Estimating seafood harvest requirements to support the traditional food system of First Nations in British Columbia

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Introduction

Traditional food systems are integral to the physical, emotional, social, and spiritual health of First Nations (FNs). However, climate change is projected to impact the abundance and distribution of several culturally significant marine species.[1] To develop fisheries management strategies and enhance food security and food sovereignty in FNs, it is integral to establish a baseline estimate of subsistence harvest requirements for coastal FNs.

It is common to rely on reported catch values when estimating subsistence harvest, but frequent underreporting and discrepancies between the fish that are caught and those that are consumed can lead to incorrect estimates. Therefore, as done in similar studies[3,4] we back-calculated required subsistence harvest from household consumption surveys collected in the First Nations Food, Nutrition & Environment Study (FNFNES).[5]

Objectives

1. Determine the quantity of Pacific fish harvest required to maintain the traditional diet of six coastal FNs communities in British Columbia (Kitsumkalum, Hagwilget, Skidegate, Nuxalk, 'Namgis, and Tla'amin).

2. Highlight suggestions for improved methodology in terms of linking ecological fisheries and household consumption to enable more accurate harvest requirement estimates.

First Nations Communities

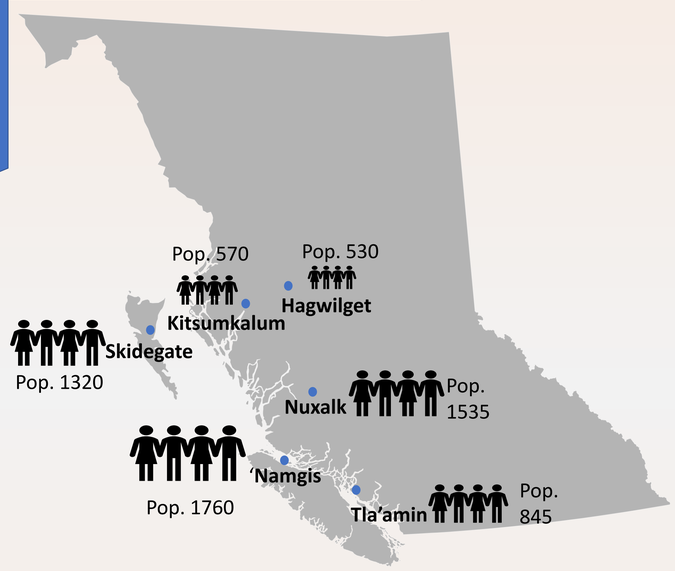

Figure 1. Map of the participating First Nation communities in the 2008-2009 First Nations Food, Nutrition & Environment Study[5] and 2016 populations.[6]

References

[1] Weatherdon LV, Ota Y, Jones MC, Close DA, Cheung WWL (2016) Projected Scenarios for Coastal First Nations' Fisheries Catch Potential under Climate Change: Management Challenges and Opportunities. *PLoS ONE 11(1):* e0145285. https://doi.org/10.1371/journal.pone.0145285

[2] Allison, E. H., & Mills, D. J. (2018). Counting the fish eaten rather than the fish caught. *Proceedings of the National Academy of Sciences of the United States of America*, 115(29), 7459–7461. https://doi.org/10.1073/pnas.1808755115

[3] Kenny, Tiff-Annie & Chan, Laurie. (2017). Estimating Wildlife Harvest Based on Reported Consumption by Inuit in the Canadian Arctic. *ARCTIC*. 70. 1. 10.14430/arctic4625.

[4] Fluet-Chouinard, Etienne, Simon Funge-Smith, and Peter B. McIntyre. Global hidden harvest of freshwater fish revealed by household surveys. *Proceedings of the National Academy of Sciences* 115.29 (2018): 7623-7628. Web. 26 April. 2021.

[5] Laurie Chan, Olivier Receveur, Donald Sharp, Harold Schwartz, Amy Ing and Constantine Tikhonov. *First Nations Food, Nutrition and Environment Study (FNFNES): Results from British Columbia (2008/2009)*. Prince George: University of Northern British Columbia, 2011. Print.

[6] Statistics Canada. (2019). Table 98-400-X20163932016 Membership in a First Nation or Indian Band (663), Residence on or off Reserve (3), Age (10B) and Sex (3) for the Population in Private Households of Canada, Provinces and Territories, 2016 Census - 25% Sample Data. Retrieved January 8, 2021, from Aboriginal Peoples Data tables, 2016 Census website: https://www150.statcan.gc.ca/n1/en/catalogue/98-400-X2016393

[7] Zeller, D., Pauly, D., Le Manach, F., Cisneros-Montemayor, A. M., Palomares, M.-L. D., Dinh Tran, L., … Teh, L. (2016). *Catch Reconstruction: concepts, methods, and data sources*.

➢ For full list of references, refer to Janacek, R. (2021). *Estimating the quantity of seafood harvest required to support the traditional food system of the coastal First Nations in British Columbia, Canada*. University of Ottawa.

➢ Cartoons from Icongeek26 https://www.flaticon.com/free-icon/fish_4327263?related_id=4327259&origin=search

Methods

1. We determined the harvest structure of 15 culturally important marine fish species through a literature review.

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Table 1. Percent consumption, edible yield, and weight distribution of selected marine species consumed by BC FNs.

Fish species[1]	Percent consumers (%)[2]	Round weight (g)[3]	Edible yield[4,5]
Sockeye salmon (*Oncorhynchus nerka*)	88	3000–7000	0.57–0.63
Pacific halibut (*Hippoglossus stenolepis*)	82	1300–300000	0.52*
Eulachon (*Thaleichthys pacificus*)	52	40–75	0.76**
Chinook salmon (*Oncorhynchus tshawytscha*)	45	13000–18000	0.46–0.73

[1] For a comprehensive list of all species, refer to Janacek, 2021
[2] Percent consumer values based on the FNFNES ecozone 6 (Chan et al., 2011)
[3] References: DFO, NOAA, Alaska Department of Fish and Game, fishbase, COSEWIC
[4] Range of edible weights reported in literature
[5] References: FAO, (Crawford, 1972), (Exler et al., 2012), (Stoner & Ethier, 2015)
* missing data that were calculated as the mean of other lower-bound edible yields
** mid-point between 1.0 and overall mean lower-bound yields

2. We used traditional food consumption data from the FNFNES[5] to determine the annual consumption rate (kg/person/year) for each fish species by sub-population.

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Food frequency questionnaires

24-hour diet recall surveys

Consumption frequency by sub-population

Percent of consumers of each species

Mean serving size by sub-population

Table 2. Mean serving size of traditionally harvested fish consumed by FNs living on-reserve in BC.

	Mean grams/serving				
	Age Group				
	0-12[1]	**13-18**[2]	**19-50**	**51-70**	**71+**
♀	36.3	72.7	109	132	87
♂	54.3	108.7	163	163	100

[1] Calculated as one third of the serving size of 19–50 age group
[2] Calculated as two thirds of the serving size of 19–50 age group

Methods Continued

Annual consumption rate (kg/person/year) for each species by sub-population

3. Using a proportional projection, we estimated the annual regional consumption (edible kg of fish/region/year) based on the percentage of consumers for each species and the 2016 Canada census[6] for two different consumption scenarios.

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4. We adjusted annual regional consumption by the lower-bound edible yield for each species to find the annual regional harvest requirements. We compared these estimates to the reported 2016 BC catch data from the *Sea Around Us* project.[7]

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Results

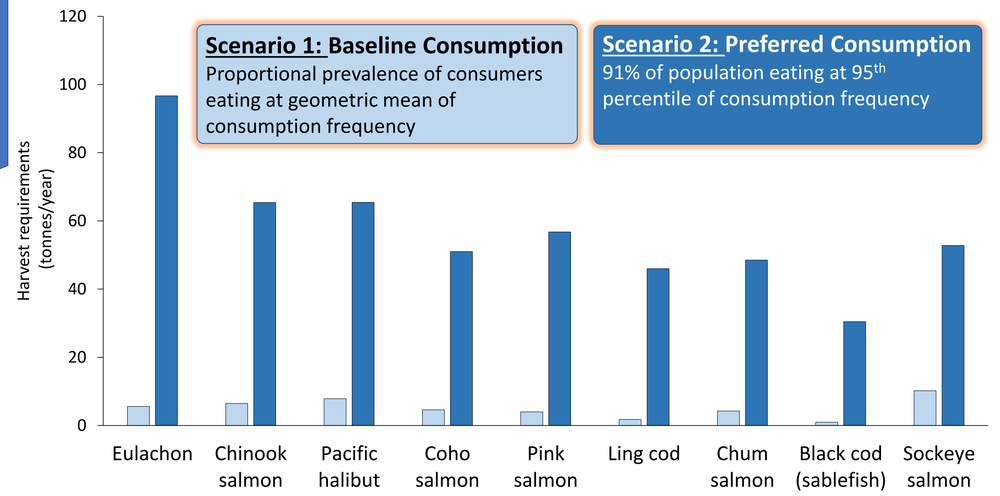

Figure 2. Estimated total annual subsistence harvest requirements of marine fish species for coastal BC FNs, based on 2016 census population data.[6]

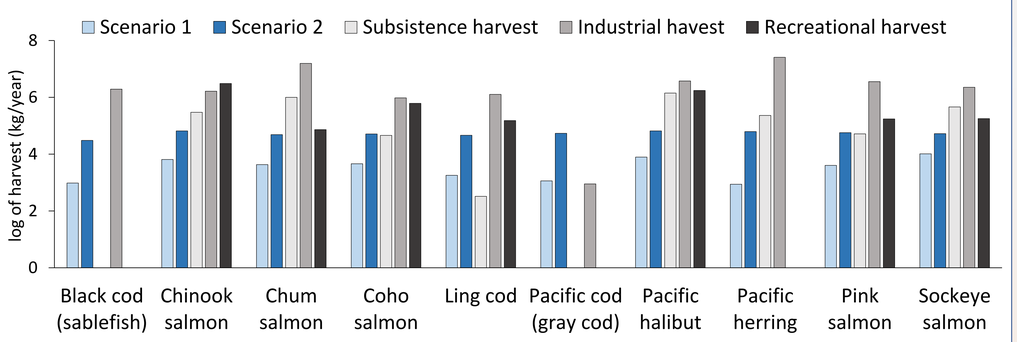

Figure 3. Log-transformed 2016 estimated total annual subsistence harvest requirements of marine fish species by coastal BC FNs. Subsistence, recreational, and industrial harvest comparisons represent reported catch data from the *Sea Around Us*[7] Canada Pacific EEZ.

Discussion

- Eulachon, Pacific halibut, sockeye, and chinook salmon have the highest harvest requirements, but they are projected to decrease in availability coastwide by 7%-29%.[1] This may have serious implications on the food and financial security, food sovereignty, and well-being of coastal FNs.
- To enable more accurate estimates of harvest requirements, there is a need to focus on community-specific traditional knowledge and harvesting activities such as harvest calendars, harvest-sharing networks, fish preparation, edible yield preferences, and traditional food consumption habits of off-reserve FNs.
- Even at the upper subsistence harvest estimate, most fisheries were lower than reported catch statistics. This can have profound implications for fisheries management.