Freshwater Growth and Recruitment in Two Western Alaskan Populations of Chinook Salmon

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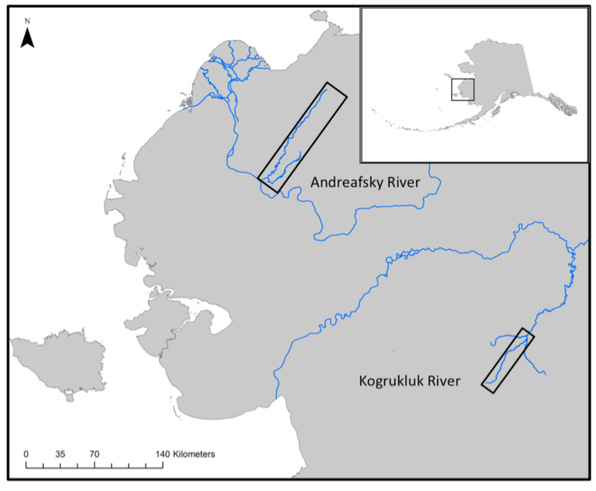

Fig 1. Study area: Andreafsky River (Yukon drainage) and Kogrukluk River (Kuskokwim drainage).

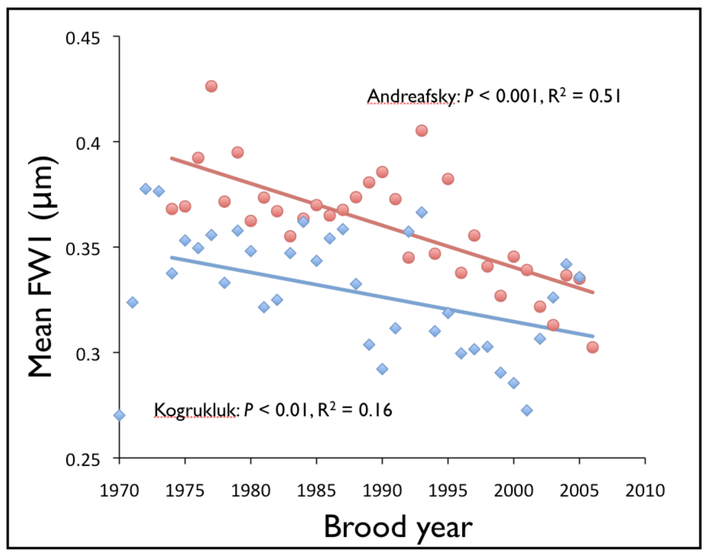

Fig 3. Scale increment width for first year in freshwater (FW1) by brood year for Andreafksky (red circles) and Kogrukluk (blue diamonds) rivers.

Research question: Are declines in Yukon and Kuskokwim Chinook salmon related to freshwater growth?

Synopsis: Returns of Chinook salmon to the lower Yukon and Kuskokwim drainages of western Alaska have declined since the 1990s. As these populations are relied upon by subsistence and commercial fishers, there is great interest in understanding what causes poor recruitment in this region. We used ~30 years of scale data from two escapement projects (the Andreafsky River, Yukon drainage and the Kogrukluk/Holitna River, Kuskokwim drainage) to test the hypothesis that poor freshwater growth was related to low recruitment. We observed a significant decline in freshwater and total marine growth (measured from scale increment width) from the 1970s to early 2000s, consistent with local knowledge regarding the loss of older, larger females from these populations. Despite these declines, we did not detect significant relationships between growth and stock productivity in either of these populations.

Methods:

- Constructed time series of growth increments measured from ADFG scale collections (females only):
  - -Andreafsky River (Yukon): 1980-2005, 2007-2010
  - -Kogrukluk River (Kuskokwim): 1978, 1981-2010
- Reconstructed brood tables from escapement, harvest, sex ratio and age composition estimates
- Estimated productivity as (harvest + escapement)/female on brood-year basis
- Tested correlations between freshwater/marine growth and productivity

Table I. Spearman rank correlation coefficients (and exact test *P*-values) between stock productivity (ln-transformed recruits/female spawner) and average growth increment.

Growth Increment(BY mean)	Stock productivity	
	Andreafsky R. (Yukon)	Kogrukluk R. (Kuskokwim)
FW1	0.005 ($P = 0.99$)	0.044 ($P = 0.87$)
SW1	-0.35 ($P = 0.15$)	0.15 ($P = 0.56$)
SW All	0.22 ($P = 0.37$)	0.11 ($P = 0.68$)

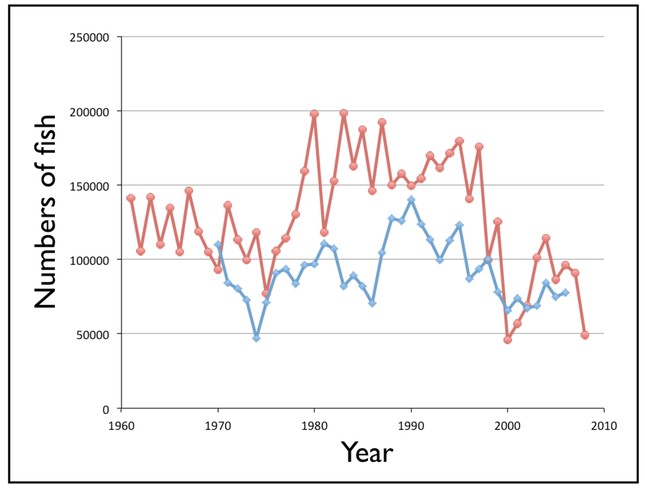

Fig 2. Annual total Alaskan harvest (commercial, subsistence, test, and sport) of Chinook salmon from the Yukon[a] (red circles) and Kuskokwim[b] (blue diamonds) rivers.

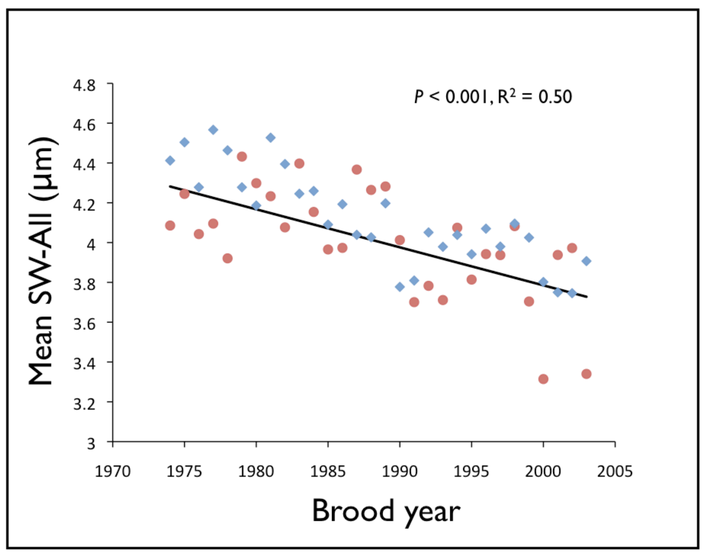

Fig 4. Scale increment width for all marine growth by brood year for Andreafsky (red circles) and Kogrukluk (blue diamonds) rivers. ANCOVA indicated that neither intercept (P=0.48) nor slope (P=0.49) differed between rivers.

Conclusions:

- Mean freshwater growth (FW1) and total marine growth (SW-All) have declined significantly over time
- Despite these declines, no significant correlations between measures of growth and stock productivity were detected
- Observed declines in growth may be due to loss of older, larger females from these populations

Caveats:

- Estimates of stock productivity are VERY imprecise
- Scale samples were from escapement collections; these represent the survivors of freshwater, marine, and fishing mortality
- Potential bias in sampling of escapement has not been fully evaluated
- Chinook salmon's long lifespan (up to 7 yr) truncated the time series for evaluating correlations between growth and productivity

Acknowledgments

- Funding provided by Pollock Conservation Cooperative Research Center and Alaska Sustainable Salmon Fund
- Larry DuBois, Bev Agler, Lorna Wilson, and Matt Evenson (ADFG) provided expertise and assistance with scale sample retrieval, reading, and compilation of brood tables
- Milo Adkison and Trent Sutton (UAF) provided input on analysis

[a]Evenson, D. R. et al. 2009. Yukon River Chinook salmon: stock status, harvest and management. Am. Fish. Soc. Symp. 70:675-701.
[b]Linderman, J. C. and D. J. Bergstrom. 2009. Kuskokwim Management Area: salmon escapement, harvest, and management. Am. Fish. Soc. Symp. 70:541-599.