyone in the population of interest (Idaho residents) has the same probability of being selected to participate in the survey. The same information would be collected from everyone included in the survey, but if designed and implemented properly, survey data could later be analyzed to focus on specific subpopulations or to identify factors of particular interest.

On the other hand, a targeted survey is used to collect information from a specific subset of the population; the survey must be designed in a manner that is appropriate for the targeted population. The chief difference between a general population and targeted subpopulation survey is how the population of interest is identified prior to implementing the survey. Targeting a subpopulation also makes an up-front public policy decision that the particular subpopulation should be the basis of human health criteria.

Both of these survey approaches have pros and cons. Rather than presuppose a policy decision, DEQ developed both types of surveys.

The focus of this discussion paper is how DEQ looks at the data after collection and the policy decisions that must be made. Should DEQ base a fish consumption rate on some statistic derived from data that include the entire population? Or should DEQ focus only on some predetermined subpopulation expected to be high consumers?

Who Are High Consumers?

Any identifiable subpopulation can be the focus of a survey. In the context of human health protection, the focus has been on those at higher risk due to higher fish consumption, so-called high consumers. Since no fixed definition exists for the term “high consumer,” it is difficult to design a survey targeted at high consumers and would require knowing everyone’s fish consumption rate in advance. This problem raises concerns about the validity of the assumptions DEQ would need to make. Furthermore, if DEQ tried to define who a high consumer is, the definition would likely be in terms of higher than the general population; but how much higher? Rather than target based on a vague concept of high consumers, DEQ could target a particular group defined by ethnicity, culture, or socioeconomic status (e.g., Hispanics or Native Americans). What is the basis of such targeting? These groups are suspected or expected to be at greater risk due to higher rates of fish consumption, which returns to the issue of what is meant by high fish consumption?

Existing studies show that sports fishermen (recreational anglers), Native American tribes, and other minority ethnic groups trend toward higher rates of fish consumption (OEHHA 2001).

Idaho's high consumers are then presumed to be recreational and subsistence fishers with high rates of success who feed themselves and their families what they catch. DEQ believes caution should be exercised in making assumptions about subpopulations in Idaho; the way in which ethnic or other subgroups are defined can be critical in shaping the results of survey data.

While many tribal and angler surveys have been conducted in the Pacific Northwest over the past several decades, no general population, recreational angler, or tribal surveys exist explicitly for the state of Idaho. In absence of such data, the state cannot endorse the assumption that tribes and anglers eat more fish than other Idaho residents. However, the US Environmental Protection Agency (EPA) suspects that Idaho's Native American tribes represent the high consumers in the state and is developing a fish consumption survey targeted specifically toward tribal members.

DEQ is interested in completing the picture by designing surveys for both the general population of Idaho and recreational anglers. DEQ believes the department has an obligation to include all Idahoans in the effort to develop a new fish consumption rate. In this way, DEQ will be able to fill any potential data gaps that could arise as a result of surveying only a subset of the population while also meeting EPA's recommendation:

If a State or Tribe chooses values (whether the central tendency or high-end values) from studies that particularly target high-end consumers, these values should be compared to high-end fish intake rates for the general population to make sure that the high-end consumers within the general population would be protected by the chosen intake rates. (EPA 2000)

Coupled together, the survey efforts of EPA and DEQ should provide a thorough and scientifically defensible view of the range of fish consumption rates in the state and better inform the choice of a rate that is protective of all fish consumers.

What Do We Already Know About Groups in Idaho that may Eat More Fish Than Others?

The simple response to this question is—not much. Data are limited and current efforts rely on numerous assumptions because what little Idaho-specific data that exist are derived from studies that were not aimed at identifying a fish consumption rate.

The Idaho Department of Fish and Game reports that roughly 30% of Idahoans are licensed to fish. In 2011, the agency conducted an angler opinion survey that targeted licensed resident and nonresident Idaho anglers to help inform fisheries management decisions. Of the 16,000 surveys mailed, approximately 5,600 responses were received (IDFG 2013). The survey found that not all licensed anglers consume their catch; some practice catch and release fishing only (Parrish 2013). Unfortunately, the data reveal nothing about whether or not licensed anglers eat fish from other sources as well (i.e., market fish), nor does it quantify how much fish anglers consume.

As discussed in DEQ's policy discussion paper #1 regarding fish consumers and nonconsumers (DEQ 2013), data collected as part of the Behavioral Risk Factor Surveillance System (BRFSS) indicate that the majority of Idaho residents are fish consumers (Vannoy 2013). The BRFSS data also show that Idahoans of low socioeconomic status (SES) eat fish less often than more affluent Idahoans: 72% of low SES adults reported they ate fish at least once per month, compared to 82% of respondents who were not considered low SES. Non-Hispanic people reported eating fish

more frequently than Hispanics (79% versus 68%), while Native Americans and Alaska Natives reported eating more fish than either whites or Hispanics (90% versus ~79%). It's important to note that these are not large differences, statistically speaking. And although Native Americans and Alaska Natives ate more fish than other ethnic groups included in the survey, they make up a small fraction of Idaho's overall population (roughly 1.2%). These data also indicate that a higher proportion of Idahoans are fish consumers compared to the US as a whole.

The Agency for Toxic Substances and Disease Registry conducted a survey in 1989 that was both a consumption survey and a health risk assessment (ATSDR 1989). The survey was aimed at three fish consuming populations in the Idaho Panhandle region: tribal members, licensed anglers, and other residents (volunteer respondents). Although people were asked about fish consumption, frequency of fish consumption, and number of meals of fish consumed, actual fish consumption rates (e.g., in grams per day) were not reported. An interesting result of the survey was that fewer tribal households served meals containing fish than did licensed anglers or households of volunteer respondents, although the tribal households that did serve fish served fish meals more often. The survey did not provide consumption amounts; it only speaks to frequency of consumption.

Though not an Idaho-specific survey, the Columbia River Inter-Tribal Fish Commission study, which DEQ has often referred to during this rulemaking process, shows that the average fish consumption rate for tribal members was 58.7 grams per day (g/day); this mean value includes non-fish consuming tribal members (CRITFC 1994). In looking at the higher consumers surveyed, the 90th percentile was between 97.2 and 130 g/day and the 95th percentile was approximately 170 g/day. The report did not take into account varying body weight among consumers. DEQ believes this is a shortcoming of this fish consumption study. The fish consumption rate should be reported as grams of fish per kilogram of body weight per day (g/kg/day).

DEQ demonstrated through its review of regional and national fish consumption surveys (DEQ 2012), that more information is needed to paint an accurate picture of fish consumption in Idaho. However, in general, higher-consuming ethnic subpopulations and other high consumers are part of the general population and may be represented by upper percentile consumption rates (such as the 95th percentile) derived from a distributional analysis of the data for the general population (OEHHA 2001). This approach is consistent with EPA's national guidance (EPA 1998).

What Else Do We Need to Know?

After deciding to move forward with both a general population survey and an angler survey, the next step is to make policy decisions with respect to analyzing the data. Should the focus be on the entire population or on the high consumers? Who are considered high consumers? What are some advantages and disadvantages to using a general population rate versus a subpopulation rate? Is it appropriate to trim the data prior to analysis?

Identifying the Desired Population Statistic

A general population distribution and associated statistics would represent the entire population of the state, including some who may be considered high consumers. The data could be analyzed

to identify an average consumption rate or some other statistic relating to the distribution as a whole. A targeted subpopulation distribution and associated statistics would represent a subpopulation of the state that was assumed to have higher fish consumption rates than the overall general population. Data from this subpopulation distribution could then be analyzed to identify an average consumption rate for the subpopulation.

General Population Distribution

EPA has stated that the 99th percentile of the Continuing Survey of Food Intakes by Individuals (CSFII) general population survey is a value that likely represents the average consumption rate of subsistence fishers and would be protective of that group (EPA 2002). The result of the CSFII survey was a distribution that included everyone, regardless of consumption rate, a per capita rate. A different, lower percentile would be comparable if non-consumers were excluded (DEQ 2013). Due to a preponderance of low consumers, the overall general population distribution is a log-normal distribution where the majority of the population is identified as low consumers and smaller percentages of the population consume high quantities of fish. Defining high consumers as the 99th percentile is somewhat arbitrary and assumes that only 1% of the population is in the high consumption group. However, selecting a fish consumption rate that is higher than 99% of the entire population rate ensures that 99% of the population will be protected at the determined level or greater.

By selecting a statistic (mean, median, or other percentile) from the general population distribution, DEQ would be able to speak to a level of protection for the population as a whole. If a state uses the general population distribution to select a fish consumption rate, EPA guidance recommends that the state thereby ensures that high consumers are protected at a rate of no greater than a 10^{-4} rate of increased cancer risk (EPA 2000). However, defining that high consumer (unless choosing the 99th percentile as per EPA guidance) may be contentious. Currently EPA defines no acceptable range of risk for non-carcinogens.

Advantages and Disadvantages of Using a General Population Distribution

The primary advantage to using the general population distribution to identify a fish consumption rate is the ability to select a rate that is representative of the entire Idaho population and determine the level of protection the state wants to achieve. This method would be the most straightforward and transparent way of emphasizing the various assumptions that go into determining a level of risk associated with setting human health criteria, such as the fact that criteria are set to protect a certain percentage of the population (be it the 50th, 90th, or 99th percentile).

One disadvantage to using only the general population distribution to define a fish consumption rate is the possibility that high consumers may not be protected at an acceptable rate (i.e., 10^{-4}). Of course to reach such a determination, high consumers must first be defined. Another disadvantage is that this method also requires that the general population survey data used to create the overall population distribution be designed in a manner that does not systematically miss those who are high consumers. For example, if high consumers typically do not have phones and the survey implements a phone interview as its only method of reaching candidates, it is likely that high consumers would be missed due to their inaccessibility. This systematic bias away from high consumers would then lead to a fish consumption rate being biased low.

Targeted Subpopulation Distribution

The state has chosen to focus on recreational anglers as a subpopulation expected to be higher consumers. Data from this subpopulation distribution could then be analyzed to identify an average consumption rate for the subpopulation. However, no information is available on how that relates to the overall general consumption rate unless the general population distribution is known. Other statistics such as the median or a 90th percentile could be chosen from this subpopulation distribution. The state would then be able to define a level of protection only for this high consumer population.

Advantages and Disadvantages of Using a Targeted Subpopulation Distribution

An advantage to using the subpopulation distribution to choose a fish consumption rate is being able to show that high consumers are being protected at a set level. By identifying a statistic from this subpopulation to use as a fish consumption rate, the state would clearly be placing a greater importance on protecting high consumers.

The primary disadvantage to using a targeted subpopulation distribution to define a fish consumption rate is not being able to relate the rate and associated level of protection to the overall general population. Another disadvantage of this method is that it requires that the survey accurately target a subpopulation of high consumers. If the targeted subpopulation turns out not to be high consumers (e.g., recreational anglers actually consume fish at a lower rate than urban residents with access to local fish markets) then the premise of protecting all by targeting those at greater risk is invalid. Without general population data to use for comparison, DEQ won't know where the current efforts stand in this regard.

The following analogy may help articulate the issue of defining a subpopulation. In the US, a defined annual household income represents the poverty level; this poverty level is based on the entire population of the US. It would seem rather unjust to redefine the poverty line by conducting a survey that included only one minority group perceived to be low-income, or just of low-income individuals.

Other Data Analysis Considerations

A probability sample is used to sample a portion of the population so that results are applicable to the entire defined population, whether that population is defined as all residents of Idaho or recreational anglers residing in Idaho. A hazard exists, however, in trimming data after collection, but before analysis, as doing so may yield incorrect standard errors and confidence intervals (Graubard and Korn 1996). For this reason, it is not recommended to take the data from the general population survey and trim prior to data analysis to estimate the high consumer group. Instead, the entire dataset should be analyzed and the high consumers identified from the resulting full distribution. Alternatively, the recreational angler survey or tribal surveys could be used as representative of high consumption. DEQ believes it is in the best interest of Idahoans to be able to compare how these different ways of looking at the data affect the consumption rate.

How Has EPA Handled High Consumers in Developing Fish Consumption Rates?

EPA recommends “ensuring that the fish intake level chosen is protective of highly exposed individuals in the population,” though “highly exposed” is not defined (EPA 2000). The guidance goes on to state, “EPA also believes that criteria based on a 10^{-5} risk level are acceptable for the general population as long as States and authorized Tribes ensure that the risk to more highly exposed subgroups (sport fishers or subsistence fishers) does not exceed the 10^{-4} level” (EPA 2000).

For such a comparison to take place, data on both populations are needed. The statement above also implies the chosen consumption rate can be derived from the general population data, if that rate can be shown to be protective of more highly exposed groups (i.e., their risk level does not exceed 10^{-4}).

EPA guidance does not clarify how a highly or more highly exposed subgroup is defined. The term subgroup suggests it is related back to the whole population. But is it a 90th or 95th or 99th percentile of the whole population? As discussed in previous rulemaking meetings, in deriving a fish consumption rate to protect subpopulations (high consumers), EPA used the 99th percentile from the general population data. The resulting national recommendation for a fish consumption rate for subsistence fishers is 142.5 g/day (EPA 2002). This is a value that was based on EPA review of numerous studies on sport anglers and subsistence fishers, which EPA put forth as “an approximation of their average consumption” (EPA 2000).

Recommendations

To appropriately target high consumers, they must be well defined. Since the phrase “high consumers” points to rate of consumption as the defining characteristic, it seems logical that a definition should be based on fish consumption rate, not *a priori* on an ethnic, economic, or geographic characterization. There seems to be some precedent for this in EPA choosing the 99th percentile of the general US population per capita fish consumption rate to represent subsistence fishers.

The rationale for defining a high consumer should be clearly stated. As part of this rationale there should be an analysis of how high consumers relate to the broader population, not just in their rate of consumption but also in terms of their fraction of the overall population so the risk for all can be described.

DEQ recommends that the general population distribution be evaluated and used to determine the statistic for setting a fish consumption rate. This specific statistic would be determined to represent the high consumers within the general population. The resulting consumption rate should be compared to the rates from distributions for targeted populations that are available, such as the Idaho recreational angler and tribal surveys, to determine if it is adequately protective of those fish consumers in the state as well.

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