Considerations in Deciding Which Fish to Include in Idaho's Fish Consumption Rate

Policy Summary

State of Idaho
Department of Environmental Quality

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Introduction

Water quality criteria are established, in part, to protect human health. For strongly bioaccumulative environmental contaminants, the major route of exposure is through consuming contaminated fish tissue. Therefore, water quality criteria for toxic chemicals are derived based on the usual fish consumption rate (FCR) for a targeted population. This paper summarizes the factors considered in recommending which fish to include in Idaho's regulatory FCR.

Idaho Regulatory Jurisdiction

Idaho does not have regulatory authority over discharges to either estuarine or marine waters. As such, Idaho water quality criteria have very little effect on the contaminant body burden (i.e., total amount of contaminant) of estuarine or marine fishes. Similarly, Idahoans' exposure to estuarine or marine fishes is mostly limited to what they purchase in the market.

In addition, the Clean Water Act only applies to US waters. The US Environmental Protection Agency (EPA) acknowledges this regulatory reality by excluding marine fish from its estimated national FCR. Furthermore, EPA suggests that "an inland state may only be interested in freshwater fish UFCRs [usual fish consumption rates]," acknowledging the lack of regulatory authority inland states have over the quality of both marine and estuarine fishes (EPA 2014).

Moreover, inclusion of fish in Idaho's regulatory FCR implies that Idaho water quality standards can be used to improve the quality of those included fish. Therefore, the Idaho Department of Environmental Quality (DEQ) limited the FCR to only those fish that are likely to pick up their contaminant body burden in Idaho waters and that can subsequently be expected to have reduced contaminant body burdens as a result of criteria implementation.

Market Fish versus Idaho Fish

The proposed rule excludes most market fish from the FCR used to calculate ambient water quality criteria largely because Idaho does not regulate the contaminant load of market fish. Although Idaho does have an active aquaculture industry, Idaho does not support a commercial fishing industry.[1] Therefore, it is reasonable to assume that nearly all fish purchased in the market are from outside of Idaho and that Idaho water quality standards will have little or no effect on their contaminant burden. The one exception is Rainbow Trout, as discussed below.

Importation of Market Fish

Approximately 90% of seafood consumed in the US is imported from foreign countries (i.e., not regulated under the Clean Water Act).[2] The top 10 seafood species consumed in the United States are largely imported from Asia (Table 1, Figure 1).

[1] *www.st.nmfs.noaa.gov/st1/commercial/landings/annual_landings*

[2] *www.fishwatch.gov/wild_seafood/outside_the_us*

Table 1. US per capita consumption (in 2011) and likely origin of the 10 most popular species of market seafood.[a]

Species	Per Capita Consumption (pounds)	Origin
Shrimp	4.2	>90% foreign farmed
Canned tuna	2.6	Imported from Thailand, Philippines, Vietnam, Ecuador
Salmon	1.952	Two-thirds is farmed, mainly imported from Norway, Chile, and Canada, with a small amount grown domestically
Pollock	1.12	Most is wild-caught in Alaska
Tilapia	1.287	Aquaculture. China supplies most of the tilapia in our markets, followed by Ecuador, Indonesia, and Honduras
Pangasius	0.628	Aquaculture, primarily Vietnam, with production increasing in China, Cambodia, Laos, and Thailand
Catfish	0.559	Farm-raised in the US
Crab	0.518	Wild-caught in US waters
Cod	0.501	Wild-caught in US waters. Our Alaska fisheries for Pacific cod account for more than two-thirds of the world's Pacific cod supply
Clams	0.331	Wild-caught and farm-raised in the US

[a] *Source*: *www.fishwatch.gov/features/top10seafoods_and_sources_10_10_12*

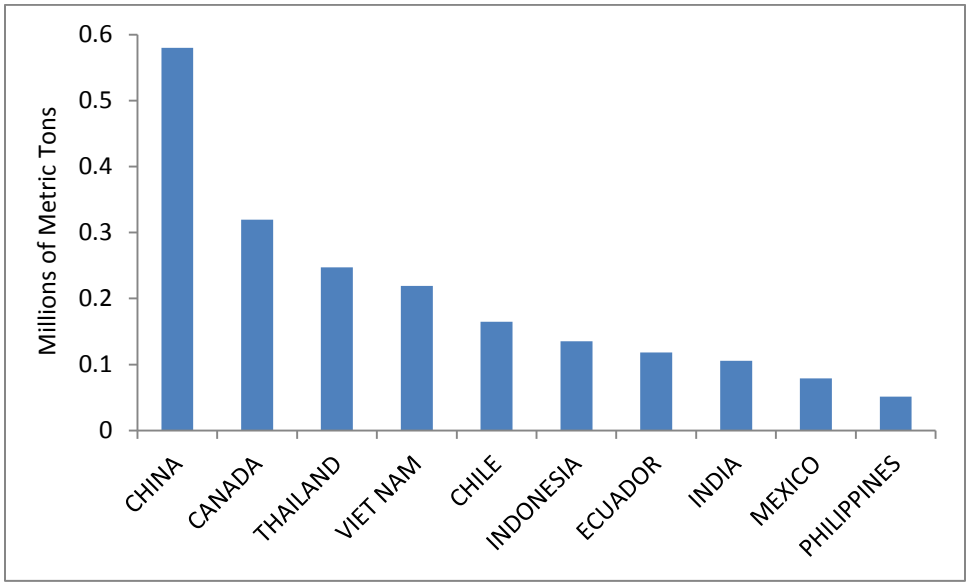

Figure 1. Top ten countries of origin for imported US seafood. Data available from *www.st.nmfs.noaa.gov/commercial-fisheries/foreign-trade/applications/monthly-product-by-countryassociation***.**

Rainbow Trout

Idaho does have an active aquaculture industry and is a national leader in trout production, accounting for 52% of the total value of fish sold by trout growers in the US.[3] Because of the high likelihood that a trout purchased in the market originated in Idaho waters, we chose to include market trout in our regulatory FCR.

Anadromous Fish

As articulated in DEQ discussion paper #5—dated July 2014—the issue when considering anadromous fish for inclusion in an FCR is where they acquire their burden of contaminants and how that should be handled in developing water quality criteria that are applied to Idaho.

DEQ proposed excluding anadromous salmon from our regulatory FCR for reasons related to their life history and the limits of our regulatory authority. Although anadromous salmon spend key parts of their lifecycle in Idaho waters, the majority of their growth, and subsequent body burden of environmental contaminants, is derived from the marine environment.

Relative Time in Marine versus Idaho Waters

Idaho salmon spend more of their life outside than within Idaho waters. The majority of Idaho Chinook Salmon emigrate as subyearling smolts, with the remainder emigrating as yearlings. Copeland et al. (2013) found that subyearling smolts accounted for up to 60% of all Chinook emigrants (and an even larger proportion of wild Chinook emigrants) moving downstream at Lower Granite Dam (Figure 2).

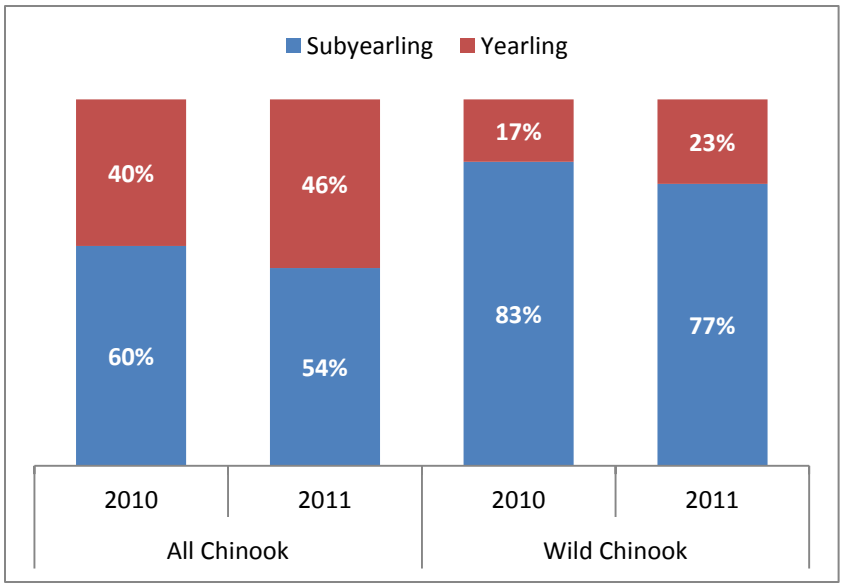

Figure 2. Percent of juvenile Chinook emigrants that were subyearling and yearling for all Chinook and wild Chinook at Lower Granite Dam, 2010 and 2011. The majority emigrate as subyearlings.

[3] *http://usda.mannlib.cornell.edu/usda/current/TrouProd/TrouProd-03-06-2015.pdf*

Most of these fish spend 2 or 3 years at sea before returning to Idaho waters to spawn. According to data from the Fish Passage Center (*www.fpc.org*), from 2000 to 2012 more than 90% of Chinook Salmon returning over Lower Granite Dam had spent at least 2 years at sea (Table 2).

Table 2. Percent of Chinook Salmon spending 1, 2, 3, or 4 years at sea before returning over Lower Granite Dam on the Snake River.

Migration Year	1 Year at Sea (%)	2 Years at Sea (%)	3 Years at Sea (%)	4 Years at Sea (%)
2000	1.5	44.6	53.7	0.2
2001	4.3	63.8	31.9	0.0
2002	10.0	75.5	14.6	0.0
2003	3.4	69.3	27.3	0.0
2004	2.3	64.8	32.0	0.8
2005	6.1	57.6	36.4	0.0
2006	7.0	72.1	20.9	0.0
2007	9.6	78.1	12.3	0.0
2008	13.1	66.6	20.2	0.0
2009	9.1	64.7	26.3	0.0
2010	18.1	59.2	22.7	0.0
2011	10.9	78.7	10.5	0.0
2012	23.1	76.9	0.0	0.0
Total, 2000–2012	9.1	67.1	23.8	0.5

Relative Growth in Marine versus Idaho Waters

Salmon growth is largely achieved in the open ocean, with more than 98% of the final weight of a salmon being achieved at sea (Quinn 2005). In fact, for the average Chinook, Sockeye, and Coho Salmon, more than 99% of the total weight of adult fish is achieved at sea (Table 3)

Table 3. Generalized weights of salmon as they enter the ocean (smolts) and adult weights, as well as the percent of total adult weight achieved at sea. Summarized from Quinn (2005).

Species	Smolt Weight (grams)	Adult Weight (grams)	Percent Weight Achieved at Sea
Chinook	18	7,220	99.75
Sockeye	10	2,690	99.63
Coho	18	3,020	99.41

Relative Source of Body Burden of Contaminants

Although salmon are known to acquire contaminants in freshwaters during early life and spawning (Qiao et al. 2000; Johnson et al. 2007), the vast majority of their body burden of contaminants is acquired in the marine environment since the vast majority of their body mass is acquired at sea.

O'Neill and West (2009) found that while Chinook smolts from a highly contaminated stream acquired organic contaminants from their natal stream, this accounted for only 3.8% of their final body burden of these contaminants.

Hope (2012) modeled 16 scenarios for Chinook Salmon exposure to polychlorinated biphenyls (PCBs), a common and typical contaminant of Chinook Salmon and their prey. He found that exposure scenarios that only included exposure in the freshwater environment (instream or through contaminated hatchery food) could not approximate observed body burden of PCBs in Chinook Salmon. Moreover, scenarios that only included exposures in estuarine and marine environments did approximate actual, observed contaminant body burdens. These results suggest that current, observed levels of PCBs in anadromous fish are almost entirely acquired outside of freshwater; removing all PCBs from the freshwater environment will have virtually no effect on the concentration of contaminants in Idaho salmon.

EPA (2014) acknowledges the insignificant role that freshwater water quality has on the contaminant body burden of anadromous fish, classifying salmon as 96% marine, 0.5% freshwater, and 3.5% estuarine. The freshwater component accounts for kokanee, a landlocked form of Sockeye Salmon. EPA states that "the freshwater percent is landlocked Sockeye Salmon (kokanee) found natively in Alaska, Washington, and Oregon, but they have also been introduced to many other states for recreational fishing." Kokanee are an important and popular freshwater species harvested in Idaho. We did not include kokanee as part of our salmon grouping, but accounted for them separately and included them in our FCR.

Steelhead Trout

Compared to other anadromous salmonids, steelhead trout life histories are highly complex. It is difficult or impossible to generalize what fraction of their time is spent in saltwater as opposed to freshwater. The anadromous and resident forms often inhabit the same waters, where they often interbreed. Furthermore, offspring may develop either migratory life history strategy, regardless of the life history strategy of their parents.

Because of the complexity of life history strategies exhibited by steelhead, and because we are not able to accurately distinguish between anadromous steelhead and resident Rainbow Trout, steelhead are included as Idaho fish in our regulatory FCR.

Further Rationale for Excluding Anadromous Salmon

Idahoans who depend largely on anadromous salmon for subsistence are particularly susceptible to high levels of fish-borne contaminants. These individuals may be looking toward this rule-making effort as a way to reduce their exposure to these contaminants. If Idaho included anadromous salmon in the FCR, we would be implying that these criteria will reduce exposure from anadromous salmon, which is not the case.

By excluding the majority of anadromous salmon and using the relative source contribution (RSC) to account for the contribution from salmon (and market fish), we are being explicit about what Idaho's water quality criteria can affect and about Idaho's jurisdictional reach.

This approach is consistent with EPA's approach, as outlined in its FCR estimate used to develop the 2015 national recommended human health criteria (EPA 2014). In its FCR, EPA limited consumption to only inland and near-shore fish, since marine fish are exposed to contaminants outside the jurisdiction of the CWA. Furthermore, EPA (2014) assigned salmon as being 96% marine (excluded from FCR used for criteria recommendation), 3.5% estuarine, and 0.5% freshwater. Since Idaho does not have jurisdiction over any near-shore marine or estuarine waters, we are proposing to exclude the estuarine proportion of salmon as well.

Popularity of Idaho Gamefish Species

The Idaho Department of Fish and Game (IDFG) conducted an angler opinion survey in 2011 to inform their *Fisheries Management Plan* (IDFG 2012). Among other information, the survey identified the most popular gamefish in Idaho (Figure 3).

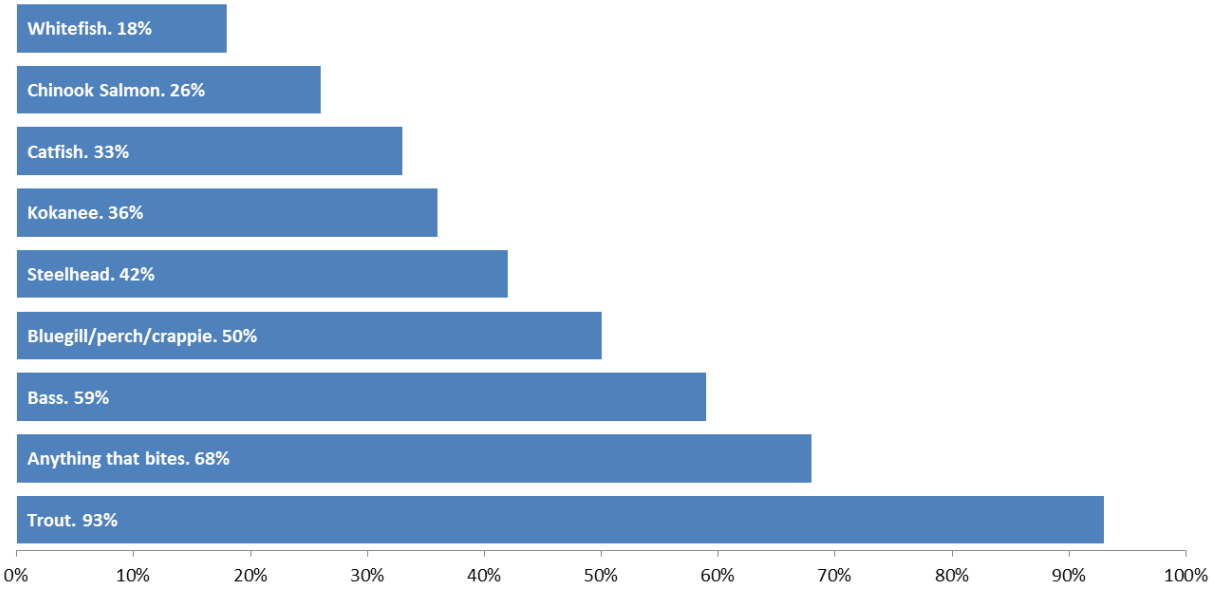

Figure 3. Gamefish most often targeted by Idaho anglers.

While the survey does not specifically address harvesting versus catch and release, it is reasonable to assume that anglers prefer to harvest fish in roughly the same proportions, making trout the most popular fish for Idaho anglers.

Suppression

Suppression of fish consumption can affect the rates reported in a survey of usual fish consumption rates. Fish consumption can be suppressed due to contamination of fishes, which in turn causes a decreased consumption of fish due to health concerns. Consumption of fish could also result from decreased availability of fish from historical levels.

From a regulatory perspective, human health water quality standards can only affect the first instance of suppression: when consumption is suppressed due to health concerns associated with contaminated fish. While there are certainly individuals in Idaho who may be limiting their fish

consumption due to health concerns, this represents a very small percentage of the population: only 3% of respondents to Idaho's fish consumption survey (NWRG 2015) reported that they didn't consume seafood due to concerns about pollution or contamination. Conversely, nearly half (48%) of respondents indicated that they consumed fish at least in part for its health benefits.

Human-health based water quality standards cannot affect the second instance of suppression: when fish consumption is suppressed due to lack of availability or access to fish. Water quality standards are set to protect human health based on current conditions. Using contemporary rates is our best tool for protecting human health at current conditions. While heritage rates can be estimated, they do not reflect current reality. We believe requiring dischargers to meet criteria based on historical or future availability is unreasonable.

Fish Consumption has Increased

The concerns about suppression of fish consumption are real, and certain individuals have certainly reduced their consumption of certain fish due to both health concerns and lack of availability. Nonetheless, the broader view is that fish consumption has increased and the trend has been toward higher consumption. According to data provided by the US Department of Agriculture, since 1980, the per capita consumption of fish for the United States has increased from 12.4 pounds per year to over 15 pounds per year (US Census Bureau 2012). EPA's recommended FCR has similarly increased over the years (Figure 4). So, while localized suppression is occurring, overall fish consumption has been rising, and so has the level of consumption accounted for in the water quality criteria. Thus, concerns that suppressed fish consumption is causing a downward spiral in fish quality is not evident.

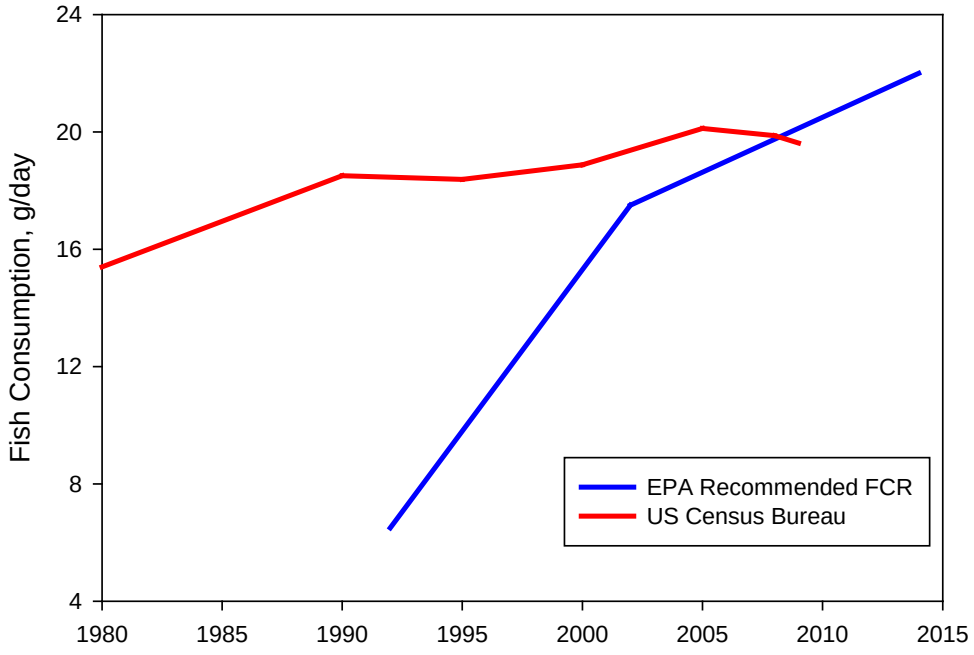

Figure 4. Per capita consumption of fish in the United States and EPA-recommended fish consumption rate (FCR), 1980–2014.

If fish become more readily available, and fish consumption increases, it is highly likely that Idaho will revise its standards and associated FCR. In fact, Idaho water quality standards have been moving toward more stringent criteria. In Idaho's 2005 update of human health criteria, our FCR increased from 6.5 to 17.5 grams/day. In 2015, we are again looking at more stringent criteria, or at least keeping them the same. Based on EPA's 2014 proposed national 304(a) criteria, we would have an increased FCR of 22 grams/day and a drinking water intake increased from 2 liters/day to 2.4 liters/day. These trends are likely to continue in the future.

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