Photo by A. Solonsky

Climate, growth and population dynamics of Western Alaska Chinook salmon

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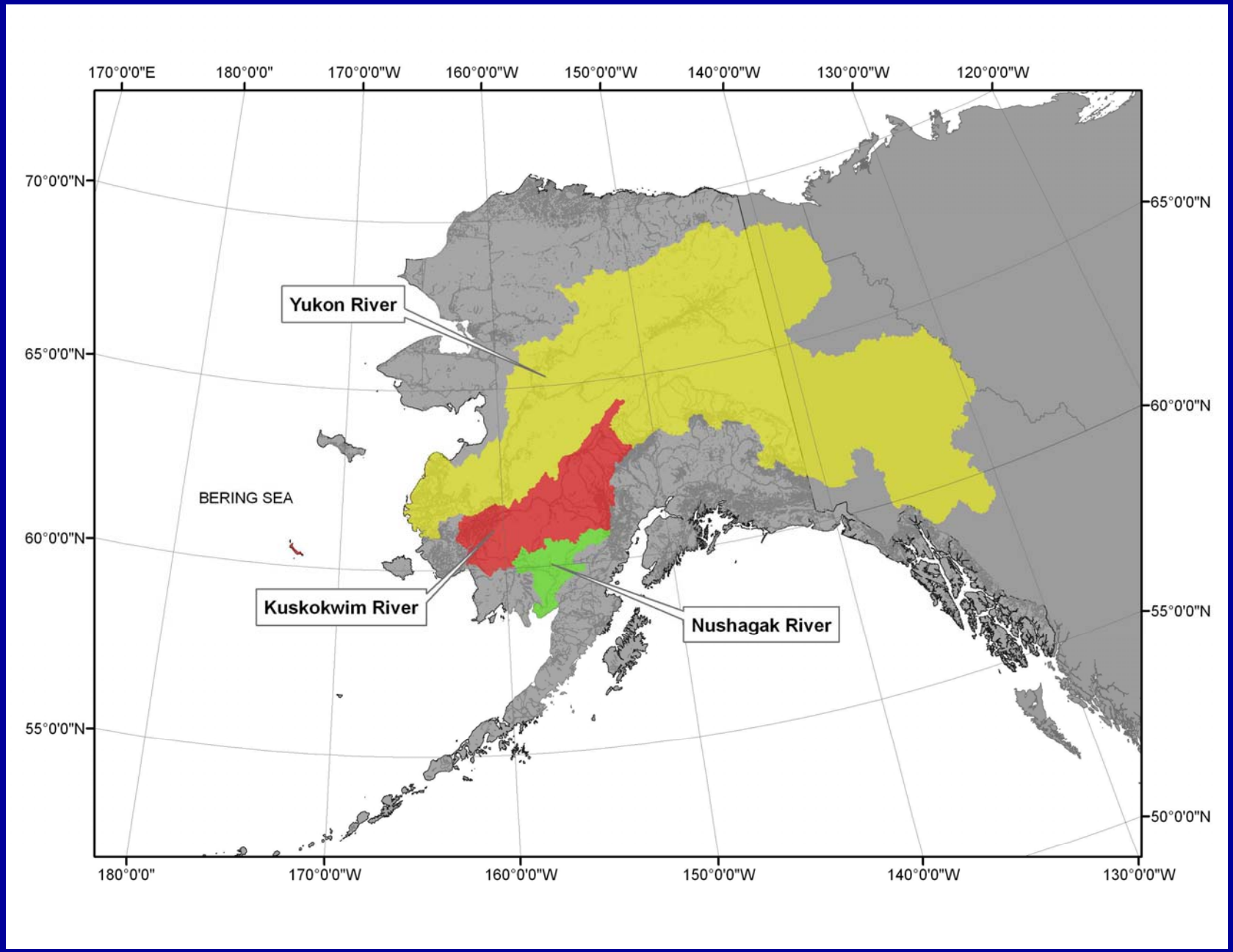
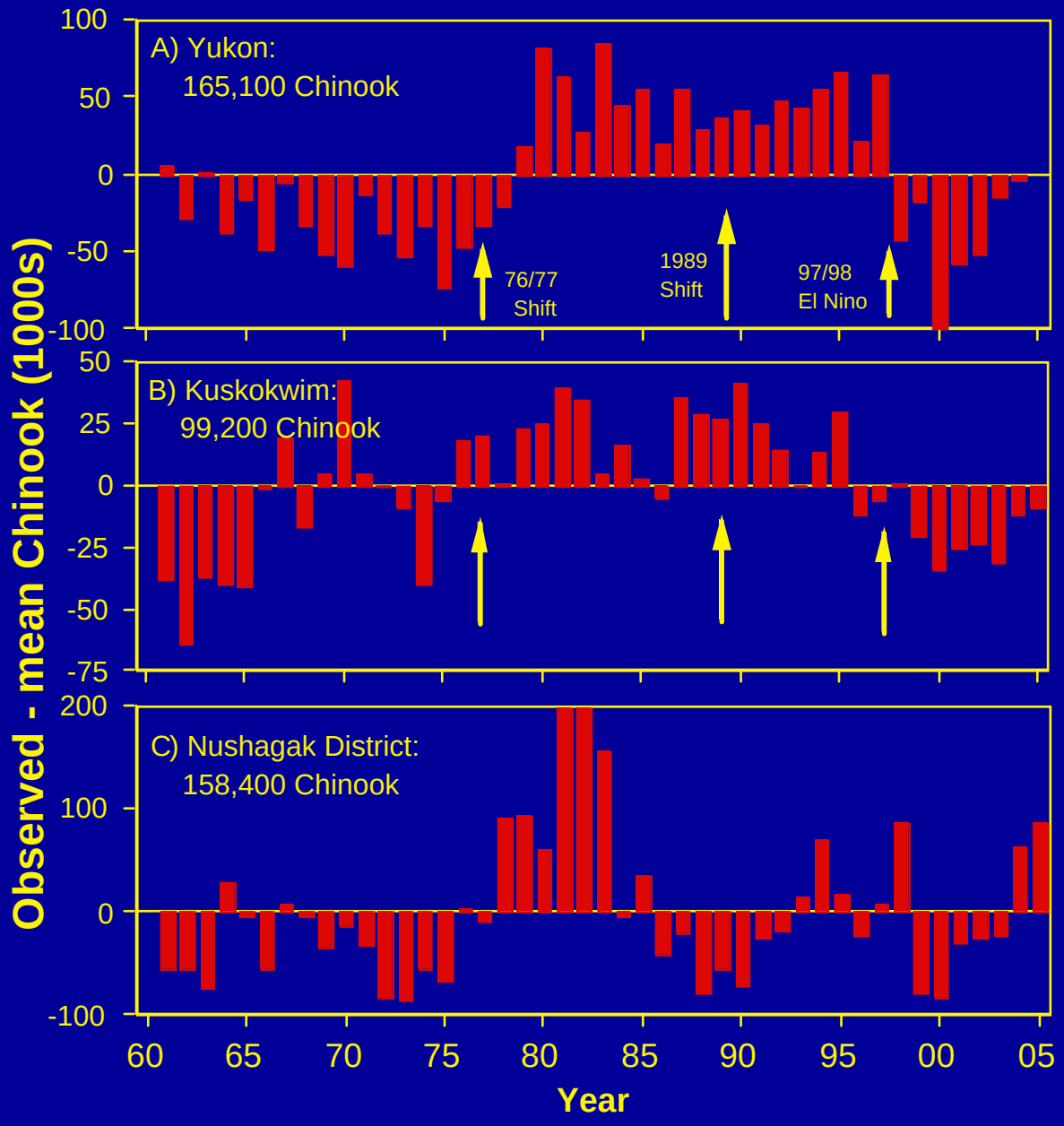
Yukon, Kuskokwim, Nushagak Rivers



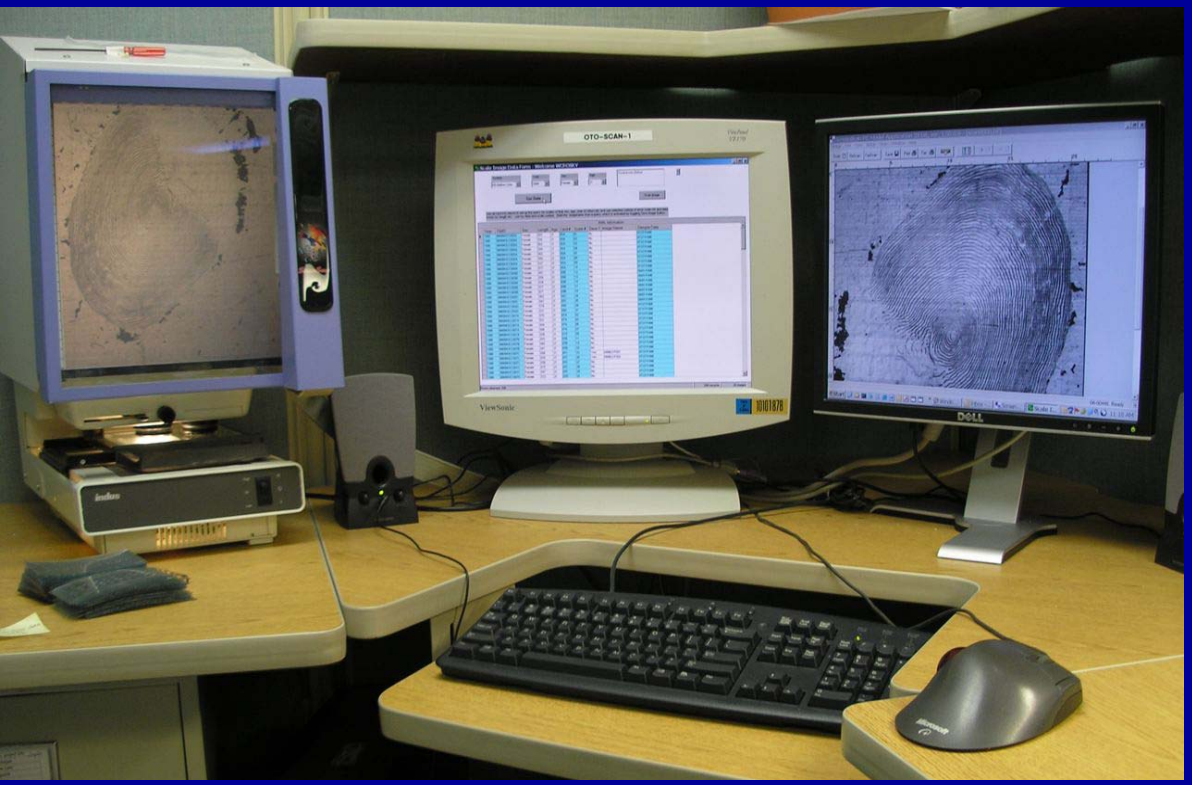
Chinook Catch Index, 1961-2005



Hypotheses:

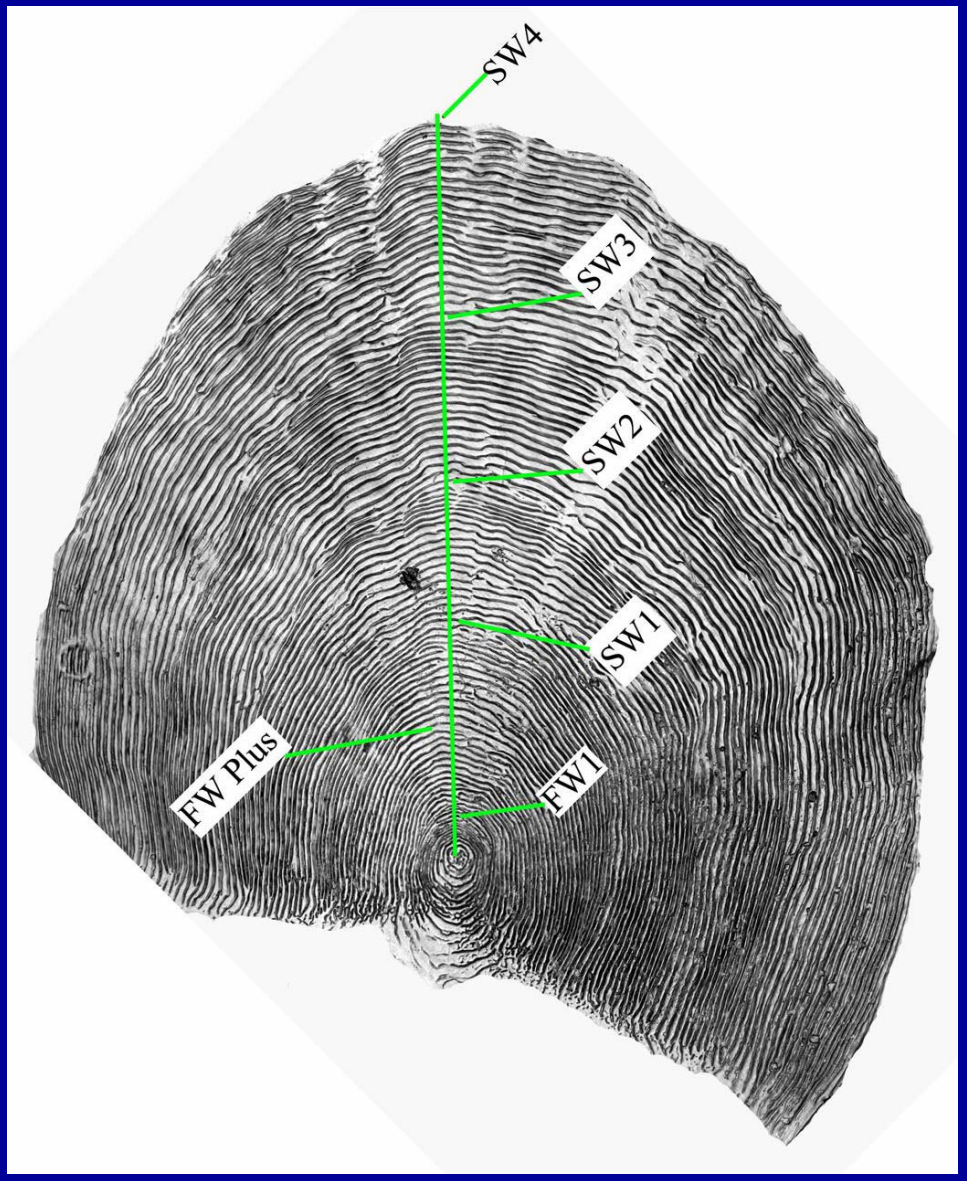
- Low Chinook abundance is associated with low growth in freshwater &/or the ocean.
- Chinook growth is associated with climate shifts (1976/77, 1997).
- Annual growth is independent of previous growth.
- Growth of male versus female Chinook is equal.

Chinook Scale Measurements

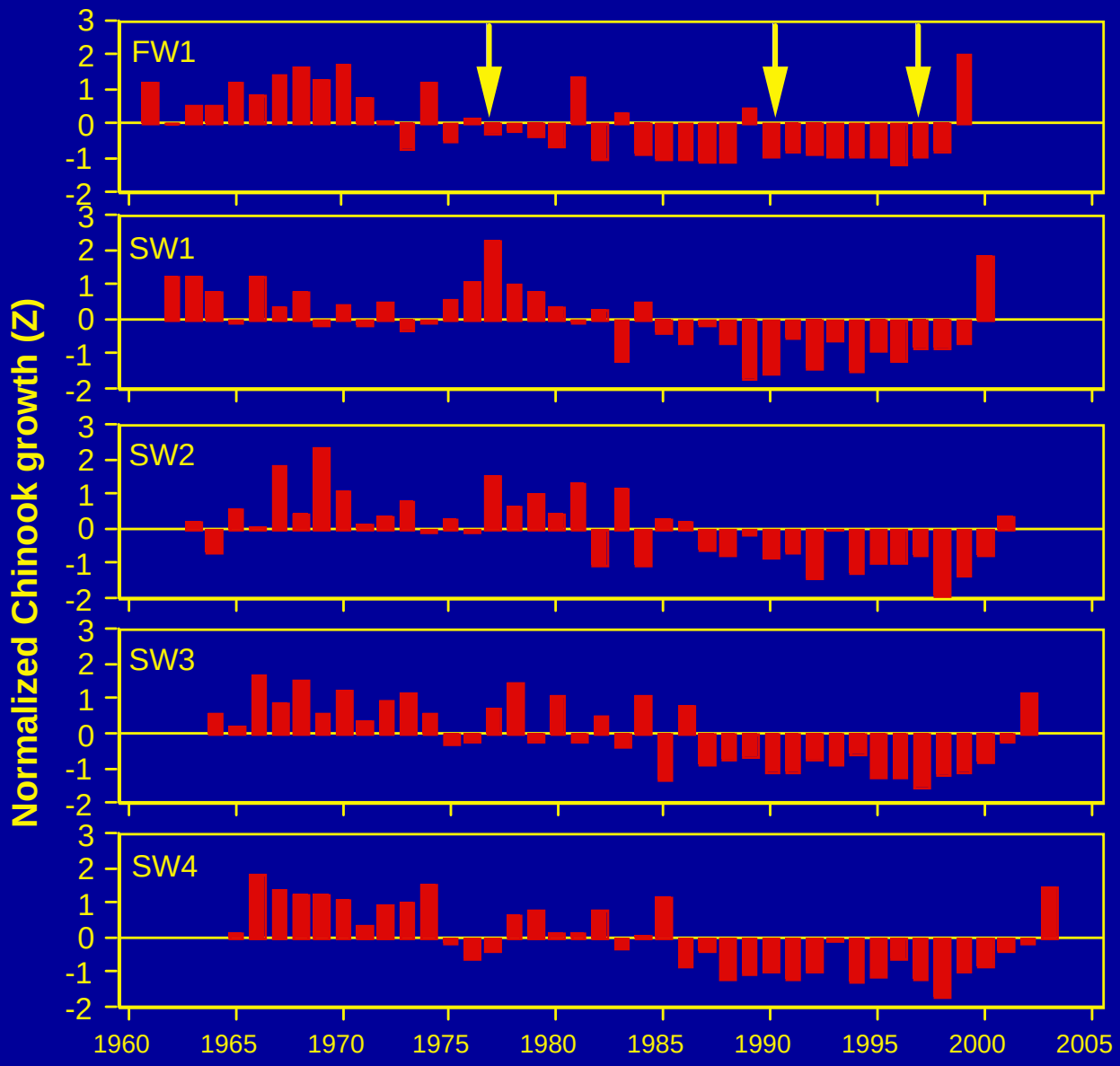


- Yukon & Kuskokwim Chinook, ~1964-2004.
- Age-1.3 & -1.4.
- 25 male & 25 female per year, age, stock.
- 200 scales per year.

Annuli & Circuli Measurements



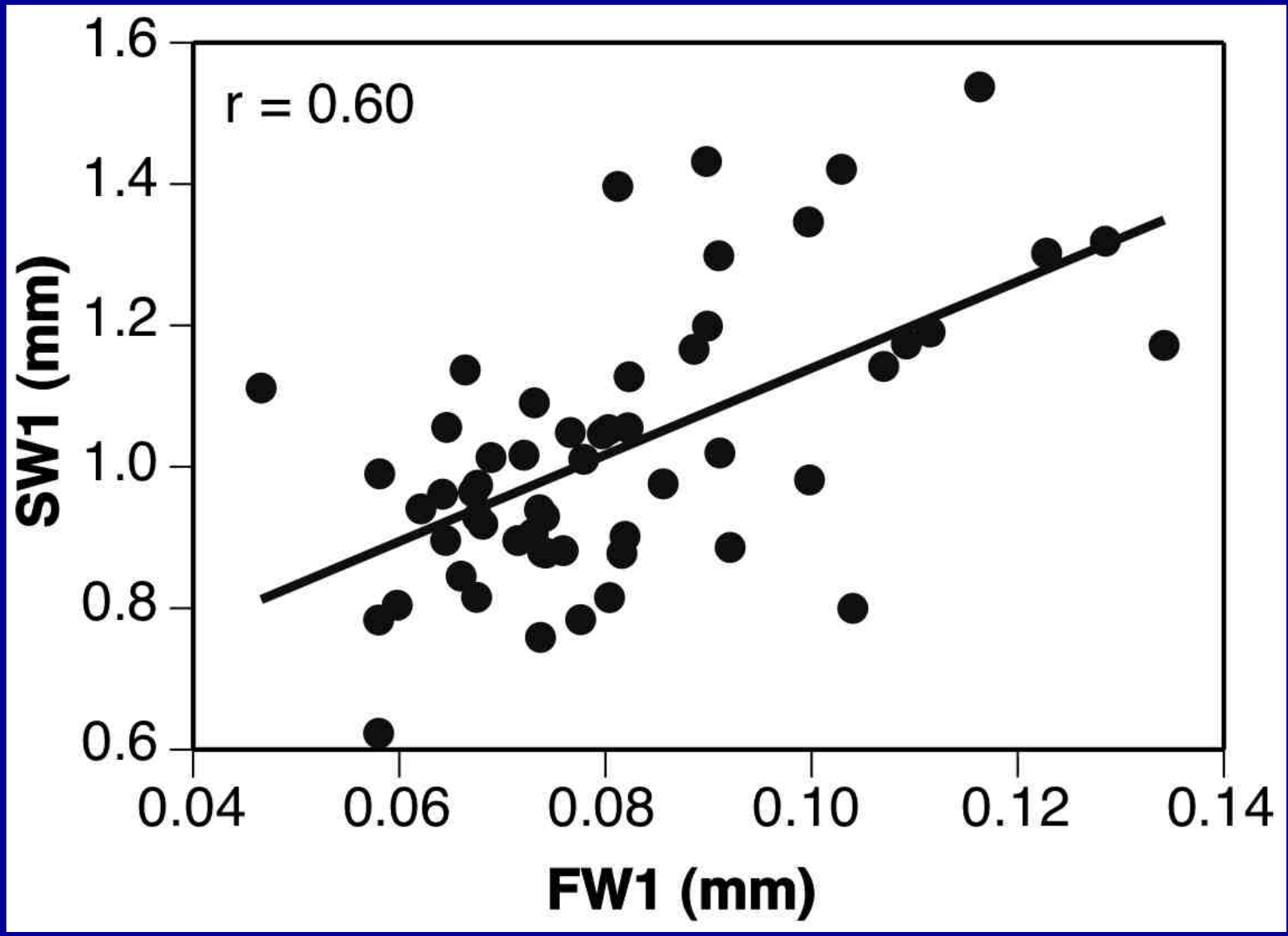
Annual Yukon Scale Growth: Year of Growth



- Scale growth does not clearly reflect climate shifts.
- Growth dependency?.

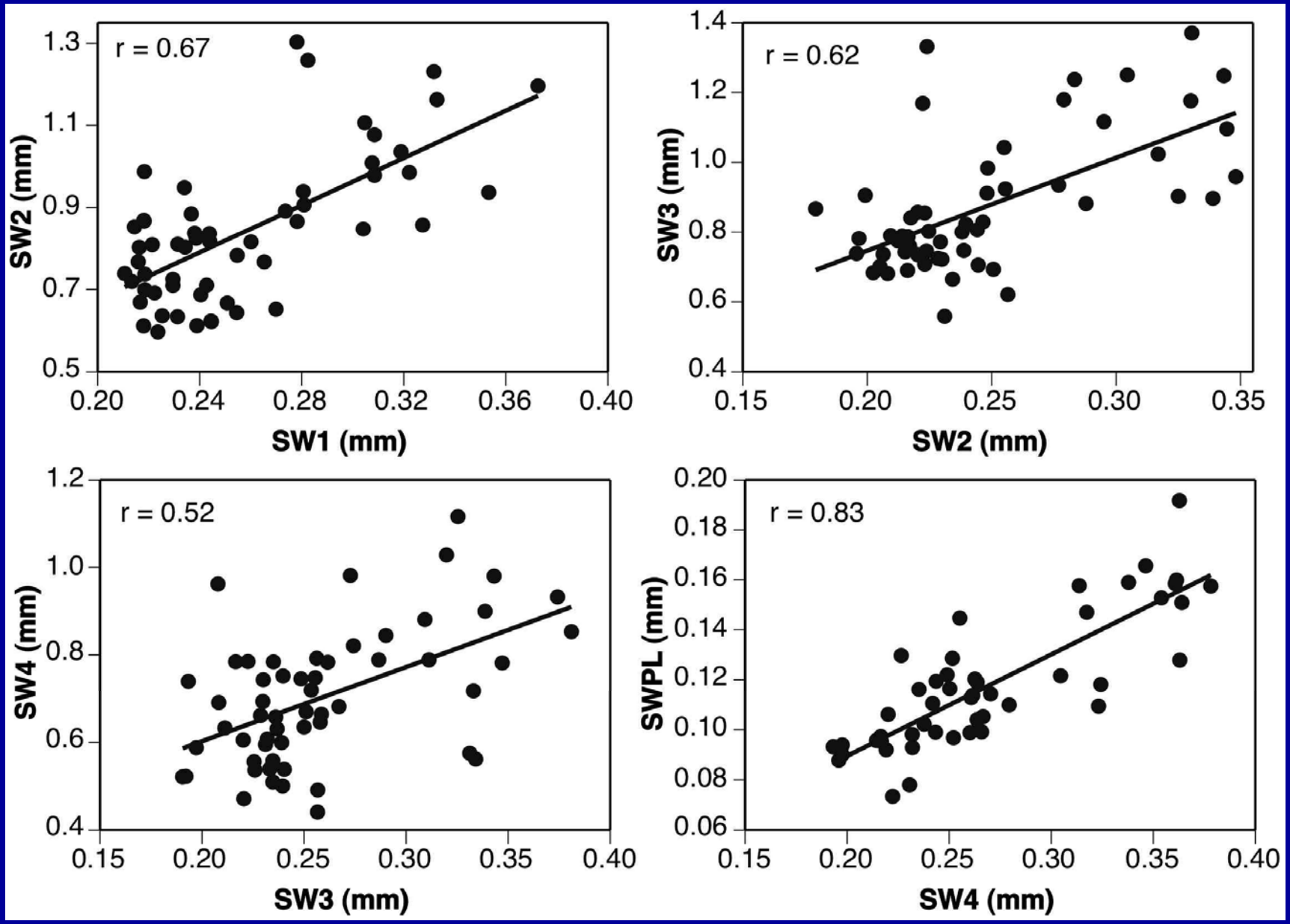
Ocean Growth is Dependent on Freshwater Growth

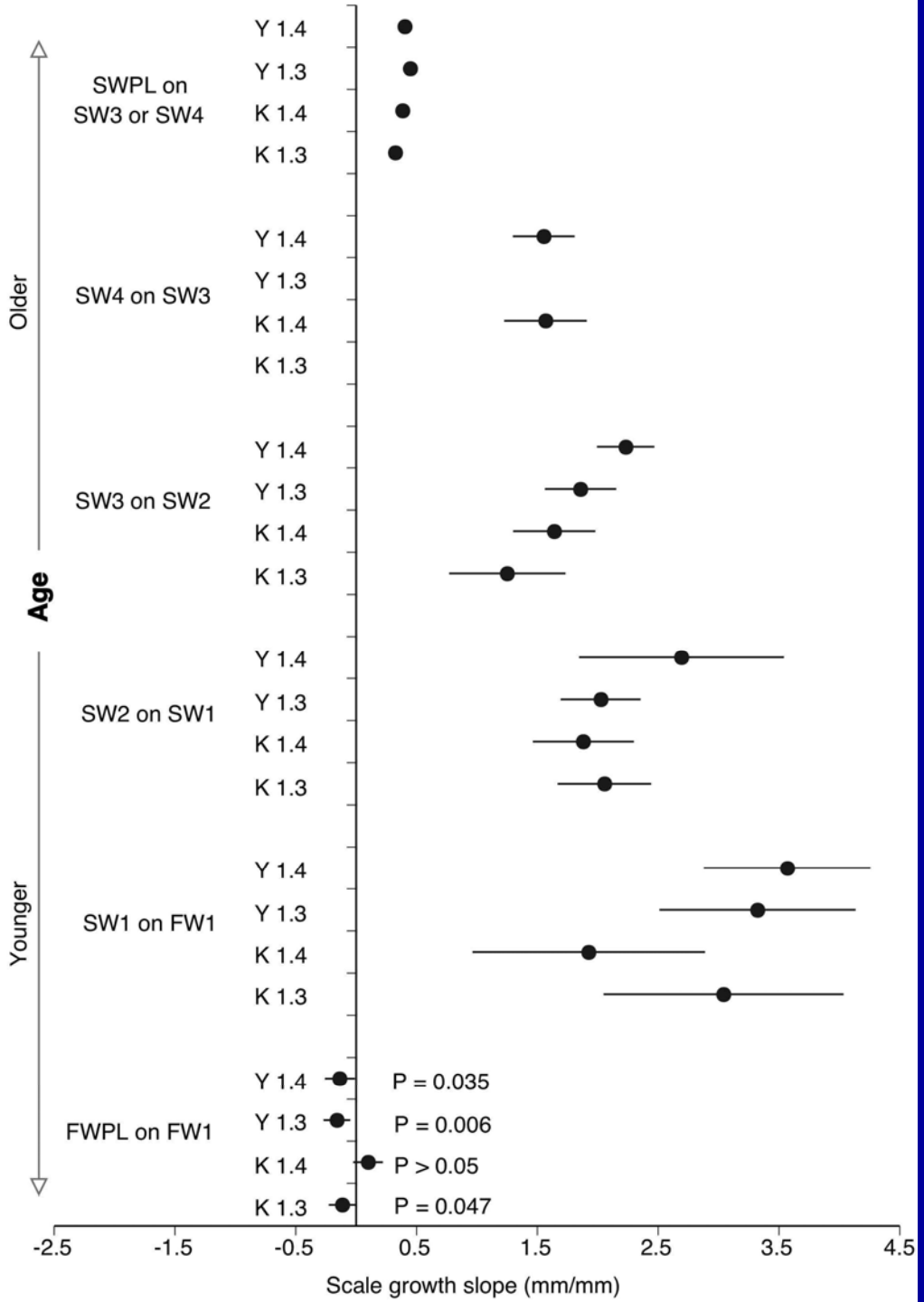
Year: 1991



Growth at Sea Dependent on Previous Growth

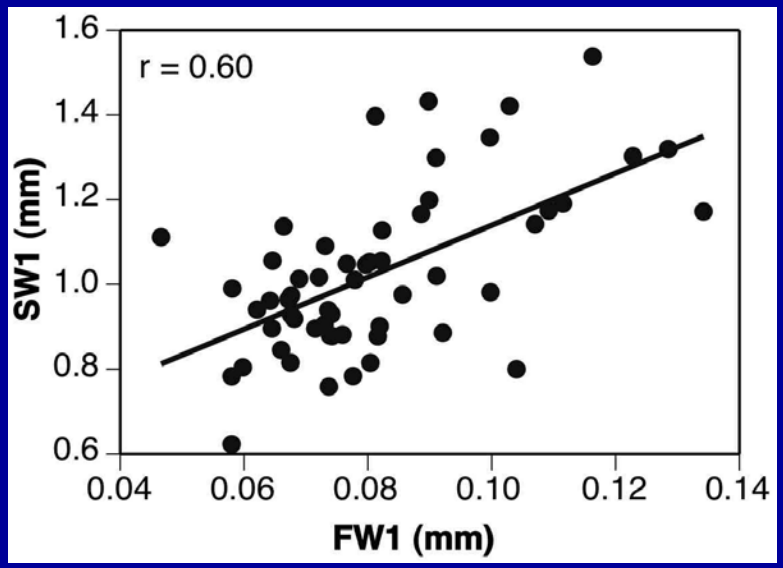
Year: 1991



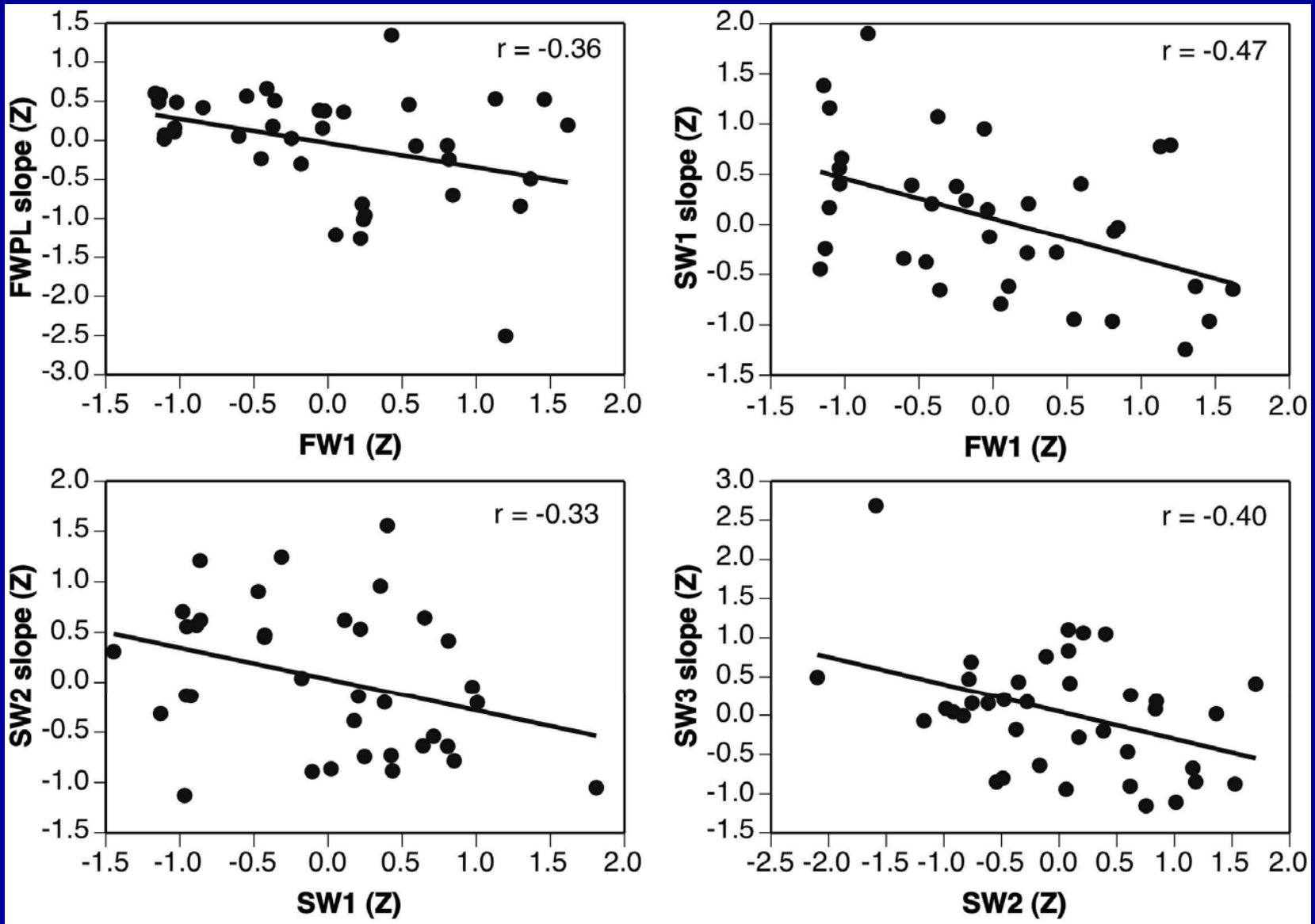


Growth Dependent on Previous Growth: Mean slope, ~1960-2004

690 regression

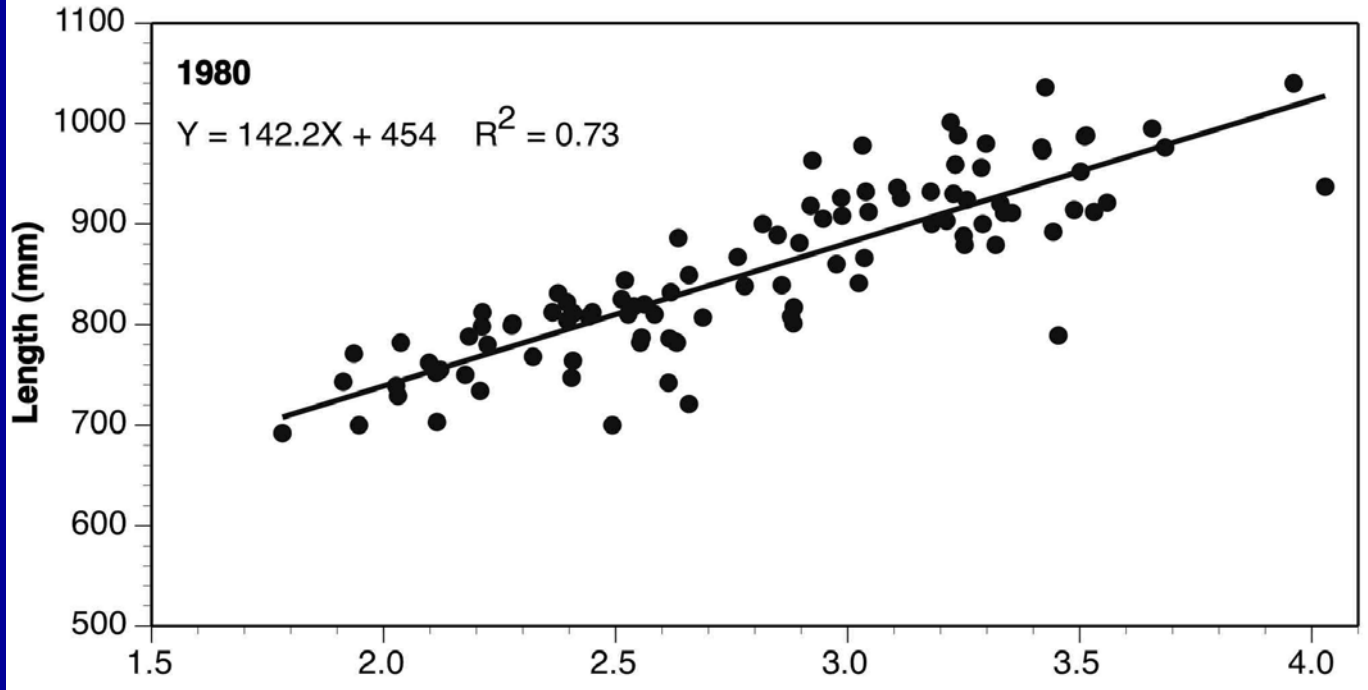


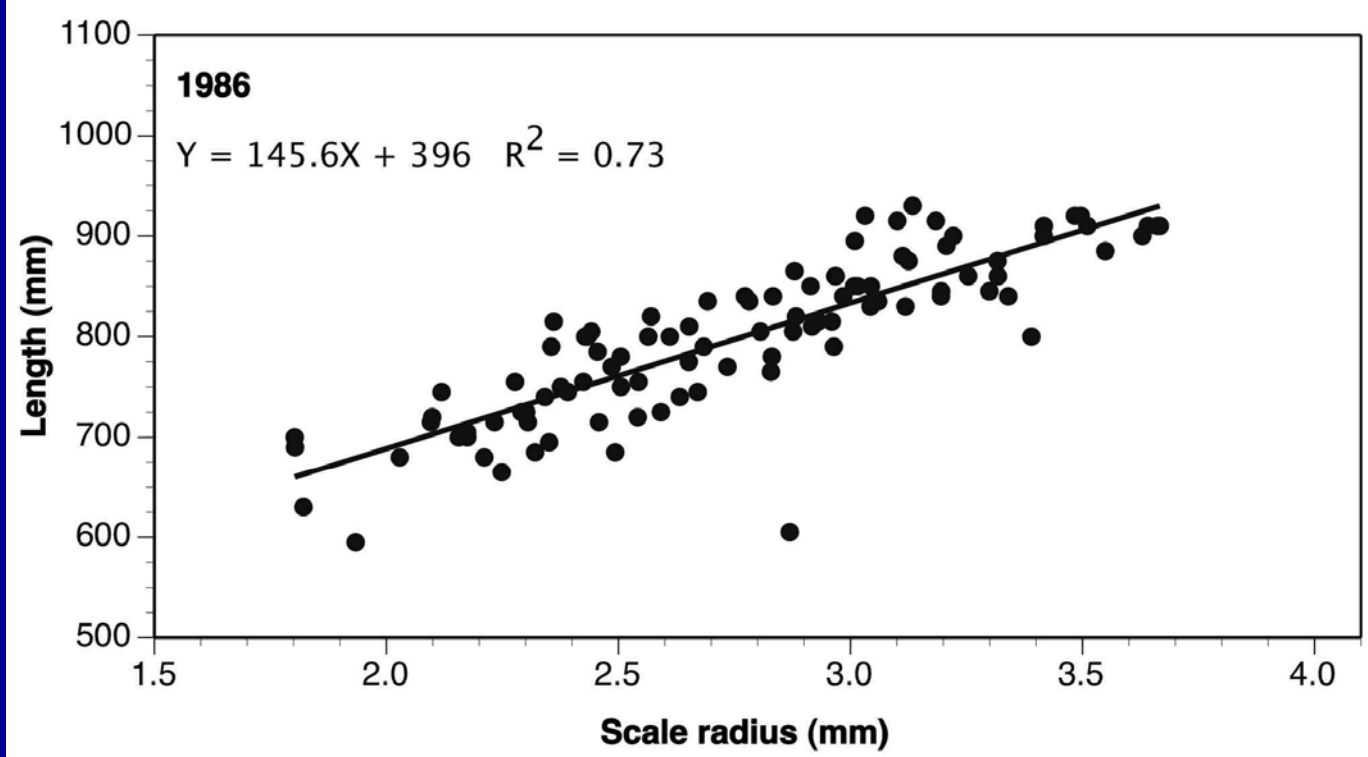
Compensatory Growth:
(mortality and/or physiology?)



Adult Length Correlated with Scale Growth

Adult length weakly correlated with freshwater growth





Chinook Growth is Dependent on Previous Growth

WHY?

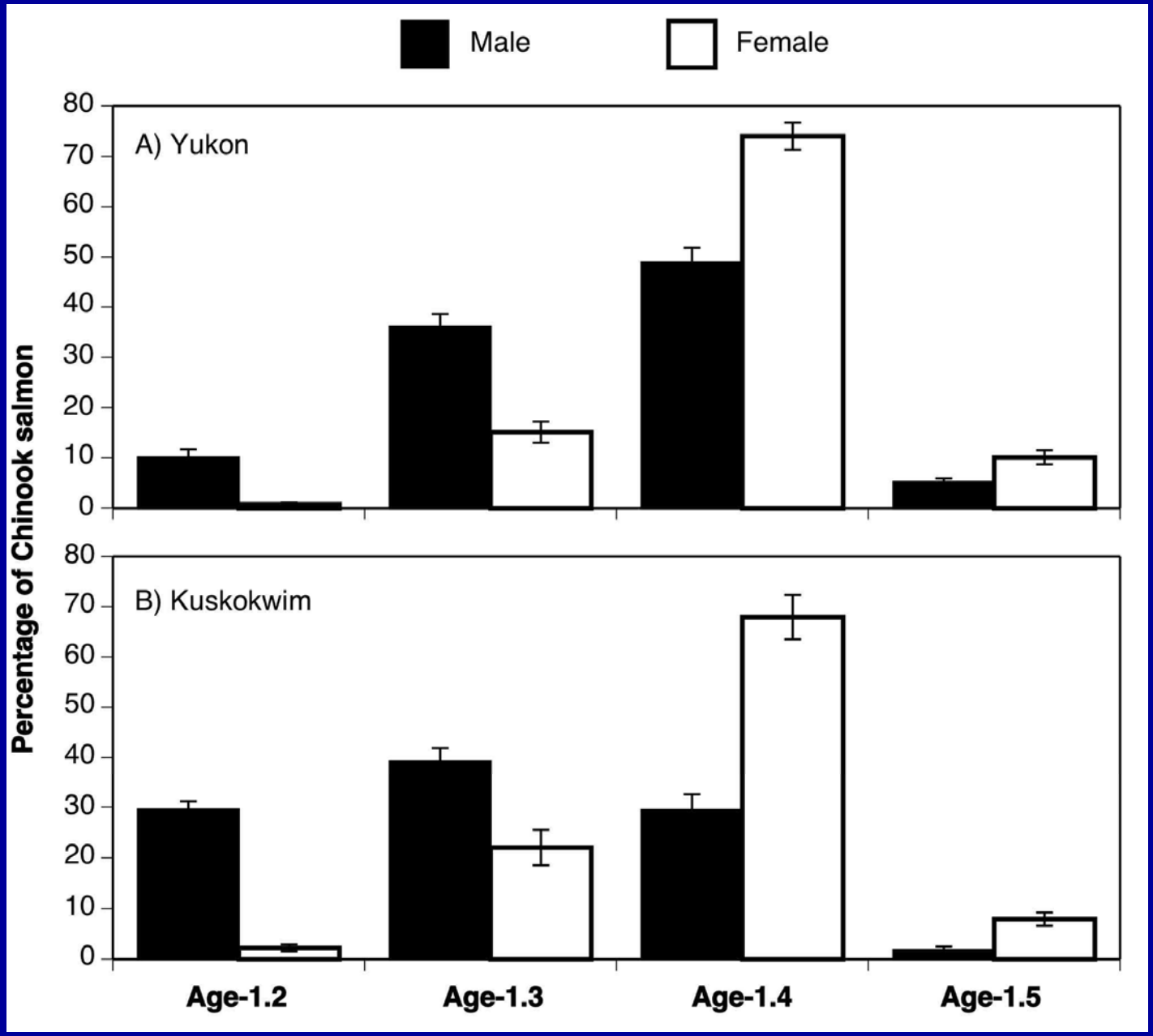
- Chinook are piscivorous at early age (Farley et al.).
- Greater size = bigger prey = greater growth.
- Also compensatory growth: mortality & physiology

Are Male Chinook Bigger than Female Chinook at Age?

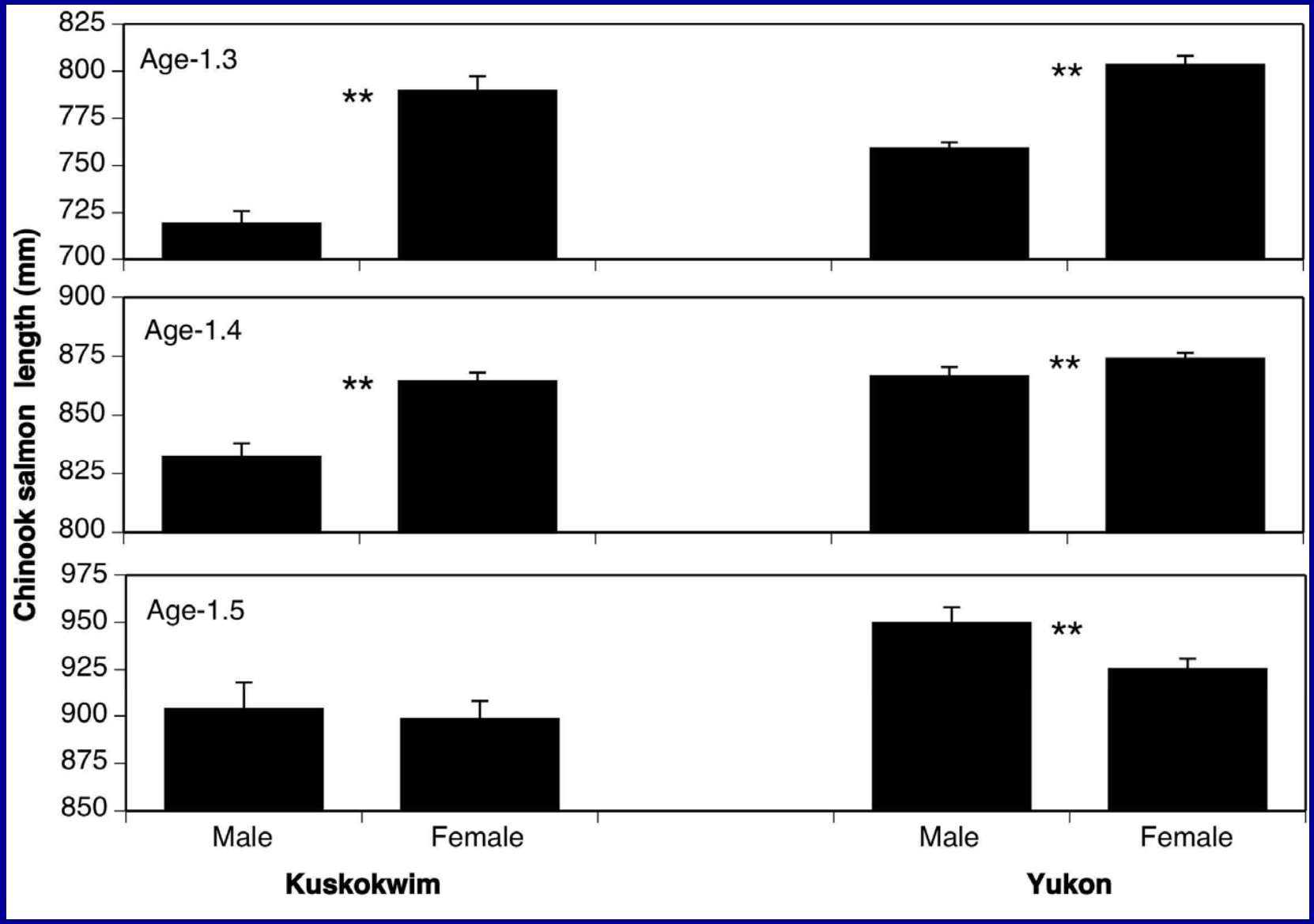
- Sockeye male > female at age.
- Chum male > female at age.
- Coho male < = female (Holtby & Healey 1986).

- Chinook?

Female Chinook are older



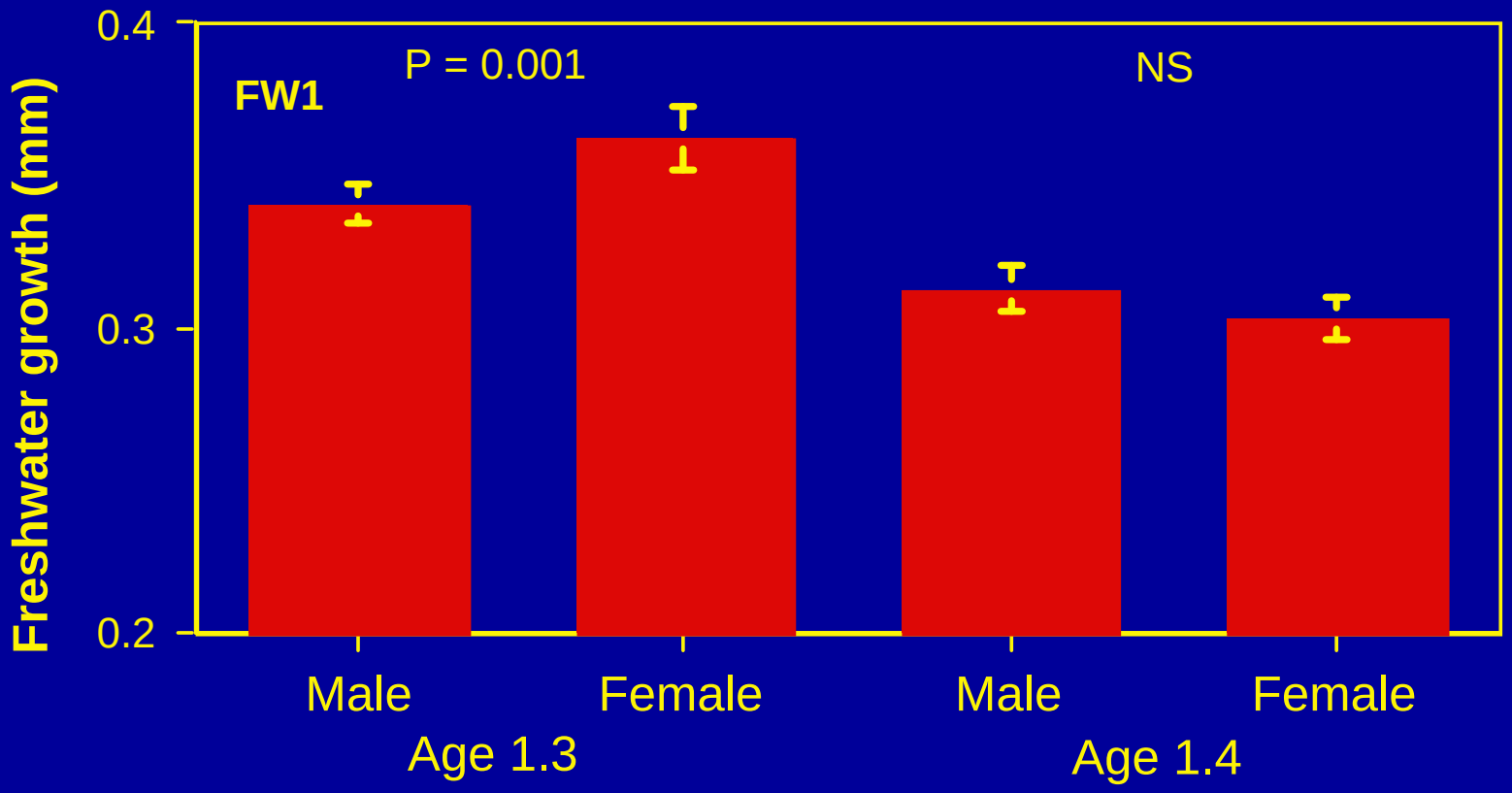
Female Length > Male Length



When Does Differential Growth Begin?

Age 1.3 > Age 1.4 freshwater growth

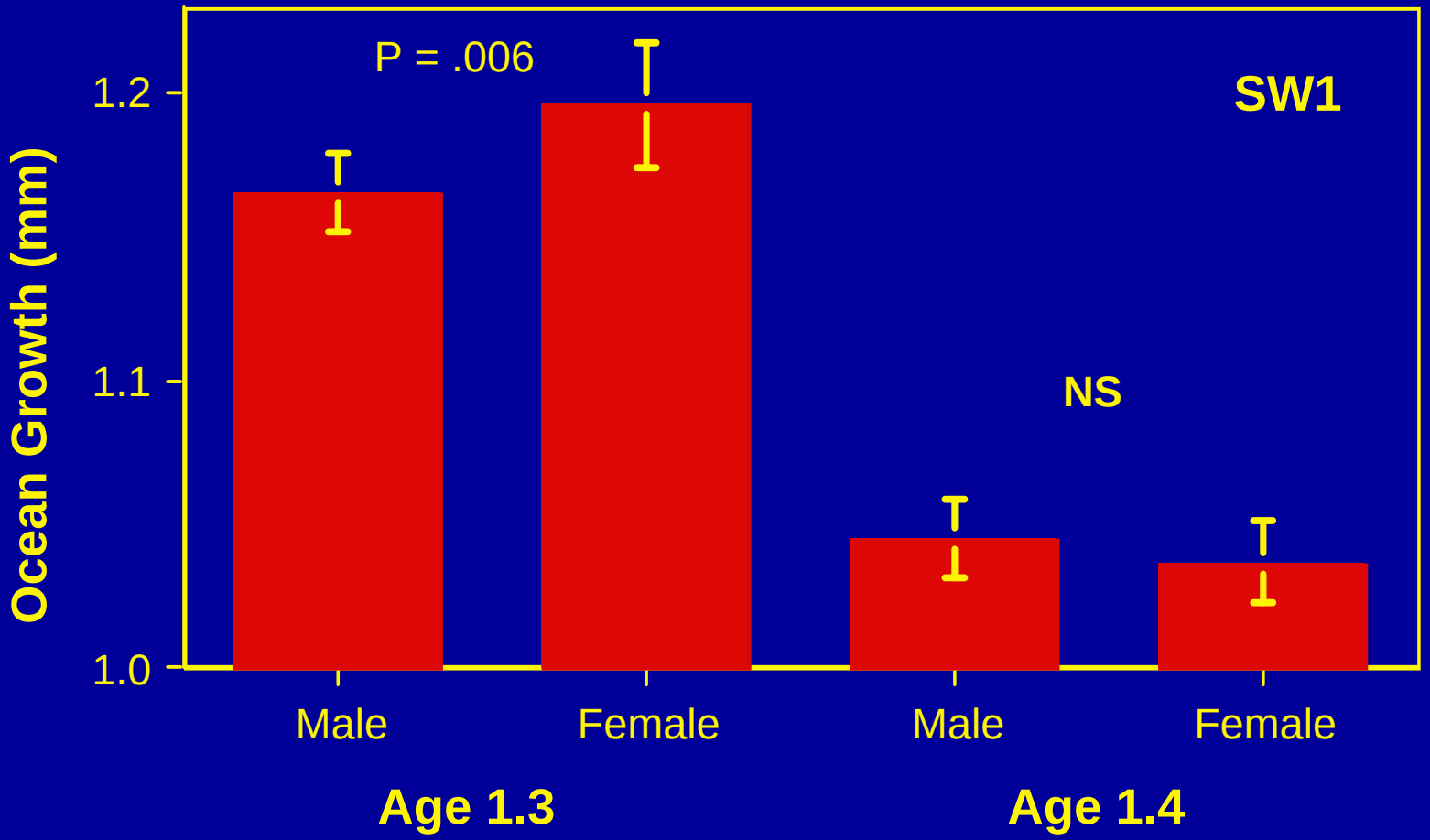
Age 1.3 Female > Male; Age 1.4 Female = Male



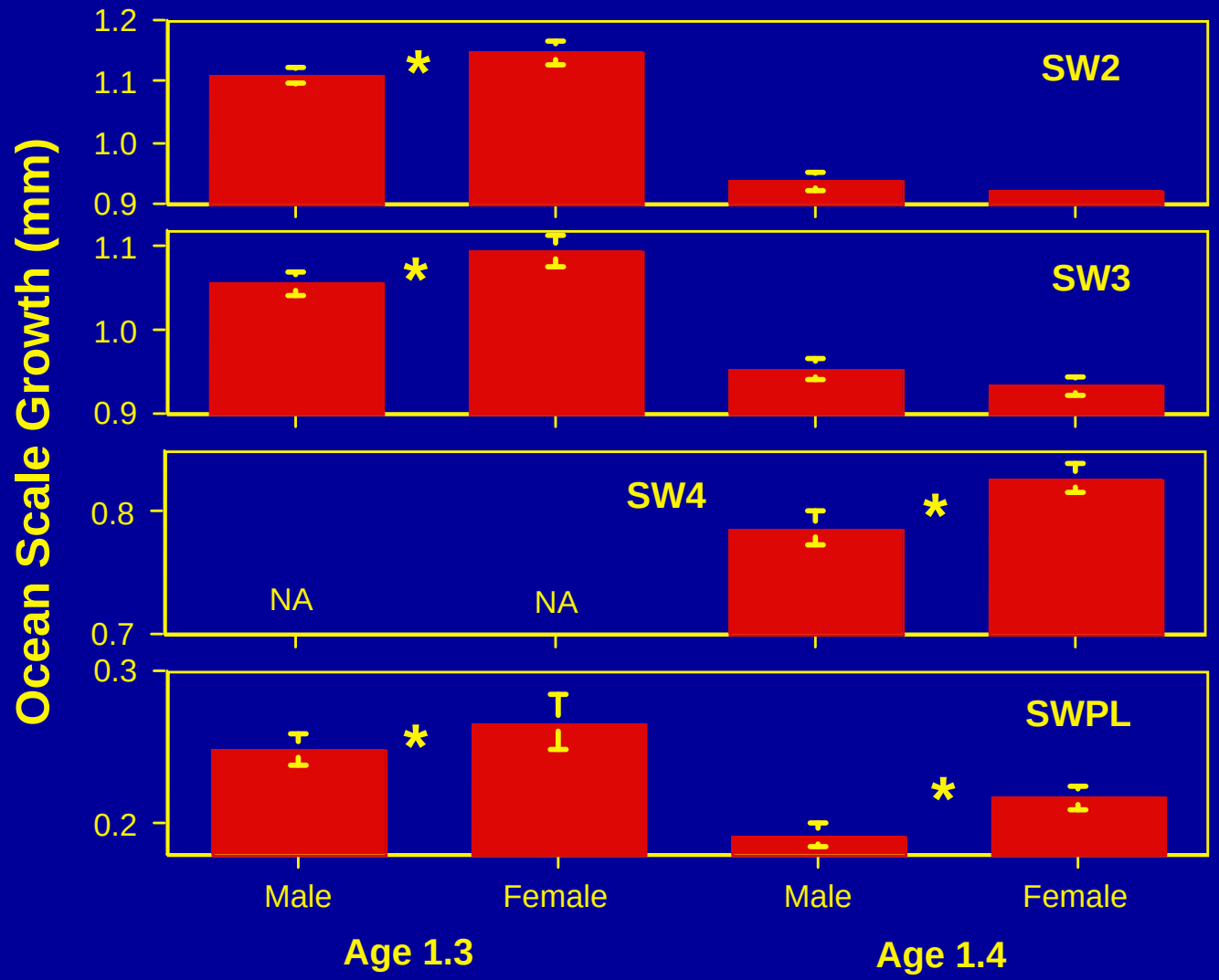
When Does Differential Growth Begin?

Age 1.3 > Age 1.4 SW1 Growth

Age 1.3 Female > Male



Age 1.3 > Age 1.4 Growth
Age 1.4 Female > Male: Late Life



Differential Chinook Growth: Age & Sex

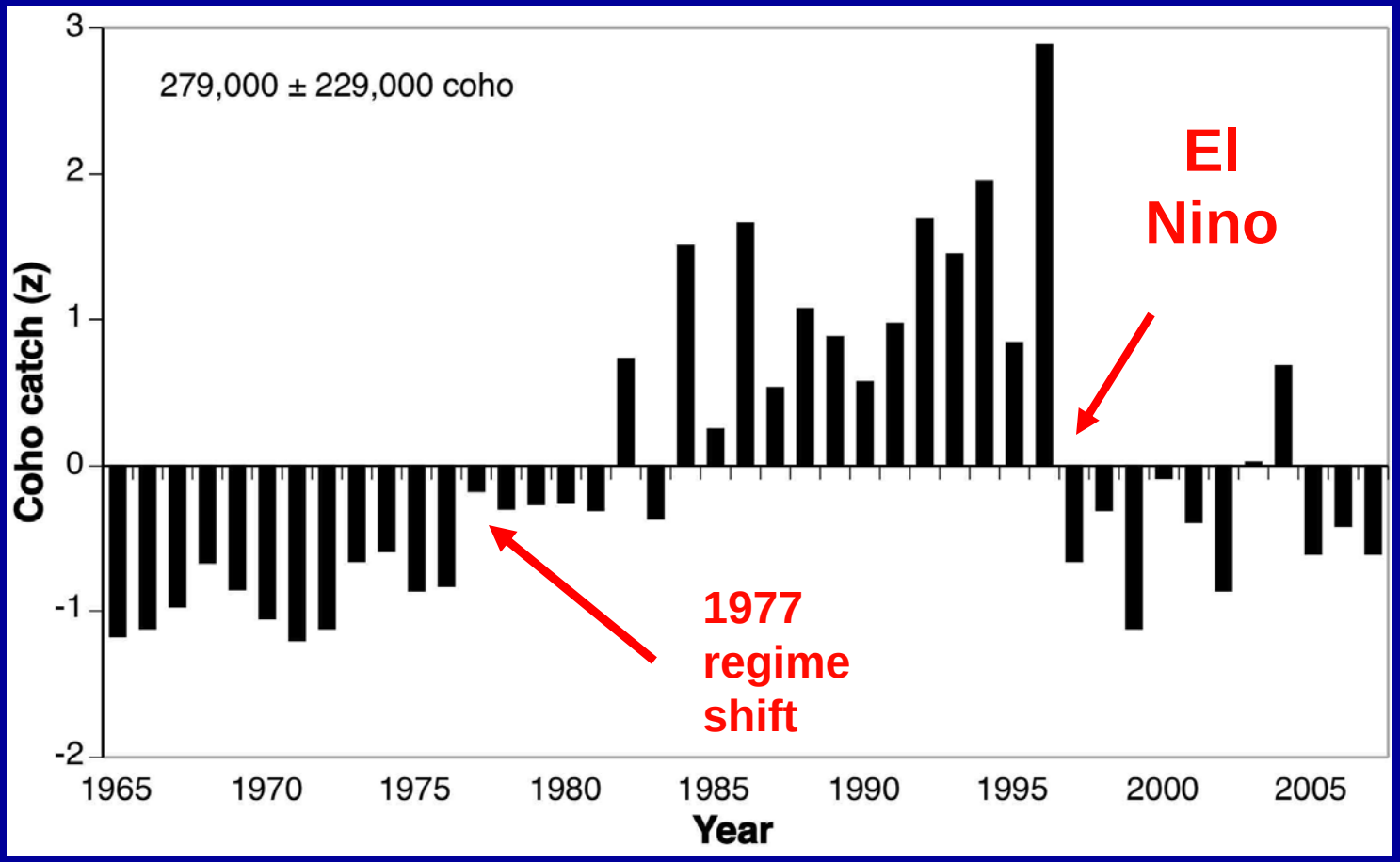
- Age 1.3 grow faster than Age 1.4 Chinook (**beginning freshwater**).
- Age 1.3: Rapid female growth, **all years**.
- Age 1.4: Rapid female growth, **late life**.
- Pattern consistent in Yukon & Kuskokwim Chinook.

Female > Male Chinook Growth

- Larger females: greater egg number & size.
- Tradeoff: mortality risk vs. fecundity.
- Large male size may be less important in Chinook (less competition for mates?).
- Key: grow fast & produce many big eggs.

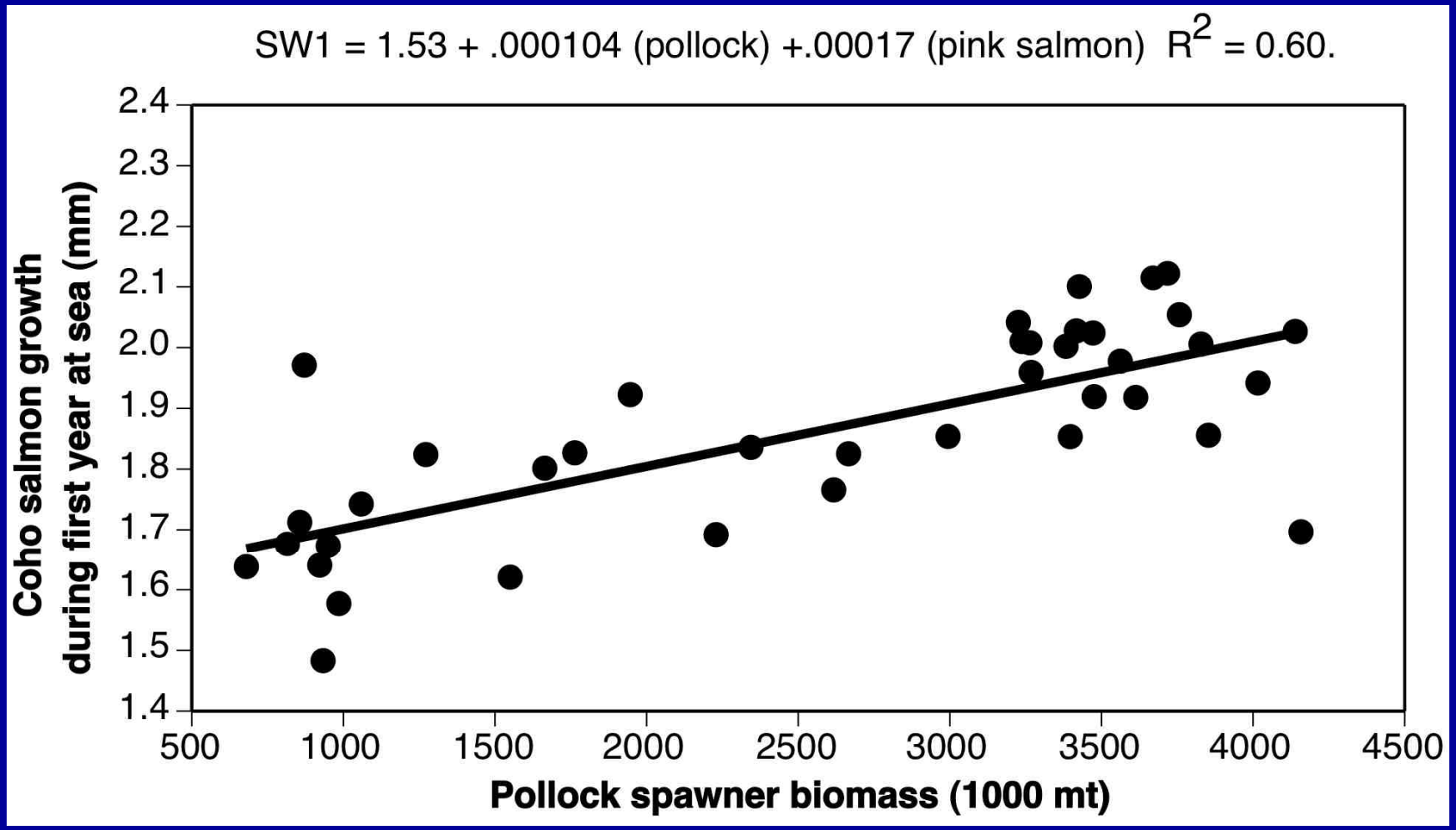
Kuskokwim Coho

- Largest stock in Alaska
- Sharp decline 1997 El Nino



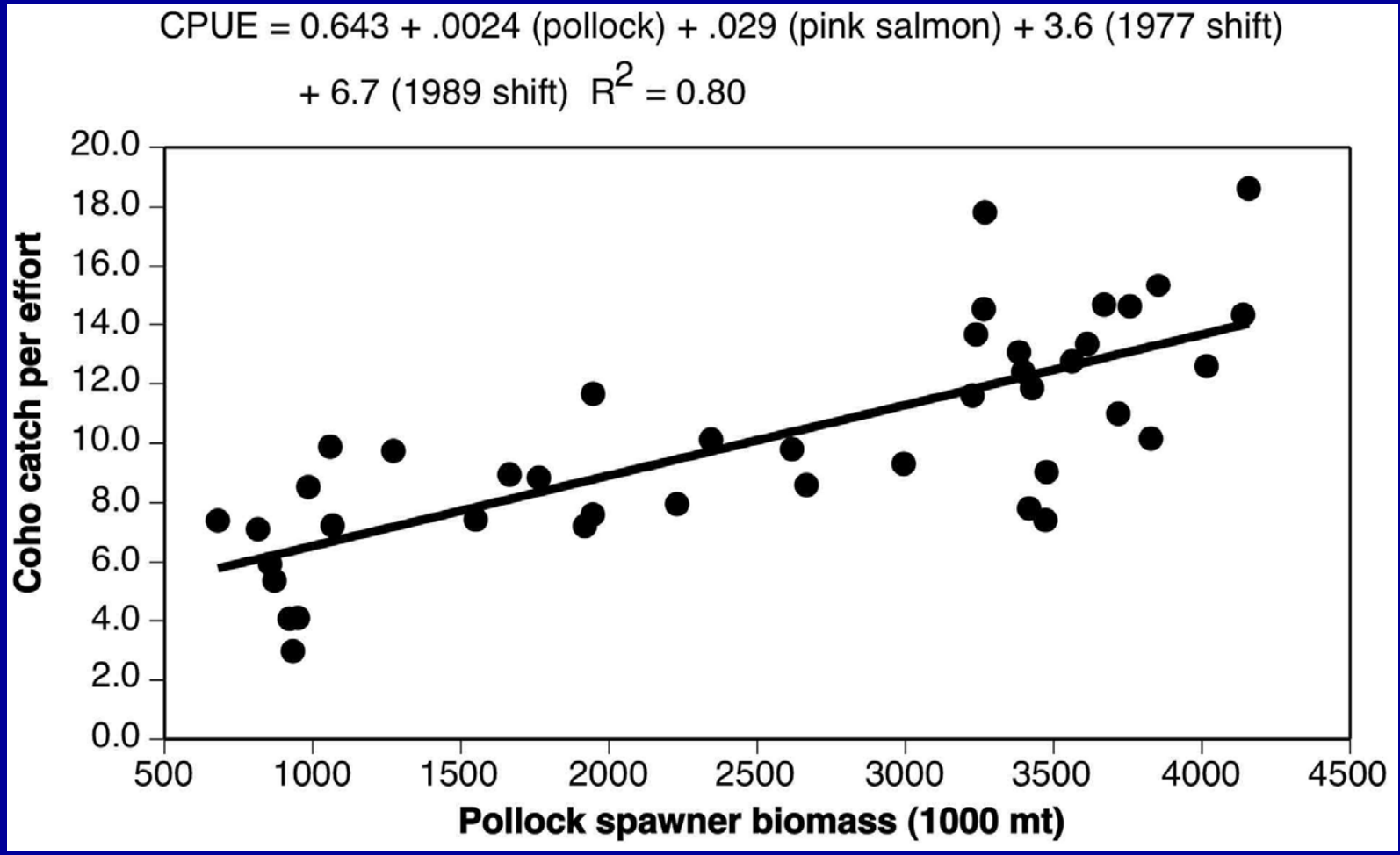
Coho Growth v. Pollock Larvae

1964-2005



Coho CPUE v. Pollock Larvae

1965-2006



Summary

- Chinook growth was highly dependent on previous growth & not clearly associated with abundance.
- Females larger than males, beginning FW (age 1.3) or late ocean life (age 1.4).
- Age 1.3 > 1.4 size beginning in freshwater.