

Policy Options Paper: Treatment of Marine Mammals in the Human Health Criteria Formula

Deliberative Document. Does not represent DEC's final policy preference(s).



1. **Background:** The DEC Human Health Criteria (HHC) Technical Workgroup has been discussing the relevance of marine mammal consumption when establishing a fish consumption rate, bioaccumulation rate for the HHC formula, and relative source contribution. EPA has not dictated a need to consider marine mammals as part of the HHC 2000 methodology. ADF&G-Subsistence has completed a statistical analysis of the ADF&G Community Harvest Database to determine consumption (use) of marine mammals by Alaskans across the different management regions. The preliminary analysis is fairly intuitive; some subsistence practitioners rely more on marine mammals than others.

Due to the complexity of this issue WQS staff with the assistance of Drs. Deglin and Verbrugge have developed a limited set of options for the HHC Workgroup to consider. These options may not represent the entire universe of options available but rather what is within the range of technical expertise of DEC to apply at this time.

2. **Options:** The following are three aspects of the human health criteria formula that relate to the treatment of marine mammals.

I. Fish Consumption Rate (FCR) Options for the Workgroup to consider

1. Simple adoption of fish consumption values without consideration of marine mammals
 - a. Essentially- status quo. Species-specific consumption concerns would be addressed by federal/state guidance as warranted- similar to fish consumption guidelines.
 - b. Pro: Acknowledges the fact that the EPA HHC methodology is not designed to include marine mammals in FCR. Including marine mammal consumption would require complex research and calculations to accurately account for widely varying contaminant levels among animals of a same species and among different tissues within an individual animal. Essentially, if we can't do it "right" we shouldn't do it. Also, with a few exceptions such as harbor seals, marine mammals are getting their contaminant loads from global sources, not from ADPES discharges.
 - c. Con: Could be controversial in places where marine mammal consumption exceeds fish consumption and people feel that they are not being protected.
2. Adopt a percentage of marine mammals as FCR (seals and belugas) based on habitat (resides primarily in waters of CWA jurisdiction)
 - a. Acknowledges the fact that certain species are considered to be predominately residing in state waters and exposed to pollutants in those waters
 - b. Pro: Acknowledges the role of marine mammals as part of general diet in a manner similar to certain fish species.
 - c. Con: Does not resolve the fact that marine mammal tissue harbors different levels of contaminants. DEC will need to establish a process for making a tissue-specific

Commented [A1]: Here again we run in the problem of having widely different concentrations in different tissues for any given chemical.

What might be possible on the other hand is to take into account different MM tissues in the denominator of the equation below:

In the following formula:

$$AWQC = \frac{POD}{UF} \cdot RSC \cdot \left(\frac{BW}{DI + \sum_{i=2}^n (FI_i \cdot BAF_i)} \right)$$

The sum appearing in the denominator allows for different fish consumption numbers for different trophic levels to be accounted for. We could include consumption of different MM tissues instead?

⇒ A BAF could be modeled for various tissues.

○ With help from for Dr. Gobas?

⇒ FI could be estimated for each tissue based on data provided by the harvest database.

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adjustment to the bioaccumulation factor (BAF). This method is also based on the assumption that the contaminants body burden of marine mammals stems from chemical discharge to Alaska waters only, discounting global distillation.

3. Full inclusion of marine mammals

- a. Pro: Treats marine mammals as other aquatic species that may be exposed to chemicals in state waters.
- b. Con: Will require extensive research on the part of DEC to develop appropriate bioaccumulation factors for different tissue types (organs, blubber, muscle...).

II. Bioaccumulation (BAF) options to consider

1. If DEC chooses to exclude Marine Mammals
 - a. DEC would still need to either adopt EPA approach of using Trophic Level 2-4 values or adopt Trophic Level 4 (more conservative) approach
2. If DEC chooses to include marine mammals and develop a tissue specific-adjusted BAF
 - a. May result in a range of BAF values depending on the tissue (e.g., blubber, liver) and other species specific information.
 - b. Consumption rates would also need to be determined for different tissues. This could be complicated by regional variations in the consumption of different tissues.
 - c. The science may be available but is generally outside of DEC's expertise.

III. Relative Source Contribution options to consider

1. Regardless of whether marine mammals are or are not adopted, the Relative Source Contribution would remain at the EPA-recommended value of 0.2. This is due to the degree of uncertainty associated with exposure due to the consumption of various types of tissue from marine mammals. There is potential for this value to be revised on a site-specific basis should significantly less marine mammal consumption take place.

Other factors to consider:

- At no time has EPA said that DEC must include marine mammals as part of FCR. This was a question that DEC raised but
- Total exposure levels should remain below the reference dose
- Not all marine mammals reside primary in state waters
 - Many belugas, seals, belugas, sea lions, and walrus do
 - Bowhead do not
- Much of the literature focuses on MeHg or legacy chemicals, most of which accumulate in the arctic by global distillation.
- Chemicals found in marine mammals have been documented to be concentrated in certain body parts (liver, kidney) in certain species, and spanning large concentration ranges in a same type of tissue. It is not possible to generalize how chemicals with HHC affect marine mammals.

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- Majority of marine species from state waters that are regularly consumed are Trophic Level 3.8/4
- Target Population concern
 - Appears that high fish consuming populations are lower marine mammal consumers
 - Inverse applies for high marine mammal consuming populations

3. Preliminary Data from ADF&G pertaining to marine mammal consumption based on Community Subsistence Information System database

Table 1. Estimated per capita values, users and non-users included.

Region	Per Capita Lbs	Per Capita Kg
Southeast	2.6	1.2
Southcentral	1.5	0.7
Southwest	0.4	0.2
Western	18.2	8.3
Arctic	117.3	53.2
Interior	0.0	0.0

Note Communities in the Pribilof Islands are known via annual monitoring programs to harvest fur seals, however those communities and reported harvests were not included in these figures.

Region	Approx. consumption of marine mammals in g/day
Southeast	3.23
Southcentral	1.86
Southwest	0.50
Western	22.62
Arctic	145.77
Interior	0

Comments: Would be beneficial to see these values when only consumers are noted- similar to what we are proposing for a statewide target population.

Consumption by Species by Consumers within that Region

Region	Used	Value derived from Per Capita Lbs
Southeast	Harbor Seal (19.8%)	Harbor Seal (100%)
Southcentral	Harbor Seal (9.9%) Stellar Sea Lion (3.0%)	Harbor Seal (70%) Stellar Sea Lion (30%)
Southwest	Beluga (9.8%)	Beluga (100%) NOTE: This seems odd since seals/sea lions are commonly taken for subsistence on Kodiak ¹ .
Western	Bearded Seal (19.3%) Ribbon Seal (2.8%) Ringed Seal (15.4%) Spotted Seal (20.8%) Walrus (13.3%)	Bearded Seal (33%) Ribbon Seal (.5%) Ringed Seal (14%) Spotted Seal (19%) Walrus (14%)

¹ Based on data in Technical Paper N. 374. The Subsistence Harvest of Harbor Seals and Sea Lions on Kodiak Island in 2011. ADF&G and Alaska Native Harbor Seal Commission

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	Beluga (17.6%)	Beluga (19%)
Arctic	Polar Bear (6.7%) Bearded Seal (41%) Ringed Seal (0.9%) Spotted Seal (11.6%) Sea Otter (0.5%) Beluga 32.4%) Bowhead (48.9%)	Polar Bear (0.6%) <i>consumed?</i> Bearded Seal (29%) Ringed Seal (3%) Spotted Seal (6%) Sea Otter (12%) <i>consumed?</i> Beluga (5%) Bowhead (47%)
Interior	(43% of total pop recorded use) Assumes most of this is via trading rather than actual take	NOTE- No Per Capita Lbs recorded- assumes that some consumption took place but the amount may be limited Bearded Seal Harbor Seal Spotted Seal Unknown seal Sea Otter Walrus Beluga Bowhead Unknown

Appears that there is a general decline in the take of seal/sea lions across the state with the exception of Kodiak. Generally related to a decrease in number of hunters. On Kodiak it appears that the decline in take is related to hunter success rather than the total number of hunters participating.

Consumption in the interior is very hard to determine as harvest by residents generally does not occur- meat is acquired via trade/barter/gift. This may lead to over/under reporting by residents. This issue is likely to occur in other areas as well as there is a limited number of actual hunters compared to individuals who "use" the resource.

Contaminant information by Species

Species		Contaminants
Bearded Seal- TL3.8	Generally not noted to haul out on land although there are exceptions. Shallow water feeding Bx. Unknown if this equates to nearshore v. offshore feeding	Elevated cadmium and mercury Lowest levels of total HCH (hexachlorocyclohexane), DDT, and PCBs (polychlorinated biphenyls). Second lowest level of CHL (chlordanes). ² Lowest levels of PBDEs. Levels of contaminants are generally

Commented [LV2]: This column makes me hesitate because it seems that each "factoid" comes from a single reference. Various papers don't always come to the same conclusion so in the absence of a careful literature review it might be better not to generalize like this.

² Quackenbush 2011. Biology of the bearded seal (1961-2009) ADF&G.

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	Contaminant testing occurred on liver, kidney, and muscle tissue	lower than other ice seal species harvested in AK
Harbor Seals- TL4.0	The harbor seal is a useful model species for studies of contamination of the marine food contaminant web and potential environmental health effects. Harbor seals tend to feed on species of fish that are coastal and, in contrast to many other phocids, they tend to migrate locally, staying close to their coastal feeding and haul-out areas, and using bays and estuaries for resting, foraging, and reproduction	PCB and DDE noted. Strongly related to sex and age (older males > concentrations) Limited data is available to make generalized statements about contaminants in seals other than the fact that certain contaminants may be concentrated in certain tissue/organs, and that a wide range of values are recorded-similar to that of other aquatic species. Studies of harbor seals in Bristol Bay noted the presence of PCB and DDE but no sources. Concentrations were lower than reported in marine mammals elsewhere. Seals had greater concentrations of contaminants than spotted seals (Neale 2009). Attributed to feeding at a higher trophic level/in coastal areas
Belugas-TL3.8	Comprise a significant part of SW, Western, and Arctic Alaska diet. Cook Inlet species considered to be near shore foragers. Likely to be representative of belugas in general	Becker (2001) notes levels of contaminants such as PCBs and chlorinated pesticides.

Commented [LV3]: Not blubber? Discussion of contaminants in column to the right is confusing, then, because blubber is where the POPs would be highest. Make sure you're comparing apples to apples.

Commented [LV4]: Search and replace – it's contaminants, not contaminates