



Human Health Criteria and State Water Quality Standards Public Scoping

Alaska Department of Environmental Conservation
AFE 2023

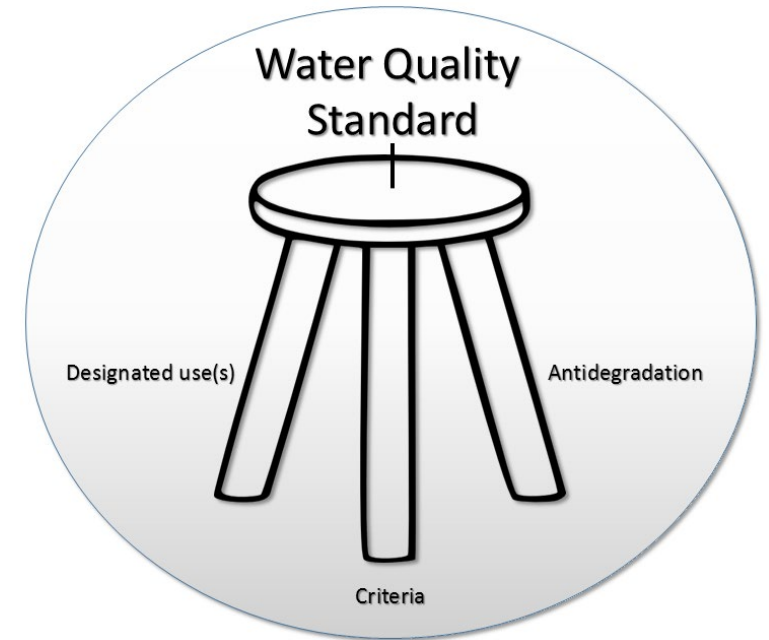


Outline

- Context
 - What is the purpose of Human Health Criteria in state water quality standards?
 - History of rulemaking to date
- EPA Recommended HHC Formulas and Key Inputs
- 2018 Workgroup Recommendations
- Next Steps

What are Water Quality Standards (WQS)

- The foundation of state/tribal water quality-based pollution control programs under the Clean Water Act (CWA)
- Designed to protect public health or welfare (*designated use*) (e.g., water supply, protection of aquatic life)
- Provide acceptable maximum concentration (generally) of a pollutant in the water (*criteria*)
- Process for determining whether degradation should be allowed (*antidegradation*)
- Help prevent polluted water; identify polluted waters; and clean-up polluted water



Human Health Criteria (HHC)



<https://glacierbayalaska.com/alaska-fishing/fish-species-guide/>



- A human health criterion is the highest concentration of a pollutant in surface water that is not expected to pose a significant risk
 - designed to **minimize the risk** of adverse effects from exposure to different contaminants
 - Based on a **chronic (lifetime) exposure** to contaminants
 - Includes **the ingestion of drinking water** from surface water sources and/or
 - **The consumption of aquatic life** obtained from surface waters.



Historical Context

- 1980 - EPA derived 64 recommended HHC. Criteria were based on national dietary information (where original FCR values were derived)
- 1992 - National Toxics Rule promulgated HHC for Alaska
 - 1992-2022 DEC adopts HHC for several non-carcinogenic pollutants
- 2000 - New EPA recommended methodology was published
 - Provides a formal equation and language that states may choose to use
- 2002 to 2022 - EPA issues updates and introduces new pollutants to the list (116 total pollutants).
 - 2015 EPA updates exposure input recommendations
 - Multiple state adoptions and lawsuits occur
 - EPA promulgates/rescinds/re-promulgates HHC for Washington



Historical Context - Continued

ALASKA 2012-2022

- DEC/ADF&G actively reviews available research and policy issues
 - Literature Review
 - Engagement with ADF&G-Division of Subsistence
 - published multiple papers pertaining to subsistence and fish consumption
 - HHC Technical Workgroup and Report
 - Reviews all aspects of the EPA recommended HHC formula and potential inputs
 - Issues recommendations and dissenting opinions
 - Staff engage with other states conducting HHC rulemaking
- 2022 - EPA and DEC engage on a formal timeline for HHC rulemaking

How are HHC derived?

- The HHC establish the specific amount of a pollutant that can be present in water without causing human harm
- $WQ \text{ Goal/Criterion} = \text{Toxicity} * \text{Exposure} * \text{Uncertainty}$

How dangerous is a chemical * how are we exposed to a chemical * Uncertainty of our knowledge



Alaska Water Quality Criteria Manual for Toxic and other Deleterious Organic and Inorganic Substances (2008)

Department of Environmental Conservation
Alaska Water Quality Criteria Manual for Toxic And Other Deleterious Organic and Inorganic Substances

WATER QUALITY CRITERIA FOR TOXICS AND OTHER DELETERIOUS SUBSTANCES (µg/l unless shown otherwise)

Pollutant CAS Number	Type of Pollutant	Drinking Water ¹	Stock- water ²	Irrigation Water ³	Aquatic Life for Fresh Water		Aquatic Life for Marine Water		Human Health for Consumption of:		References ⁴
					Acute (CMC)	Chronic (CCC)	Acute (CMC)	Chronic (CCC)	Water + Aquatic Organisms	Aquatic Organisms Only	
Endrin 72208	PEST SVOC	2	—	—	0.086 (1-hr avg) ^{11, 20}	0.036 (4-day avg) ^{12, 20, 44}	0.037 (24-hr max) ⁷	0.0023 (24-hr avg) ^{7, 10, 29}	0.76	0.81 ^{5, 32}	Drinking Water: 18 AAC 80.300(b) Aquatic Life: 57 FR 60848 65 FR 31682 67 FR 79091 EPA 440-5-80-047 EPA 820-B-96-001 EPA 822-Z-99-001 EPA NRWQC 2006 Human Health: 65 FR 31682 67 FR 79091 EPA 440-5-80-047 EPA 822-Z-99-001
Endrin Aldehyde 7421934	PEST SVOC	—	—	—	—	—	—	—	0.76	0.81 ^{5, 32}	Human Health: 57 FR 60848 65 FR 31682 EPA 822-Z-99-001
Ethylbenzene 100414	VOC	700	—	—	—	—	—	—	3,100	29,000	Drinking Water: 18 AAC 80.300(b) Human Health: 57 FR 60848 65 FR 31682 67 FR 79091

Example: ADOT& PF Speed Limit Study

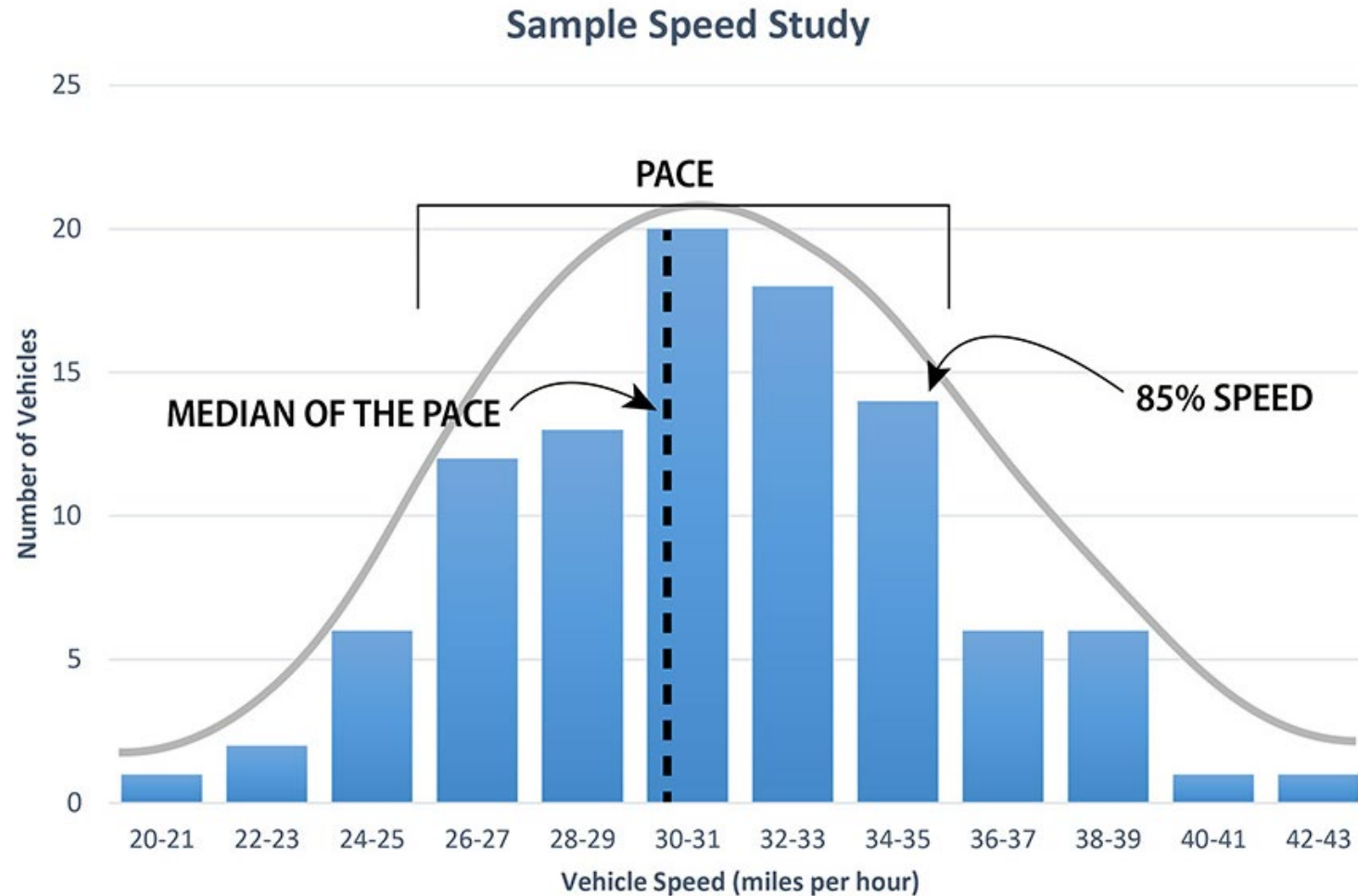


Image courtesy of ADOT&PF – Travel Topics

Questions on History and Background?

Next we dive into EPA's recommended formulas





EPA recommended formulas for Human Health Criteria

BAF: Bioaccumulation

BW: Body Weight

CRL: Cancer Risk Level

CSF: Cancer Slope Factor

DI: Drinking Water Intake

FCR: Fish Consumption Rate

RfD: Reference Dose

RSC: Relative Source Contribution

Consumption of Organisms and Water

Consumption of Organisms Only

Criteria for Carcinogens

$$\frac{CRL \times BW}{CSF \times [(FCR \times BAF) + DI]}$$

$$\frac{CRL \times BW}{CSF \times FCR \times BAF}$$

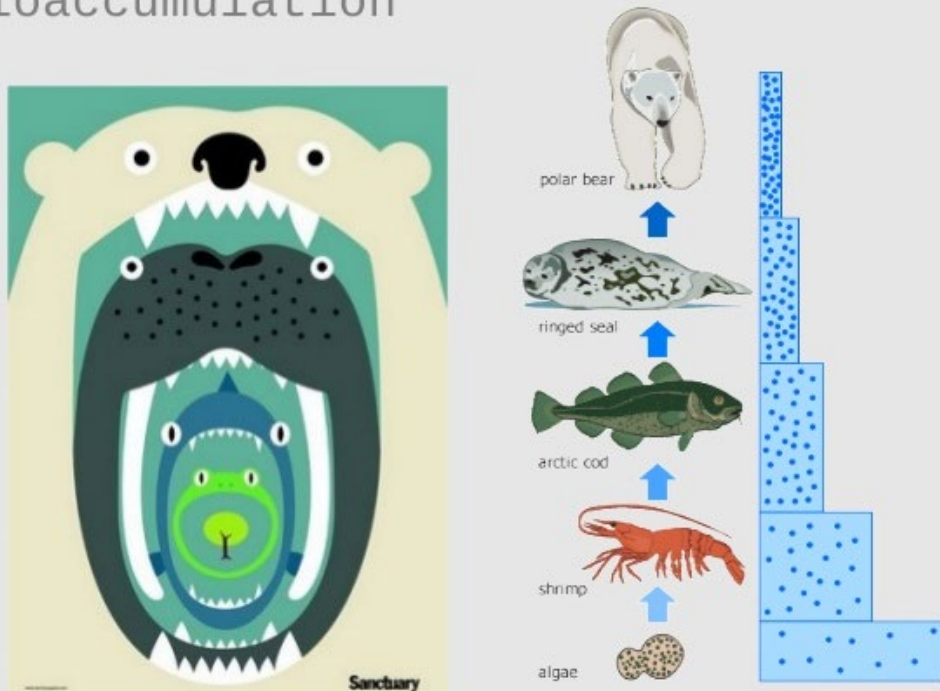
Criteria for Non-Carcinogens

$$\frac{RfD \times RSC \times BW}{(FCR \times BAF) + DI}$$

$$\frac{RfD \times RSC \times BW}{FCR \times BAF}$$

Bioaccumulation Factor (BAF)

biomagnification and
bioaccumulation



BAF = exposure to a pollutant through diet, water contact, and trophic position (where in the food chain)

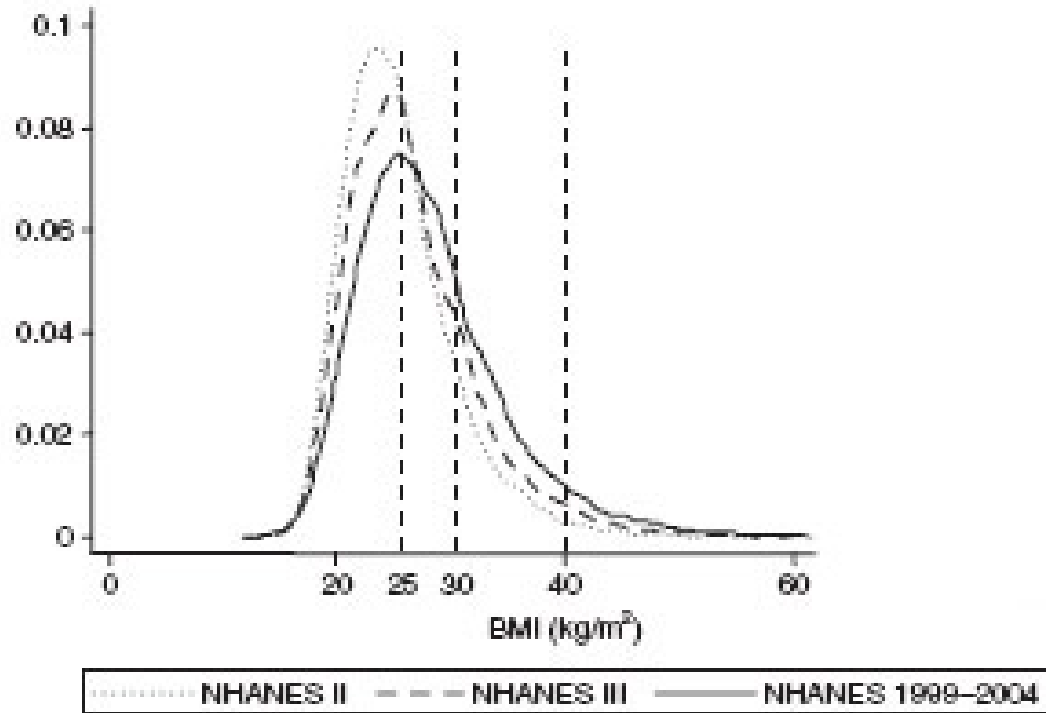
As we work upward in the food chain or TROPHIC LEVEL – we may find higher concentrations of pollutants



Bioaccumulation (BAF)

- EPA 2015 provided or updated BAF recommended values for many pollutants that previously used bioconcentration values
 - EPA 2015 retained BCF for those pollutants that did not have BAF data readily available
- Two options for DEC to consider
 - Devise a single weighted BAF: $(T_2+T_3+T_4)$
 - Looks at consumption across the food web
 - Apply T_4 BAF values alone
 - Looks at consumption at the highest trophic levels

Body Weight (BW)



- Average adult weight
- EPA updated recommended values in 2015 = 80 kg (176 lbs)
 - Value based on NHANES (1999-2006) adult mean values
 - Males 85kg / Females 75kg

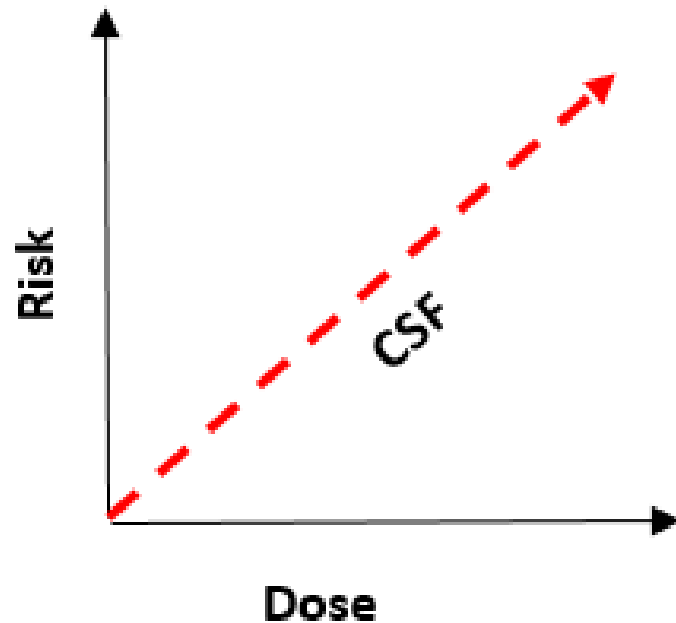
Cancer Risk Level (CRL)

- CRL represents an **additional** (aka incremental) increase in the risk of developing **cancer through the consumption of aquatic life and drinking untreated water** over a lifetime i.e., 70 years).
- DEC has adopted 1 in 100,000 in regulation for multiple programs.
- Sources of cancer in Alaska are typically associated with smoking/genetics rather than environmental factors.
- *“EPA understands that fish consumption rates vary considerably, especially among subsistence populations, and it is such great variation among these population groups that may make either 10^{-6} or 10^{-5} protective of those groups at a 10^{-4} risk level.”*

EPA (2000) P. 2-6

Cancer Slope Factor (CSF)

Uncertainty is factored into the slope



- EPA publishes recommended values
- CSF describes the 95% confidence limit of the dose to response relationship between exposure to a pollutant and risk of having a carcinogenic effect from lifetime exposure

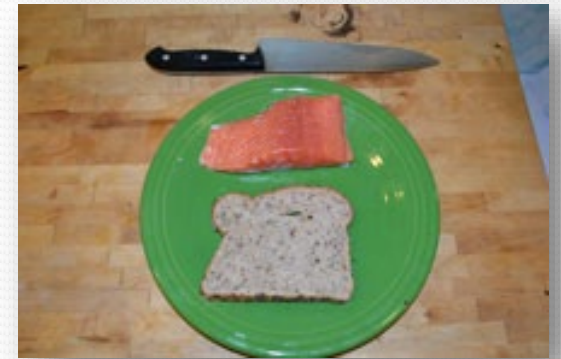
Drinking Water Intake (DI)

- 2000: 2 liters per day (L/day). Inc. all sources of water (e.g., drinking water, coffee, other beverages/food derived water)
- 2015: EPA-recommended 2.4 L/day
 - Based on 90th percentile of adult consumption data
- SPAR adopted a 2.5 L/day DW in C-Site risk assessment in 2018
 - Consistent with 2011 EPA Exposure Handbook values



Fish Consumption Rate (FCR)

- Represents aquatic life consumed over time (grams/day)
- A person's FCR can be assessed by dietary survey responses
 - Food diary for a person or household, or
 - Interviews asking people to recall what they ate
- Example: Jane eats 8 ounces (serving size) of fish three times per week (e.g., one lunch and two dinners)
 - If you assume this happens every week over the course of a year Jane's FCR is ~100 g/day



Fish consumption data

- Dietary survey statistics for general and high consuming populations
 - DEC is currently using data provided by ADF&G-Subsistence as the primary source of information
 - Recognizes that there are studies that have been conducted by Tribes that will inform this process
 - ADF&G data is based on *harvested* aquatic life
 - Data is based on rural populations from around the state

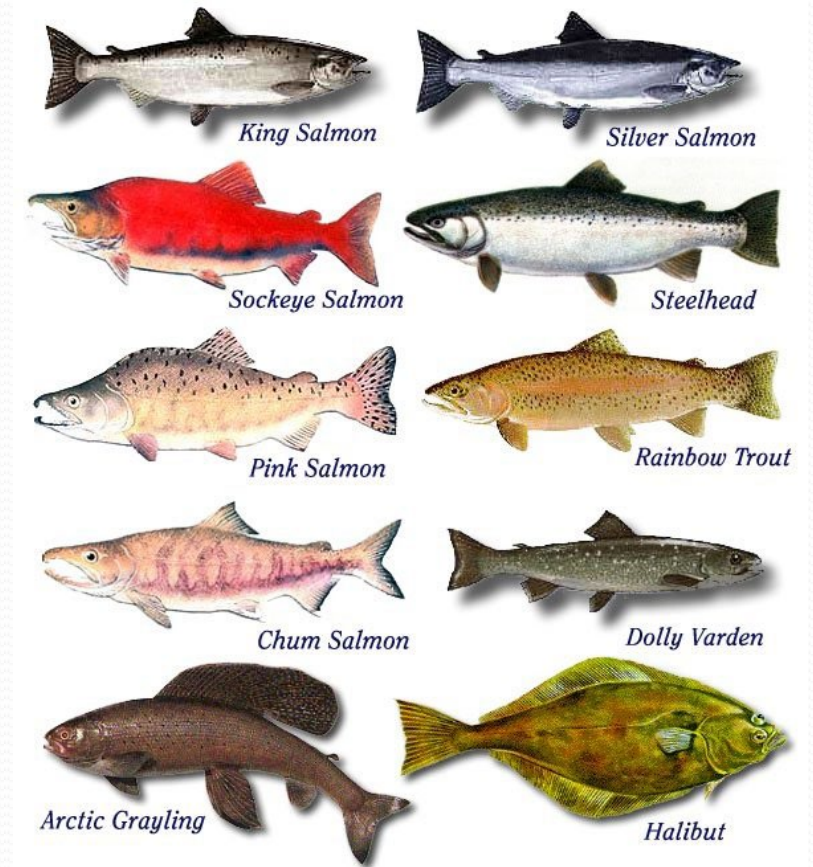


States in the Pacific Northwest have included marine, freshwater, and nearshore species in their definitions of aquatic life used for FCR development.

Things to consider: Which Fish

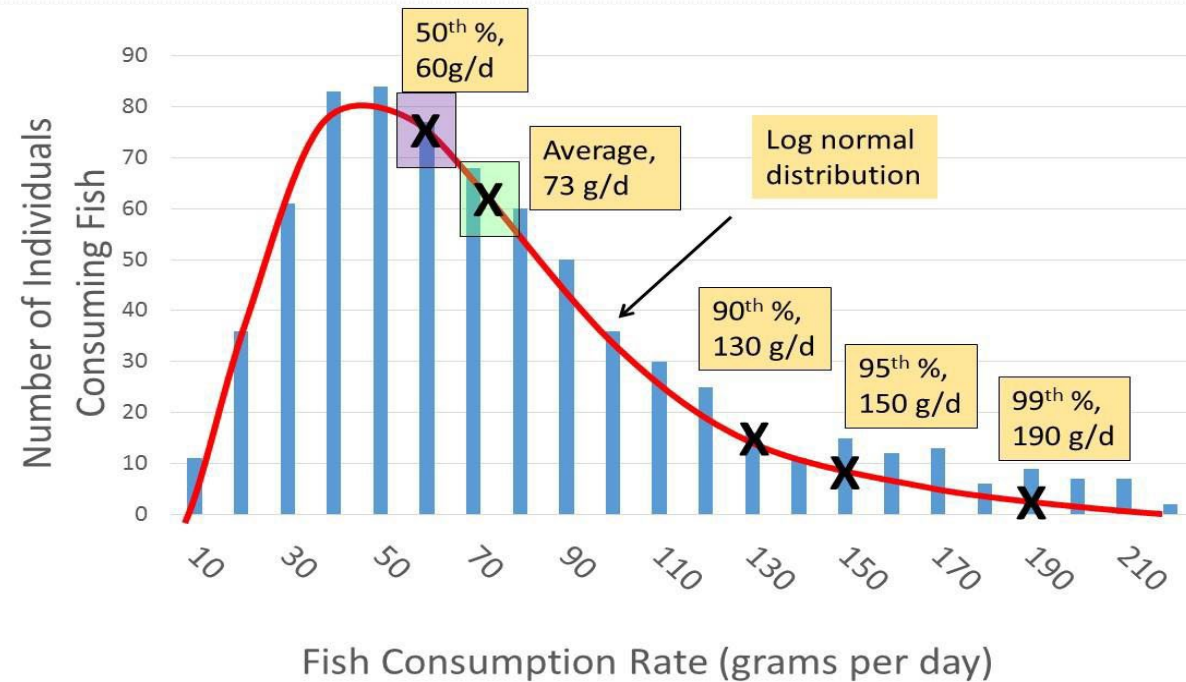
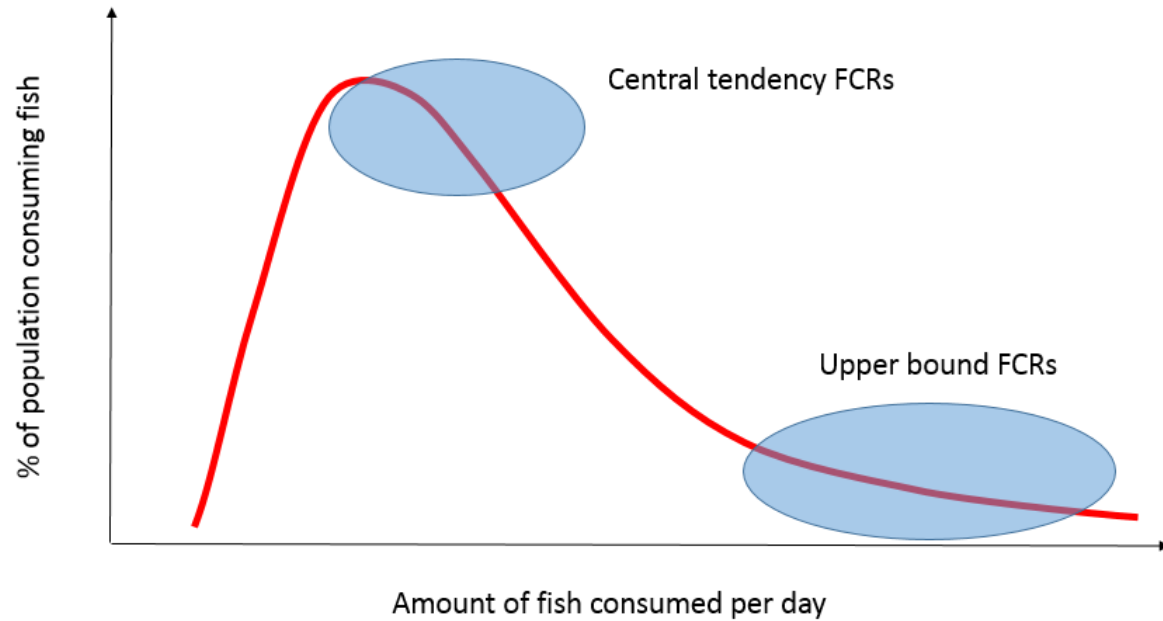
What fish should be included in FCR?

- Local freshwater and nearshore species are part of EPA's 2000 recommended HHC Methodology
- Marine species?
 - Not included in EPA 2000 Methodology but included by other Northwest States
 - Commercially-sourced fish?



<https://glacierbayalaska.com/alaska-fishing/fish-species-guide/>

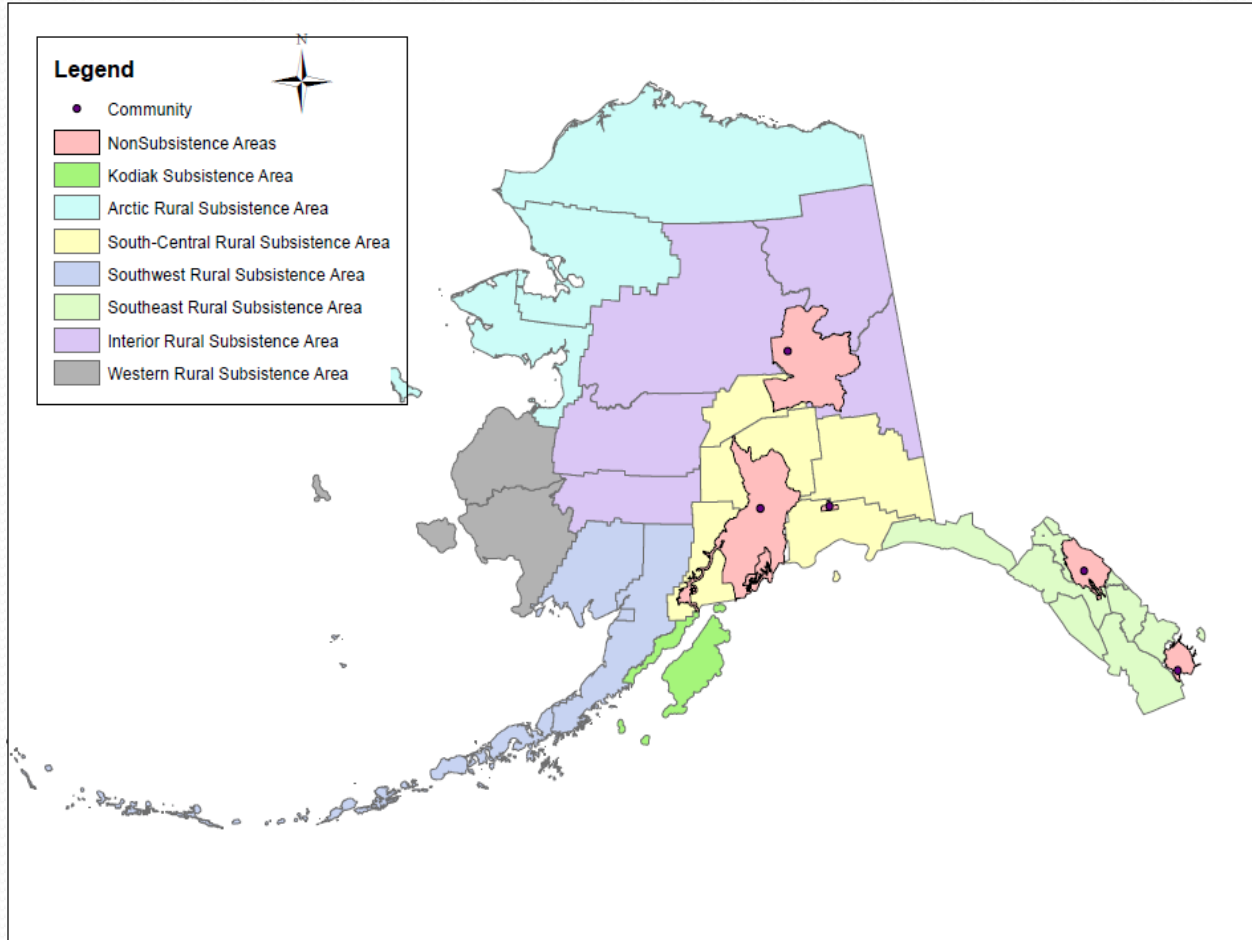
Things to Consider: Fish consumption rates statistics



EPA 2016



Things to consider: Regional Differences



Are FCRs significantly different from one part of the state to another?



EPA-contracted
Mountain
Whisperlight
Statistics to review
ADF&G data

Adjusted FCR based
on weighting of
respondent data

Table 1. Statewide and Regional Fish Consumption Rates¹⁹

Population, age; species consumed	No. of consumer respondents	Mean	90 th Percentile
Alaska's six regions, rural communities, all ages; Salmon, Halibut, Herring, Non-marine Fish, and Marine Invertebrates A			
Statewide	6,632+	149	308
Southeast	499+	152	217
Southcentral	1,218+	113	287
Southwest	645+	145	379
Western	1,550+	190	291
Arctic	1,663+	125	246
Interior	1,057+	127	308

+The Alaska counts in this column refer to the responding households which provided useable data for the rate calculations. The Alaska surveys provided data per species for the entire household and not for individual household members

Marine Mammals?

- Marine mammals are not referenced in the EPA guidance nor included by any other states
- Bioaccumulation of pollutants is highly variable
- USFWS and other programs already have consumption advisories for certain species and body parts
- The Relative Source Contribution is designed to account for marine mammal consumption

Nutrition Facts	
Beluga whale meat, raw	
Serving Size: 3oz (85g)	
Amount per Serving: 1	
Calories 94	Calories from Fat 4
% Daily Value*	
Total Fat 0.4g	1%
Saturated Fat 0.08g	0%
Cholesterol 68mg	23%
Sodium 66mg	3%
Total Carbohydrate 0g	0%
Dietary Fiber 0g	0%
Sugars 0g	
Protein 23g	45%
Vitamin A 6%	Vitamin C 0%
Calcium 0%	Iron 122%

*Percent Daily Values are based on a 2000 calorie diet. Your daily values may be higher or lower depending on your calorie needs.

Source: U.S. Department of Agriculture, Agricultural Research Service, 2012

Reference Dose (RfD)

- Like the CSF, RfD is a toxicity value
- It's the estimated total amount of daily exposure to a pollutant that is not likely to result in harmful effects
 - EPA publishes recommended values
 - Uncertainty is accounted for in the RfD
 - Typically has a safety factor of 10-1000 is built into the value to account for intra-species and differences between animals and humans

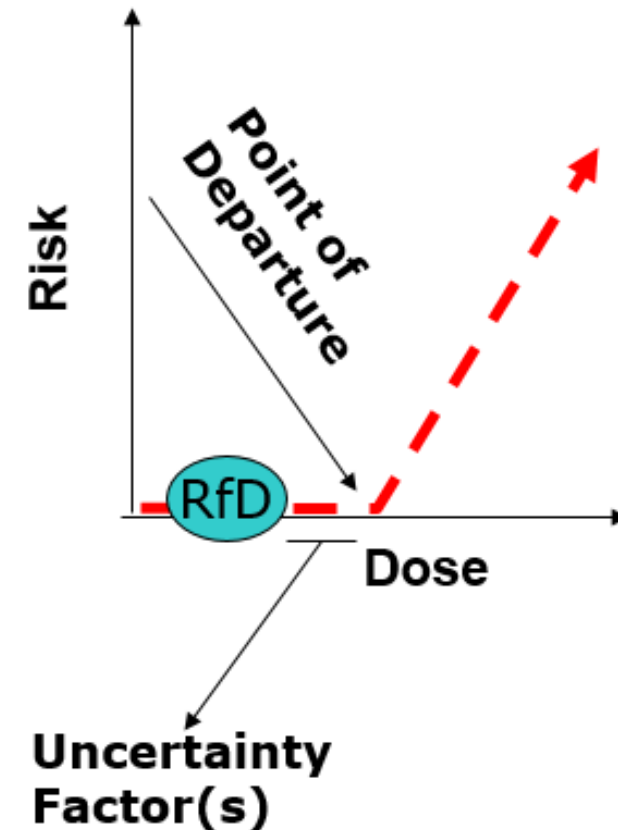
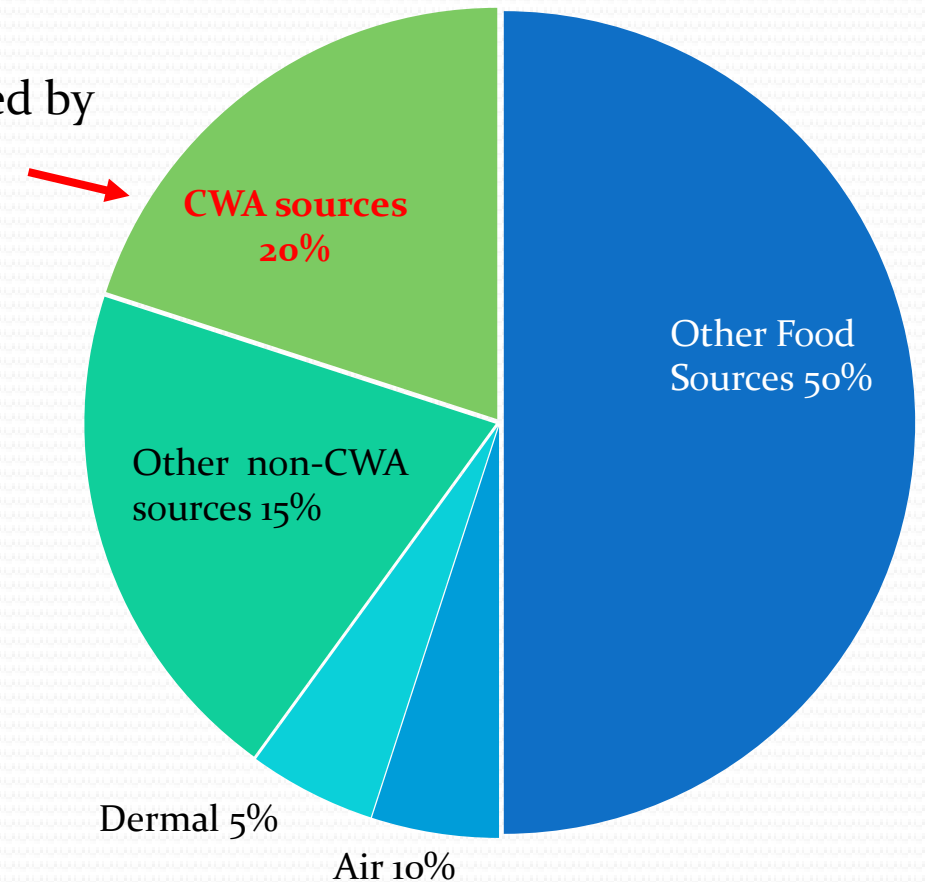


Image: Oregon DEQ

Relative Source Contribution (RSC)

- Fraction of the RfD for a pollutant from drinking water and fish consumption in comparison to other exposure sources
- RSC applies to non-carcinogens and carcinogens with a non-linear response
 - A RSC of 1 would equal the reference dose value – all exposure comes from consumption of fish and water
 - Less than 1 leaves room for other sources of exposure than fish and water consumption

Pollutant sources addressed by this rule making





Relative Source Contribution (RSC)

- 2015: EPA recommended default value of 0.20 for most pollutants. Can be adjusted up to 0.80 max
- WA HHC Ecology and EPA both adjusted all default 0.20 RSC values
 - Adjustment of default values from 0.2 to 0.5 accounts for marine fish consumption (e.g., salmon) to ensure consumption of marine fish isn't double counted (i.e., FCR and RSC)
 - Kept existing recommended 0.5 and 0.8 values



Summary

- **Bioaccumulation** refers to how pollutants enter into aquatic life and in what amounts
 - DEC does have information related to what Trophic level most consumption occurs at
- **Body weight** value is a fixed rate, and the adult value is used because it is more representative of weight over a lifetime
- **Drinking Water Intake** refers to untreated or source water consumed on an annual basis over a lifetime
- **Fish Consumption Rate** represents average consumption in grams per day over a lifetime
 - States can choose values based on available survey data and populations
 - DEC does have state & regional info



Summary

- **Cancer Slope** and **Reference Dose** values are based on scientific studies
- **Cancer Risk Levels** are science policy decisions set by states
- **Relative Sources Contributions** are used to ensure CWA-sources of exposure will not cause a person to exceed the **Reference Dose**
 - States can adjust them if they can attribute higher exposure via a CWA-regulated source



Questions

- Next section – Sources of info, key points, next steps



EPA recommended formulas for Human Health Criteria

BAF: Bioaccumulation
 BW: Body Weight
 CRL: Cancer Risk Level
 CSF: Cancer Slope Factor
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 FCR: Fish Consumption Rate
 RfD: Reference Dose
 RSC: Relative Source Contribution

Consumption of Organisms and Water

Consumption of Organisms Only

Criteria for Carcinogens

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$$\frac{RfD \times RSC \times BW}{FCR \times BAF}$$



2018 DEC Human Health Technical Workgroup

- Met 13 times between 2015 and 2018
- Representatives from: State, Tribal, Federal, Utility, NGO, University
- Topics they were asked to review and make recommendations on:
 - Issue #1: What information about fish consumption and fish consumption rates is available to inform the HHC process?
 - Issue #2: What options does DEC have for developing criteria on a statewide/regional/site specific basis?
 - Issue #3: What is the appropriate level of protection for Alaska and its residents?
 - Issue #4: What should Alaska's FCR(s) be?
 - Issue #5: What are Alaska's options for implementing the proposed criteria?



2018 DEC Human Health Technical Workgroup

- Recommended that the ADF&G Division of Subsistence data provides a basis for a statewide FCR
 - Current; Broad; Accepted Methodology
- Recommended which species should be including during the FCR-development process
 - Freshwater, nearshore, and select marine species
 - Combination of scientific and policy decisions



Existing Values and Workgroup Recommendations

	Current Value	Workgroup Recommendations
BAF	BCF-values applied (1992)	Apply Trophic Level 4
BW	70 kg (~154 lb.)	Change to 80 kg (~176 lb.)
CRL	1 in 100,000 (1997)	Majority recommended to retain 1 in 100,000
CSF	Pollutant specific	Apply EPA recommended values
DI	2.0 liters/day	Change to 2.5 liters/day
FCR	6.5 g/day. Does not include anadromous fish and other marine species	Majority recommended: Anadromous and non-anadromous local fish, and use rural consumers as target population
RfD	Pollutant specific	Apply EPA recommended values
RSC	N/A	Apply EPA values (did not deliberate on the adjustment of RSCs to account for inclusion of marine species)



Sources of Information

- DEC posted these informational documents on the DEC Human Health Criteria webpage.
 - ADF&G Fish Consumption Rate Analysis (2019)
 - DEC Human Health Criteria Technical Workgroup Report
 - EPA-contracted statistical analysis of ADF&G Fish Consumption Rate Analysis (2019)
 - HHC Factsheet (2023)

Implementation

- DEC raised implementation concerns with EPA on multiple occasions
- EPA provided responses to DEC's concerns most recently in their 2022 correspondence with DEC about the HHC rulemaking process
 - All letters are available on the DEC HHC Website
- DEC is very aware of the challenges associated with implementation of criteria (e.g., criteria v. method detection limits, fish tissue criteria)



Important Points

- The state recognizes that this rulemaking is an issue of interest to many Alaskans
- ADEC-Environmental Health conducts fish tissue sampling across the state
 - DHSS testing indicates that most fish have **low to no detectable levels of contamination from pollutants**
 - Potential waters of concern are addressed through **Fish Advisories**
- Alaska has tools available to make water quality criteria **more restrictive**, when needed, based on local data on fish consumption, bioaccumulation rates, and other HHC inputs



Next Steps

- **DEC is accepting “scoping” comments on this issue via state SMART COMMENT website**
- Public scoping closes March 12th 2023
- Future opportunities to comment once draft regulations are public noticed
- DEC is in the process of scheduling other outreach opportunities



What is DEC looking for Feedback On?

Methodology

Formula Inputs

Additional sources of data

Any other comments related to HHC



Schedule

Spring 2023	Public scoping and comment solicitation
Summer 2023	Develop draft rulemaking and guidance
Fall 2023	Agency review of draft rulemaking and guidance
Spring 2024	Public notice for draft regulations
Fall 2024	State adoption of new HHC; submission to EPA

Questions?

Thank you!

