AYK Paper Notes

Follow up papers:

* Linderman & Bergstrom 2006
* Costa 2006 (zoop spatial patterns)
* Buklis and Barton 1984 Yukon age comp
* Data sovereignty: Kukutai and Taylor 2016
* Sampling results and proportional stock composition estimates for each fishery can be found in the WASSIP final report for chum salmon stock compositions (Templin et al. 2012).
* Chum bycatch: (Stram and Ianelli 2009)
* Bue, F.J., Borba, B.M., Cannon, R., and Krueger, C.C. 2009. Yukon River fall chum salmon fisheries: management, harvest, and stock abundance. In Pacific salmon: ecology and management of western Alaska’s populations. American Fisheries Society Symposium 70, Bethesda, MD. pp. 703–742.

In a plot I could highlight years when it was considered a federal or state disaster. Based on these poor runs of Chinook salmon, plus concurrent declines of chum salmon, state and federal agencies declared either fishery or economic disasters in the following years: 1997, 1998, 2000, 2001, 2002, 2009, 2010, 2011, and 2012.

🡪 Currently there are escapement goals for Aniak River and Kogrukluk River chum salmon stocks, but no drainage-wide goal has been established for Kuskokwim River chum salmon. A major shortcoming has been the lack of whole-river abundance estimates upon which to base an analysis of productivity.

**Kusko RR Papers (from Zach)**

1. **KUSKOKWIM RIVER CHINOOK SALMON RUNRECONSTRUCTION & STOCK-RECRUITMENT MODELS “Schindler, D.E., T.E. Walsworth, M.D. Adkison, R.M. Peterman, and A.E. Punt. 2019. Kuskokwim River Chinook salmon run-reconstruction and stock recruitment models: a review by an independent expert panel. Arctic-Yukon-Kuskokwim Sustainable Salmon Initiative. Anchorage, AK. 164 pp.”**

* This paper was suggested because the chinook model is super similar to the Chum RR, this paper reviews the Chinook model and makes suggestions, so similar thought process could be applied to the Chum model.
  + The original run-reconstruction model was highly sensitive to starting values used for abundance-related parameters.
  + Suggests that pooling errors for the Chinook model when dynamics across basin were non-synchronous would reduce error in abundance estimates. [chum model doesn’t have error though??]
  + 🡪 Fodder for a discussion suggesting increases management resources in monitoring wider breadth of stocks: “Management strategies that assume a homogeneous stock run the risk of overexploiting smaller and less productive stocks, thereby eroding the resilience of the overall stock complex to future changes in the environment. Thus, it is important to examine the consequences of various harvest regimes for sustainable production over the long-term, as well as maintaining the biocomplexity within the system. Maintaining biocomplexity in the system may require lower harvest rates in the short-term, and this trade-off should be explicitly examined using simulation and analysis of the existing data.”
* The original model assumed that production dynamics of Chinook salmon in the Kuskokwim are stationary through time – all these papers show examples of how salmon dynamics are non-stationary: (Adkison et al. 1996; Peterman et al. 1998 Independent Expert Panel Review Page 14 2003; Pyper et al. 2005; Dorner et al. 2008, 2018; Ohlberger et al. 2016; Peterman and Dorner 2012; Kilduff et al. 2014; Malick and Cox 2016).
* “To simulate the effect of regime shifts on ecosystem productivity, two levels of productivity were generated for each population by setting productivity at the origin (α in Ricker relationship, α/ in Beverton-Holt relationship) to 10 for periods of high productivity, and to 5 for periods of low productivity. Maximum abundance of recruits for each sub-population (p for the Beverton-Holt, p/(pe) for the Ricker) was randomly drawn from a normal distribution N(mean=25 000, standard deviation=6 000) to simulate populations of different sizes.”
* Assumed constant age structure through time
* Overly complicated harvest section of the model likely causing instability.
* Model overestimated total escapement and run size, this was from pooling harvest and effort data across the final 3 weeks of the data set (Chum does this too).
* Based on results this what they improved for a new model: In particular, the revised model included log-normally distributed errors on data collected from weirs and aerial surveys, the variances were pooled for each of these survey types, and the harvest model was also reformulated.
* Take home: mark recapture data decreases uncertainty. Original model suggested that stocks were more productive then they really were, everything else was pretty much the same between the two.

**Distribution, Diet, and Bycatch of Chum Salmon in the Eastern Bering Sea James M. Murphy1, Edward V. Farley, Jr.1, James N. Ianelli2, and Diana L. Stram3 2006**

* . Bycatch of chum salmon primarily occurs during late summer and fall and is largely absent in winter fisheries which is consistent with the seasonal migratory patterns of Asian chum salmon in the Bering Sea (Fredin et al. 1977; Urawa et al. 2001, 2009; Urawa 2004).
* The diet of chum salmon varied by region and over time in the eastern Bering Sea shelf (Table 2, Fig. 9). The Arctic hyperiid amphipod, Themisto libellula, was the most important prey species of chum salmon in the northern Bering Sea shelf (31%).
* Fig 9 – jelly fish, oikopleara, amphipods majority of diet. These are larger fish. 50cm.
* Prey fields, water temperature, and ocean currents are an integral part of the dynamic migration and distribution patterns of salmon in the North Pacific Ocean and Bering Sea (Murphy 1994; Welch et al. 1995; Aydin et al. 2000; Azumaya and Ishida 2004; Azumaya et al. 2007; Myers et al. 2007; Nagasawa and Azumaya 2009).
* Area M bycatch is 50-70% WAK salmon bycatch, but they have minimal observer coverage and sampling.
* “The close association between chum salmon bycatch, diet, and catch of age-0 pollock highlights the importance of foraging behavior of chum salmon (particularly on age-0 pollock) to changes observed in bycatch levels of chum salmon in U.S. groundfish fisheries in the eastern Bering Sea over time.”

**When do environment and recruitment correlations work? RANSOM A. MYERS 1998**

* Abiotic factors suggested to be highly correlated with species at the range limits and in that case, more useful. “That is, abiotic factors should be more important at the limit of a range (Huffaker and Messenger, 1964)”

**WASSIP memo**

**Key words: stock composition, total estimates**

-Summer chum salmon harvest increased greatly during the 1980s, due to regulation changes, development of markets, higher prices and processing capacity. Guideline harvest levels for summer chum salmon were established in 1990.

- The state-managed and directed Yukon fall chum salmon commercial fishery began in 1961, with guideline harvest levels for specific districts established in 1974.

- 1994 is when the board of fish adopted Yukon Drainage fall chum management plan

- Results: TOTAL RUN Stock-specific estimates of escapement and associated uncertainties varied greatly among reporting groups (Tables 4–6). Subsistence harvest estimates by Areas varied greatly (Appendix A), while commercial harvests within the WASSIP area not documented by Eggers et al. (2011) were relatively small (Appendix B).

- Table 4-6 has useful estimates of CWAK and upper Yukon total harvest etc. I think this can be used to ground truth/ compare my estimates, esp for Kusko,

- Also estimates what % and total abundance of each stock group is harvested in salmon fisheries. Possible to use for the mortality term in addition to pollock? Again only 3 years of data…

**Gilk et al 2006 Biological and Genetic Characteristics of Fall and Summer Chum Salmon in the Kuskokwim River, Alaska**

**Key words: age, sex and size structure info.**

* In general, age 4-5 fish usually dominate Chum returns throughout the range
* Surveyed fall Chum from: Big River and South Fork Kuskokwim River. Likely two of the largest Fall Chum runs anyway.
* Fall Chum only recognized by management starting in 1990’s, maybe partly because lower abundance and distribution compared to summer fish
* The two do not co-occur in distribution. Fall typically are in glacial flour tributaries while spring is in clear water.
* Yukon: Summer chum enter early June to mid-July, while fall chum are mid-July to early September
* 330 fall, 1,964 summer sampled for age sex and size
* Fall had a higher proportion of Age-3’s
* Fall are larger (mideye – fork length)
* no significant difference in sex ratio or fecundity
  + same for Yukon
* fish that migrate farther upstream tend to have less robust body types than those that migrate far upstream, same thing seen for Fall chum here, less deep body types.
* “readily distinguish Kuskokwim River fall from summer chum salmon in mixed-stock fisheries, genetic analysis shows sufficient differences to distinguish the two runs in mixed-stock analyses.”

**Burril – Feeding Ecology of Chum in Kuskokwim Bay [Dissertation]:**

* Do their survey locations overlap with NBS surveys at all?
* “In 1997, 1998, 2000, and 2001 this region was declared an economic disaster by the Governor of the State of Alaska due to the low numbers of chum salmon returning to the system. In 2000, the Kuskokwim River chum salmon populations were declared a stock of concern (ADF&G 2000, Burkey et al. 2000). Since then, chum salmon returns have strengthened to much higher levels”
* however neither the reasons for the declines nor the rebounding of the chum salmon populations are known.
* Common prey items for juvenile chum salmon in estuarine waters are harpacticoid and calanoid copepods, gammarid amphipods, insects, and cladocerans (Feller & Kaczynski 1975, Sibert 1979, Salo 1991, Higgs et al. 1995, Sturdevant et al. 1996, Moulton 1997).
* Consequently, the diet composition of juvenile salmon may be an important factor in understanding energetic requirements and their effects on maximizing growth and survival in fish (Cho 1983, Higgs et al. 1995).
* Poor condition and inadequate growth of Kuskokwim chum salmon juveniles may be contributing to poor marine survival and ultimately affecting stock abundance.