Changes in size and age of Chinook salmon in Alaska

Bert Lewis, W. Stewart Grant, Rich Brenner, Toshihide Hamazaki, and Leon Shaul* Alaska Department of Fish and Game

Figure 1. Map of Alaska with locations of Chinook salmon populations discussed in this study.

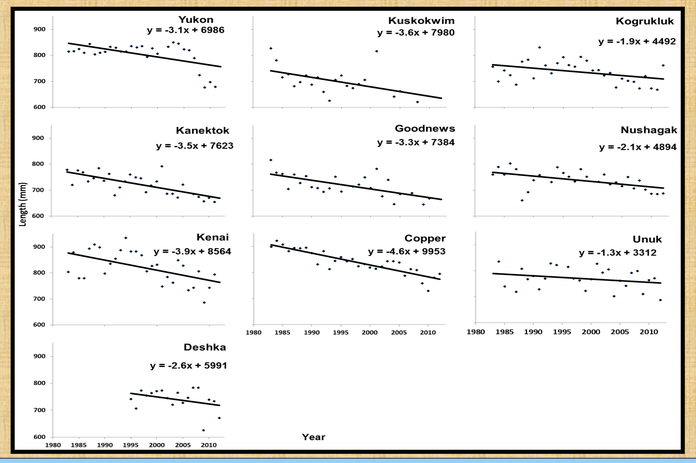

Figure 2. Linear regression of Chinook salmon mean annual length (mm) by stock and year.

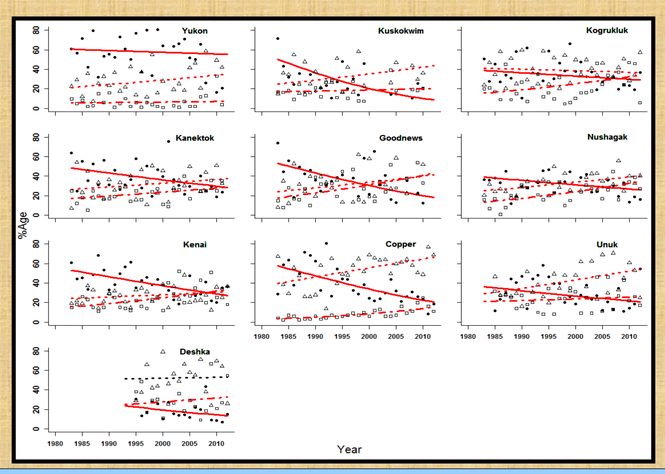

Figure 4. Logistic regression: Proportion by return year of Chinook salmon by stock, age class, and year. Closed circles, solid line = 4-ocean; open triangle, dotted line = 3-ocean, open square, dashed line = 2-ocean. **Red lines** = significantly different from zero (P <0.01).

OVERVIEW

Sizes of Pacific salmon have declined in some spawning areas in the Northeast Pacific in recent decades, but the geographic extent of these declines in Alaska is uncertain.

We used regression analyses to quantify decadal trends in length- and age-at-maturity from 10 Chinook salmon *Oncorhynchus tshawytscha* stocks located throughout Alaska (Figure 1).

Age and length data for individual stocks was from commercial harvests, weirs, or spawner abundance surveys, depending upon the availability of samples.

Collecting data from Copper River Chinook Salmon

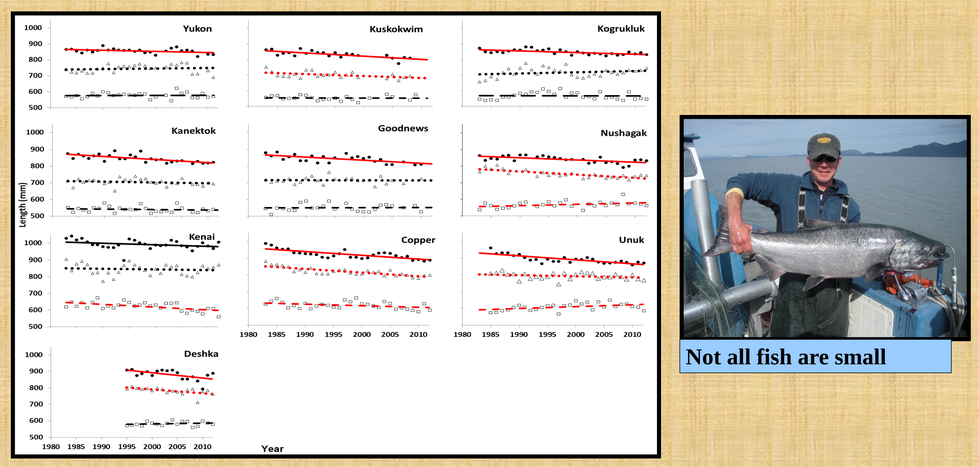

Figure 3. Linear regression of mean annual length (mm) Chinook salmon by stock, age class, and year. Closed circles and solid line = 4-ocean; triangles and dotted line = 3-ocean, open square and dashed line = 2-ocean. **Red lines** indicate slopes significantly different from zero (P <0.05).

Not all fish are small

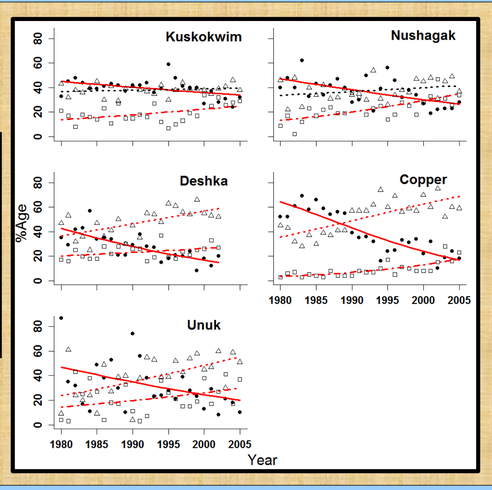

Figure 5. Beta regression of proportion by brood year of Chinook salmon stock, stock, age class and year. Closed circles and solid line = 4-ocean; open triangle and dotted line = 3-ocean, open square and dashed line = 2-ocean. **Red lines** indicate slopes significantly different from zero (P <0.05).

RESULTS

On average, Chinook have become smaller over the past 30 years (Figure 2), due to a decline in age at maturity and a decrease in age-specific length.

Age-specific lengths of 4-ocean fish (9 of 10 stocks) and of 3-ocean fish (5 of 10 stocks) have declined significantly (Figure 3).

Proportions of older and larger 4-ocean age fish have declined significantly in all stocks examined by return year or brood year (Figure 4 & 5).

CONCLUSIONS

Chinook salmon in Alaska stocks have become smaller at maturity and are returning to spawning areas at a younger age.

This study extends previous observations across a broad geographic range in Alaska and includes populations inhabiting a wide range of river systems of various size and with contrasting marine migrations.

Size-selective harvest may be driving trends in size and age, but the evidence is not conclusive. Additional factors, such as ocean conditions or competition with other salmon, may also be responsible.

Phenotypic shifts influence fecundity and population abundance, and may put populations and associated fisheries at risk of decline.