Frame of Reference

Understanding the distribution of historical Chinook salmon populations

1010—SALMON CATCH, 30M FISH, PUGET SOUND, WASH.

Jim Myers – Northwest Fisheries Science Center

Photo: Museum of History and Industry, Seattle

Comparing Chinook Salmon Populations – Past vs. Present

1. Abundance:
   1. Includes both natural and hatchery fish
   2. Rough estimates
2. Age/Size
   1. Age structure changes
3. Distribution
   1. Oceanic migratory patterns
   2. Run timing

Historical Estimates

Methodology of Craig and Hacker 1940,
Shepard et al. 1985

- Cannery Pack – Cobb 1930
  - Case of 48 (454 g) cans
  - Assume 40% wastage in packing
  - Assume 10 kg average size
  - Assume 50% harvest rate
- Caveats
  - Does not include whole fish market
  - Does not include subsistence fisheries
  - Does not include pre-packing wastage
  - 100s of other assumptions

Most estimates from Robert Kope in Myers et al. (1998)

Wastage… for example

- “Perhaps a third of the catch of 50,000 pounds consisted of fish under 4 or 5 pounds in weight. Some were brought to Mr. Kinney, who threw them overboard and refused to take more, as did other canners.” (Smith 1895)
- In some years they literally ran out of cans and harvested fish were discarded.
- During especially big run years, they could not process the fish quickly enough. Thousands spoiled and were discarded.
- Early fisheries focused on the higher quality spring-run Chinook salmon runs

Historical Estimates of Abundance

Back of the Envelope Calculations*

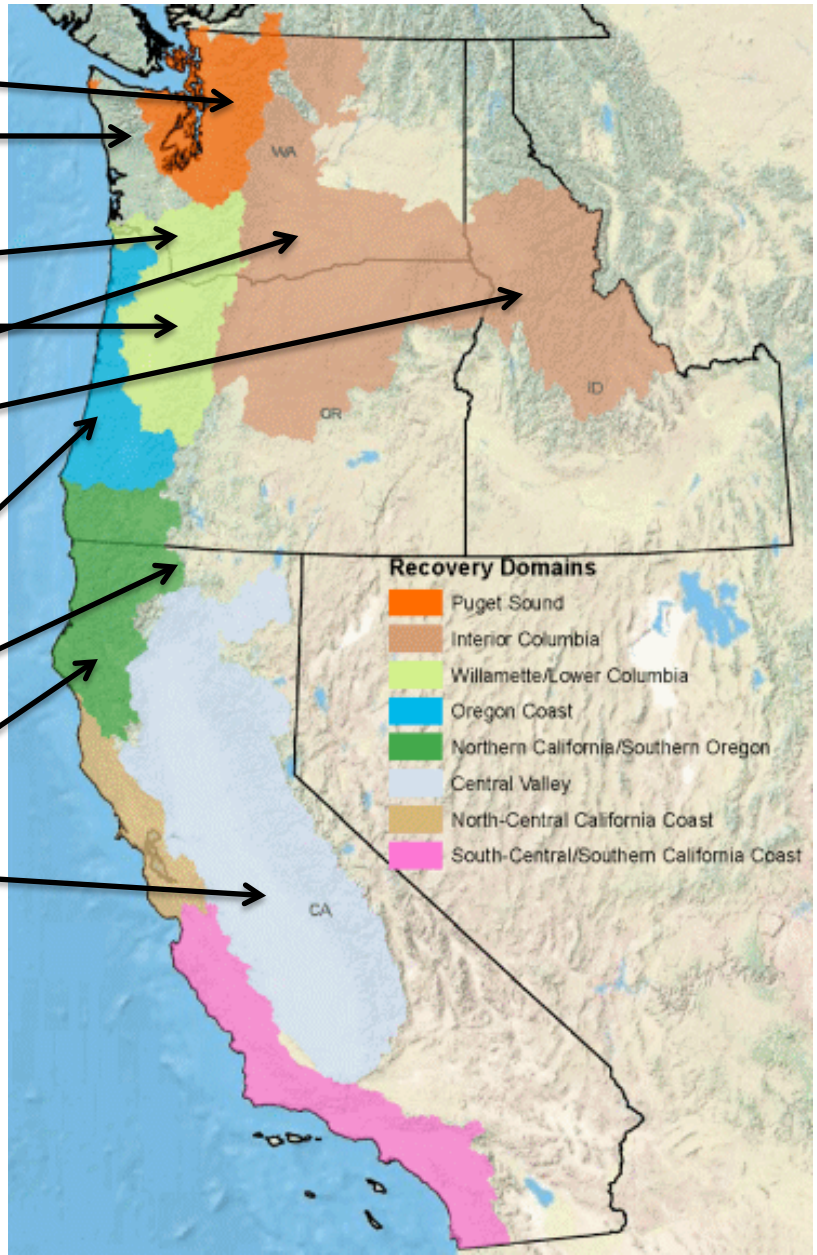
- Puget Sound (1908) 690,000
- Washington Coast (1911) 190,000
- Columbia River (1883) 4,600,000
  - LCR 500,000
  - UWR 400,000
  - MCR 700,000
  - SRF 500,000
  - Stream Type
    - SR 1,500,000
    - CR 1,000,000
- Oregon Coast (1896) 225,000
- Klamath (1912) 130,000**
- So Oregon/California (1917) 225,000
- Central Valley (1880) 1,100,000†

Total: 7,160,000 ± (20 – 40%)

*Not for navigational purposes

** 300,000 used elsewhere

† Clark 1929



Historical Estimates of Abundance BC

Back of the back of the Envelope Calculations

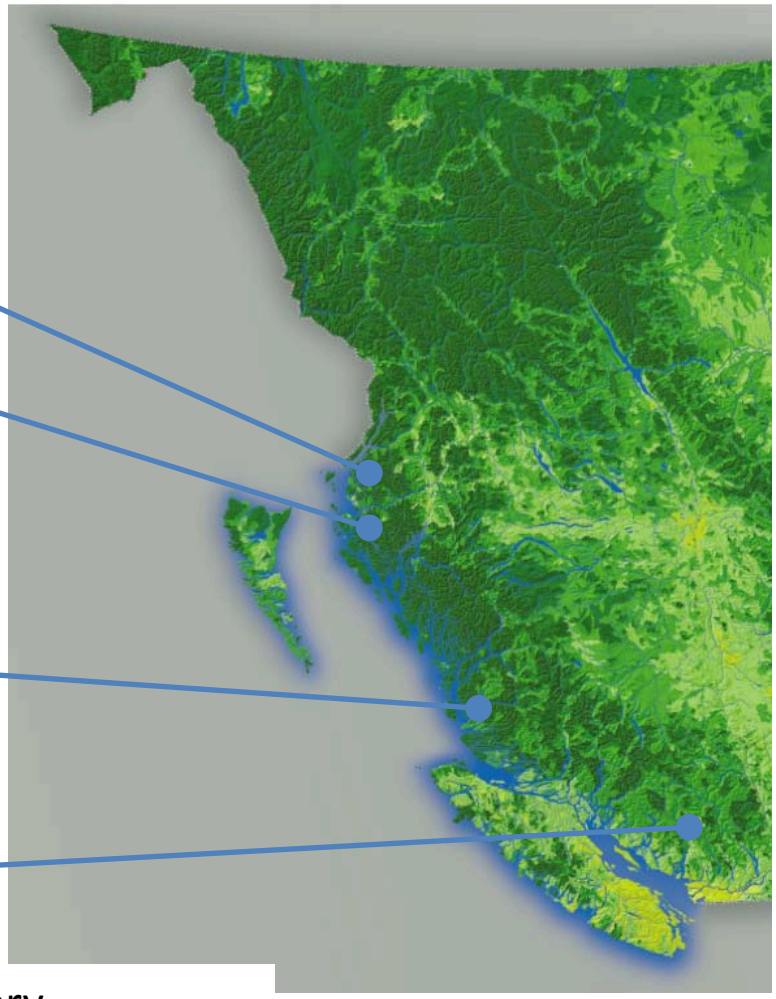
Nass (1918) 66,232

Skeena(1920) 582,600

Outlying Area (1920) 611,510

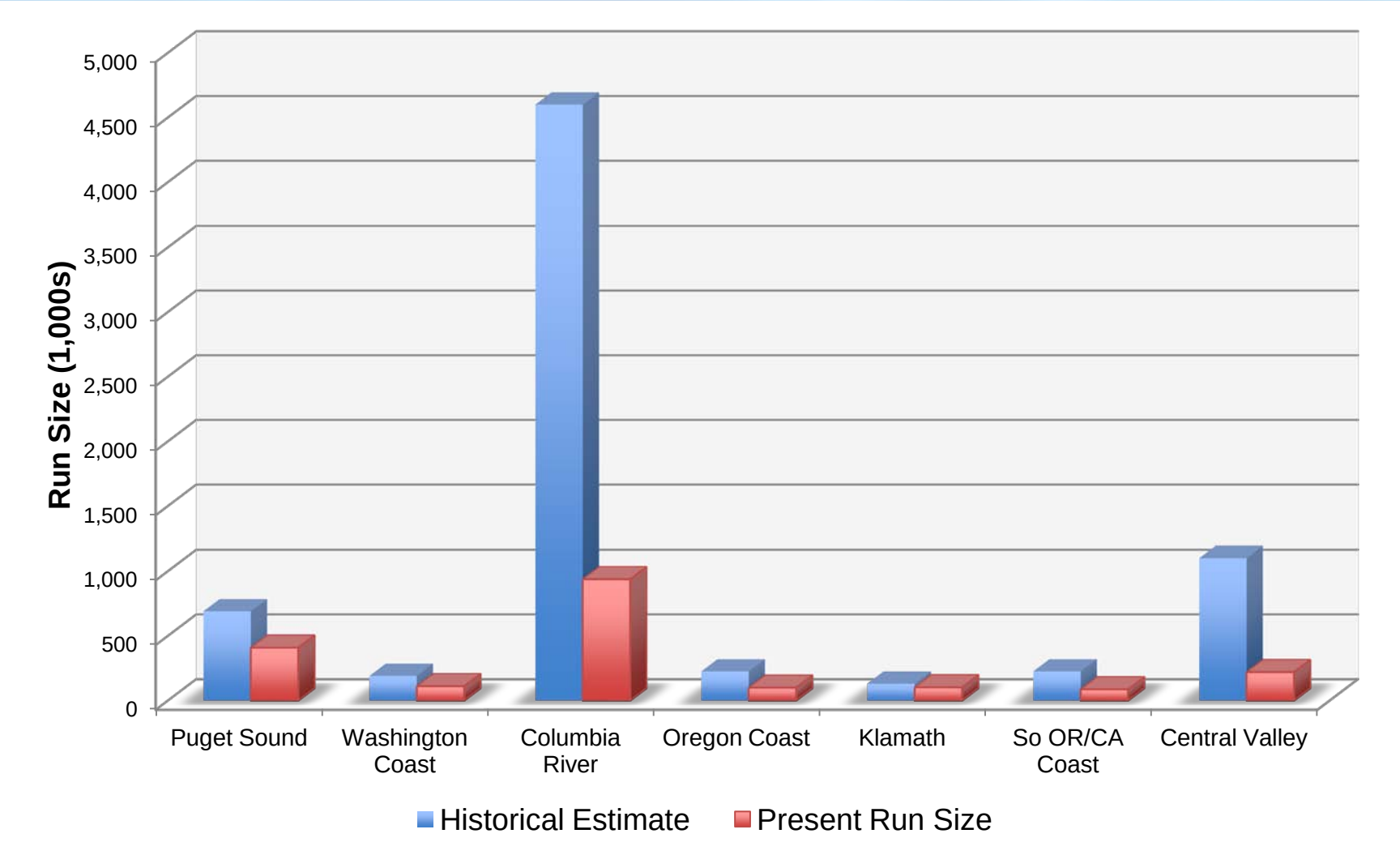
River's Inlet (1920) 22,950

Fraser (1918) 546,067

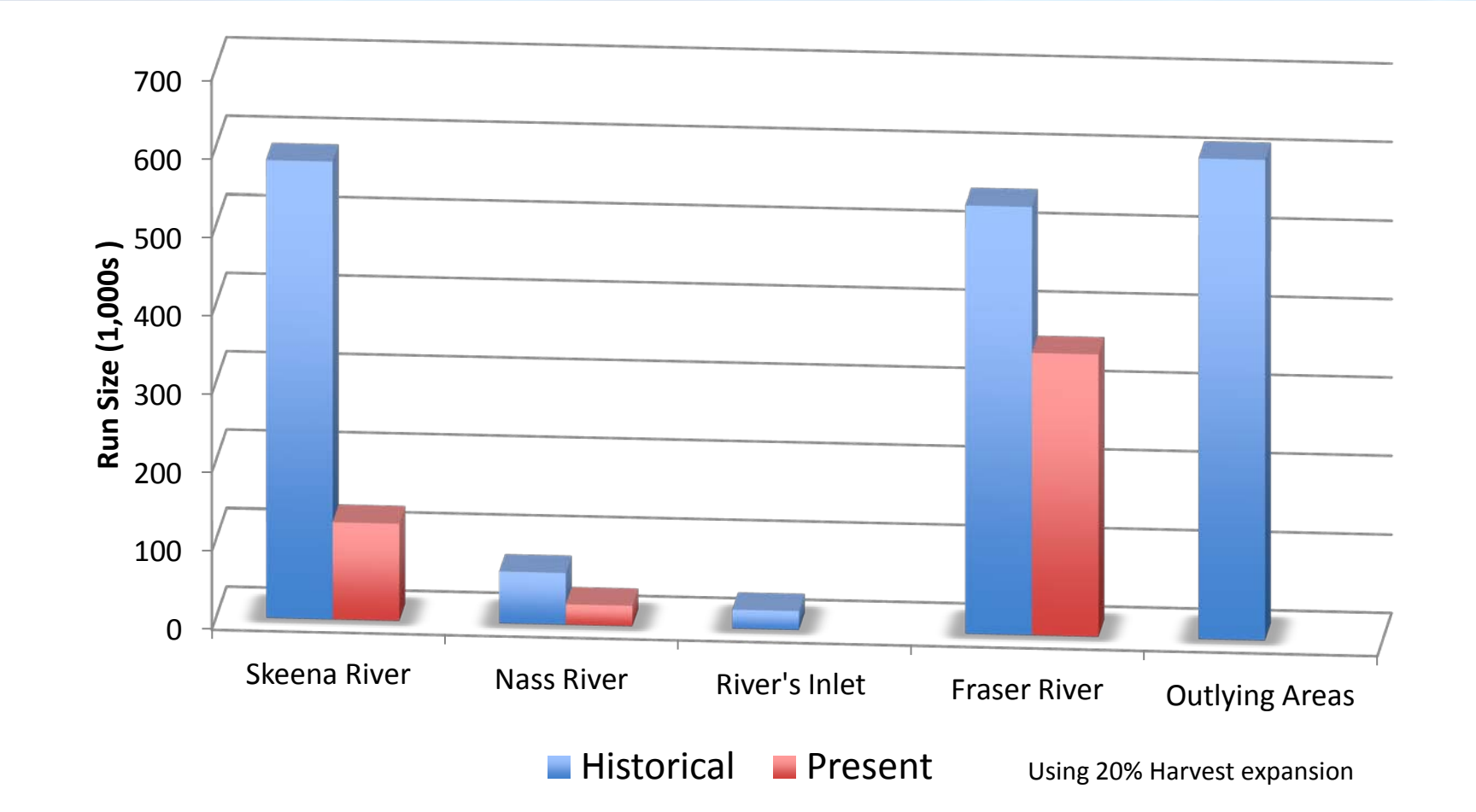


Estimate uses a 30% harvest rate for cannery fishery –
Alternatively, peak harvest 1.2 M Henderson and Graham 1989

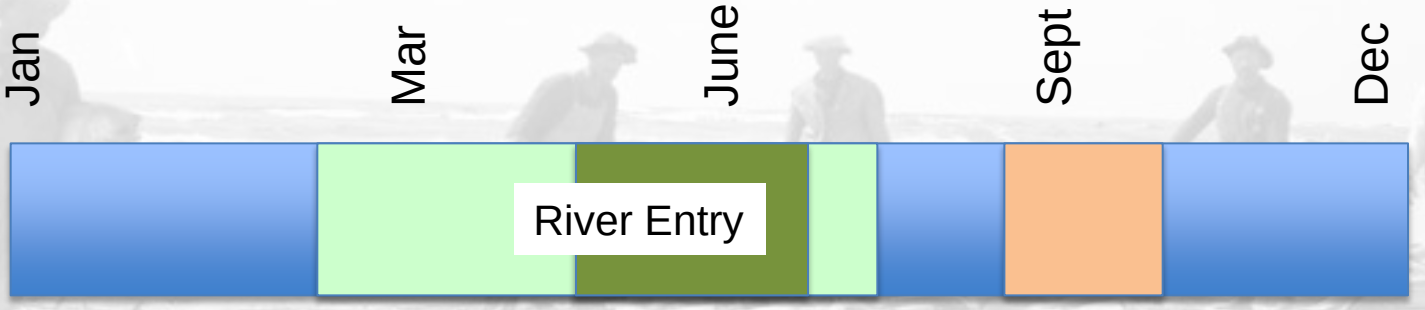
Historical vs. Present Day Run Size



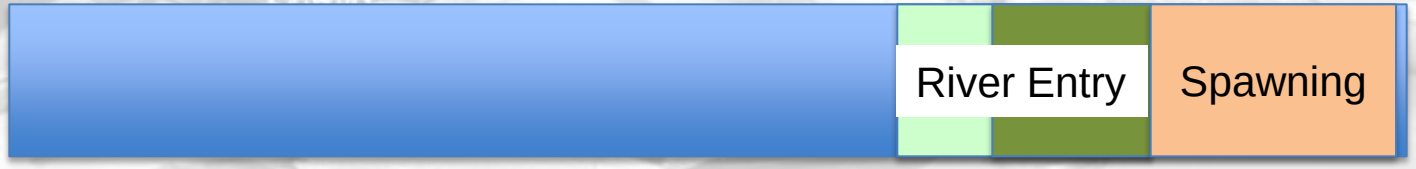
BC Historical Estimates



Life History Types: Temporal Runs



Spring-Run



Fall-Run

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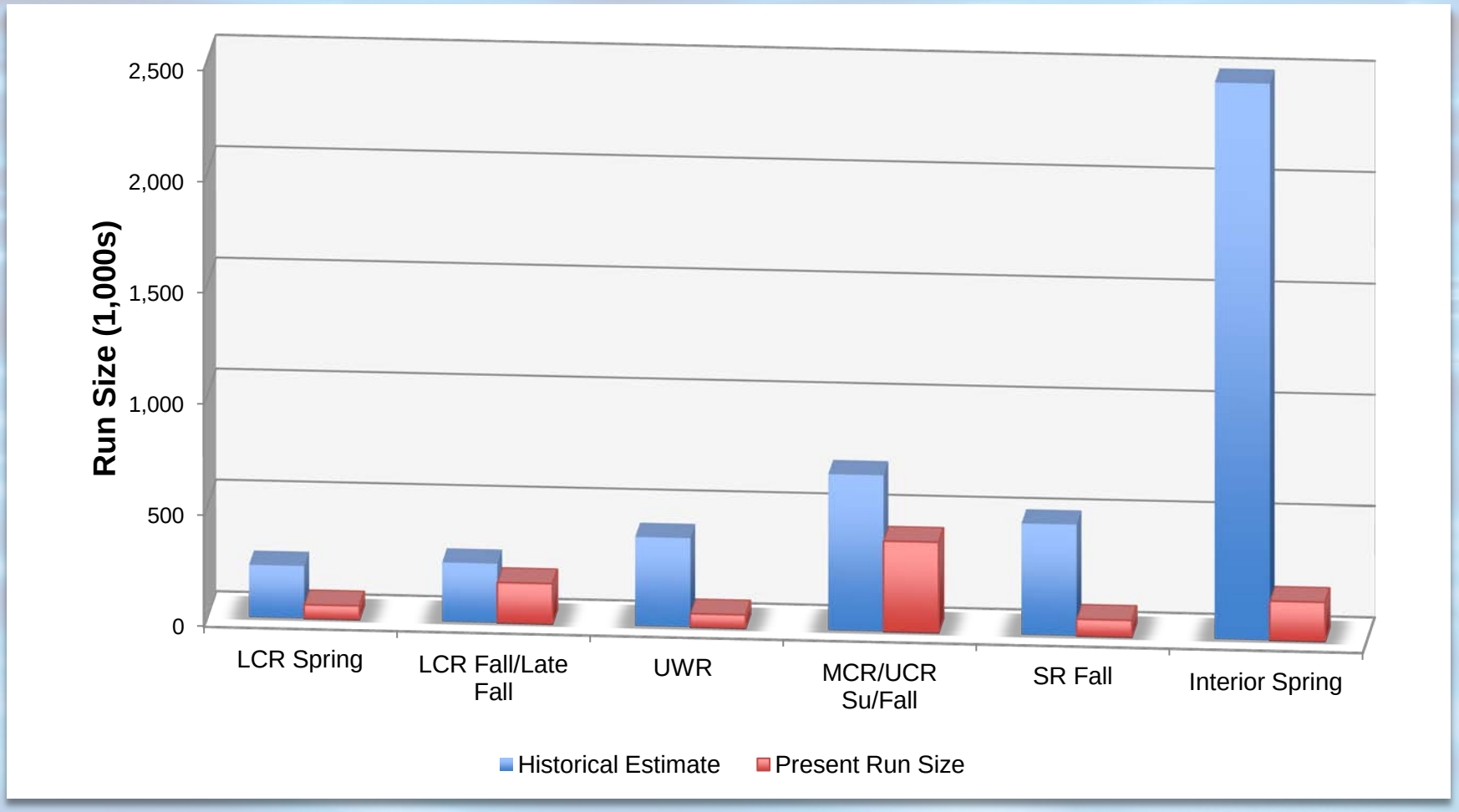
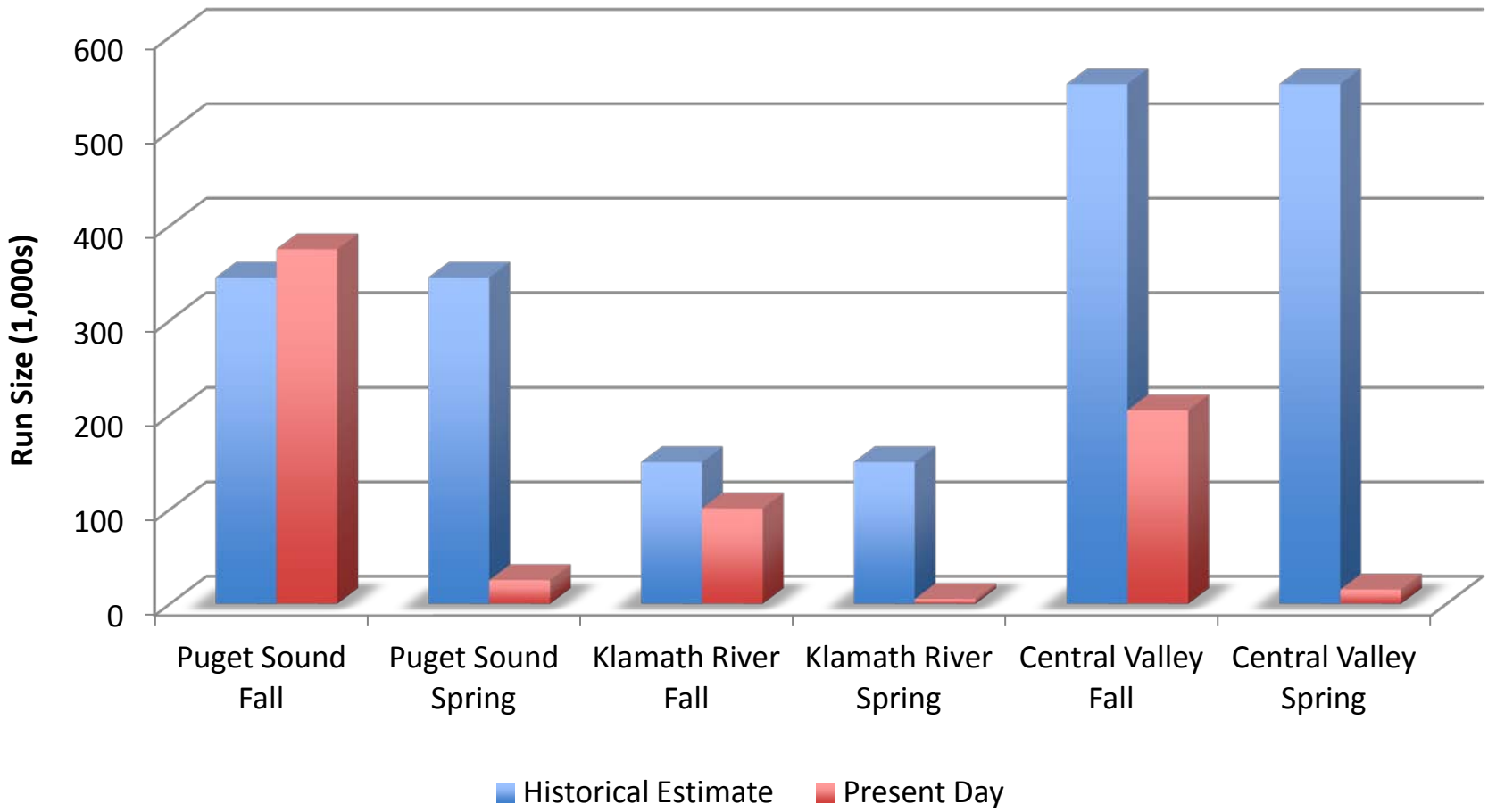
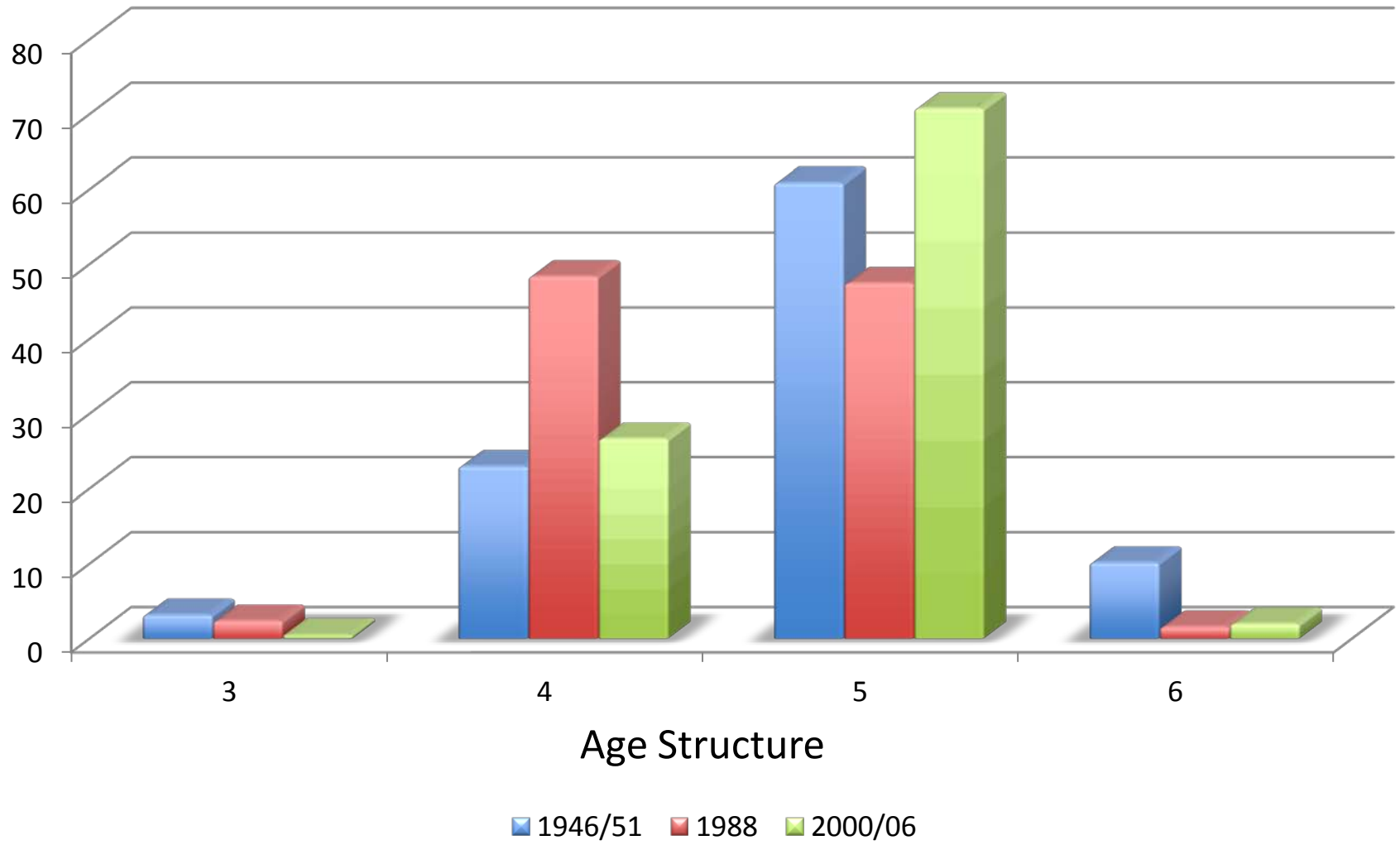
Columbia River Historical vs. Present Day Run Size



Run Timing Changes

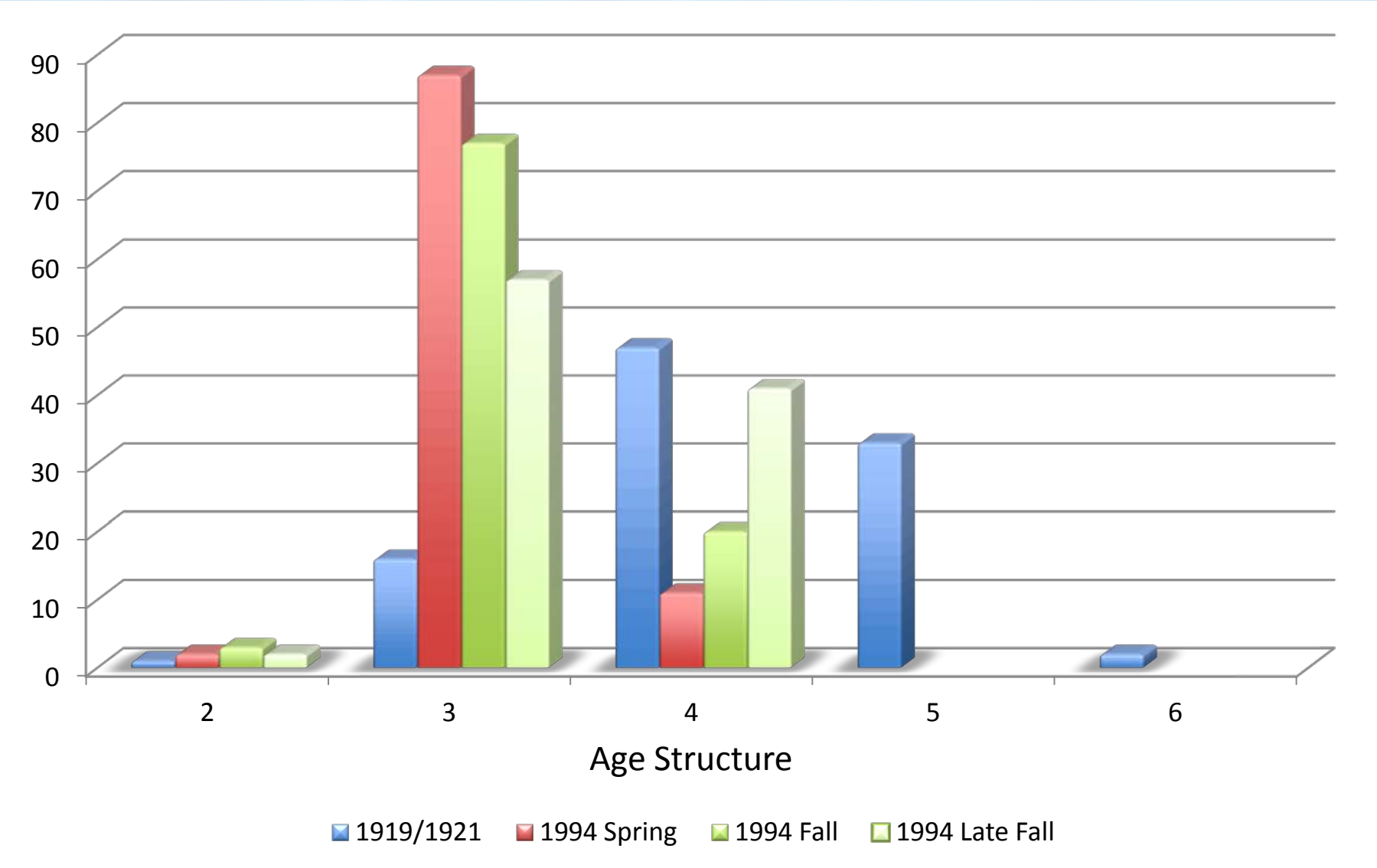


Age Structure: Upper Willamette River Spring-Run Chinook Salmon



Mattson 1963, Bennett 1988, Schroeder et al. 2007

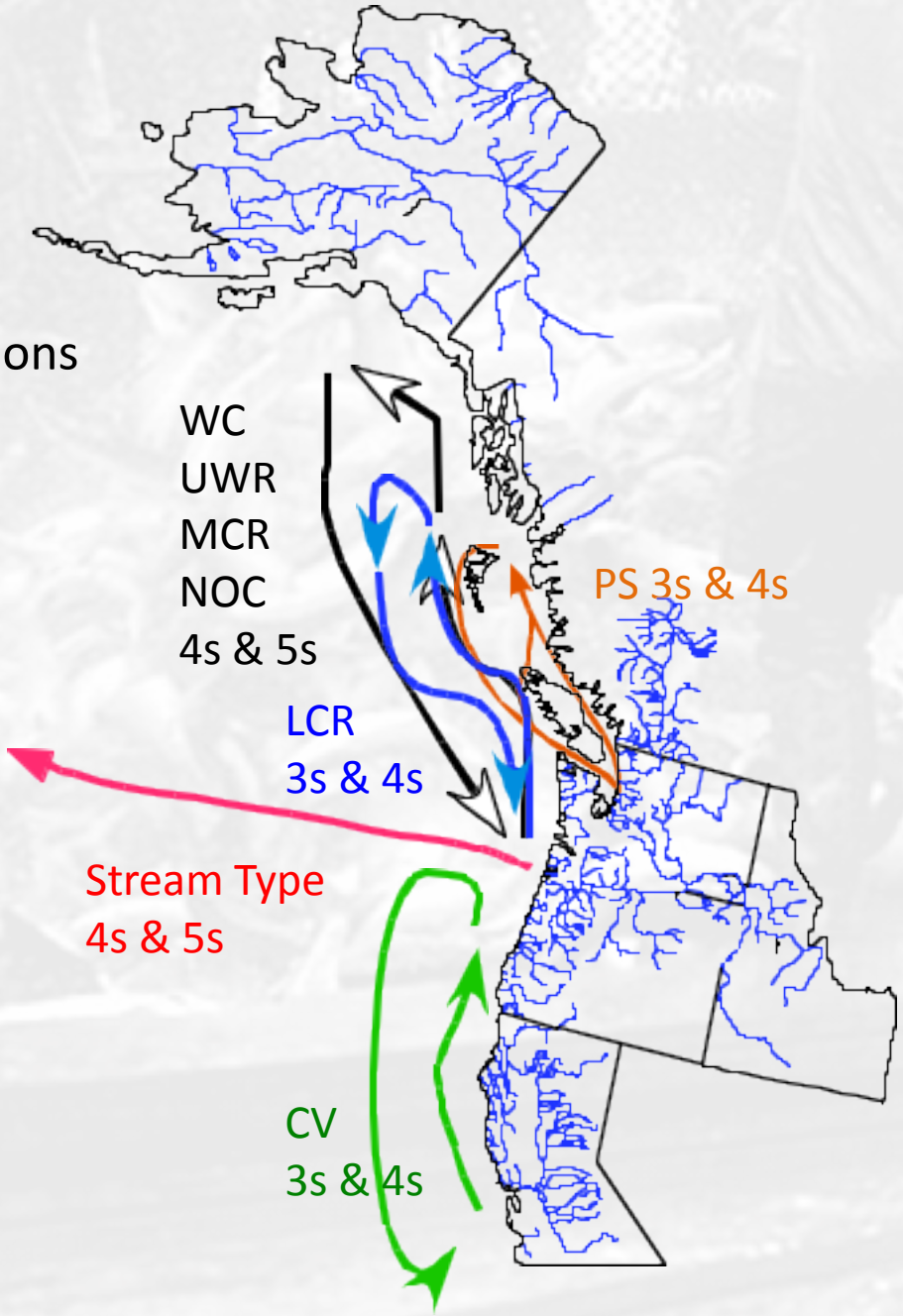
Age Structure: Central Valley Chinook Salmon



Clark 1929, Fisher 1994

Migratory Patterns

Different oceanic migration patterns for different natal regions



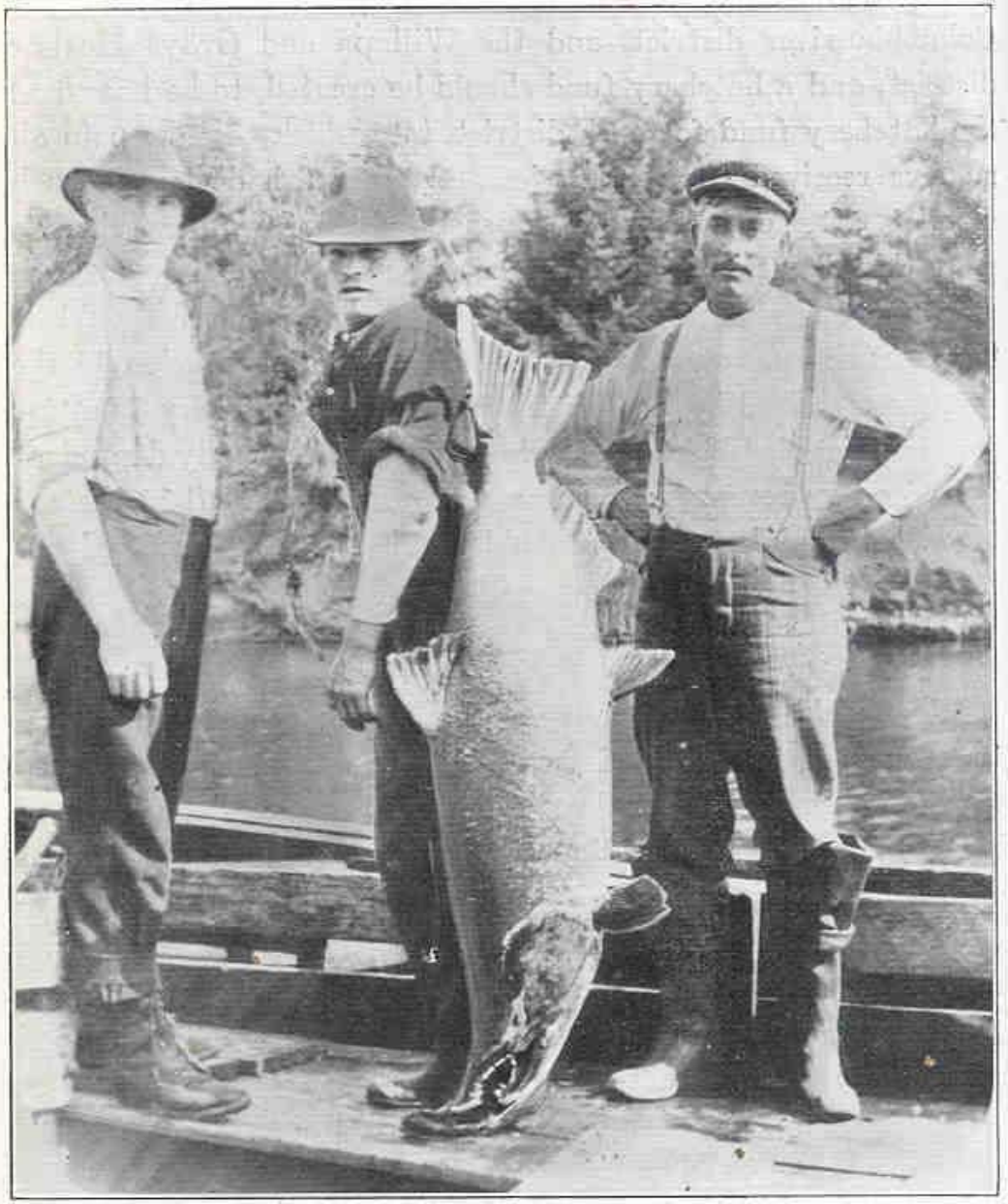
How has Chinook availability changed?

- General decrease in abundance
  - Hatchery fish do partially compensate in absolute numbers (most US regions > 50% hatchery origin)
  - Decrease is generally more pronounced in southern regions
  - Decrease is generally more pronounced in interior regions rather than coastal
  - Oceanic distribution of different regions may affect availability

How has Chinook availability changed?

- Shift in adult return timing
  - Loss or substantial decrease in spring-run Chinook salmon populations
    - Loss of headwater regions
    - Hatchery production emphasizing fall run
- Shift in age at maturation/size
  - Younger, smaller fish
  - More variable annual escapements

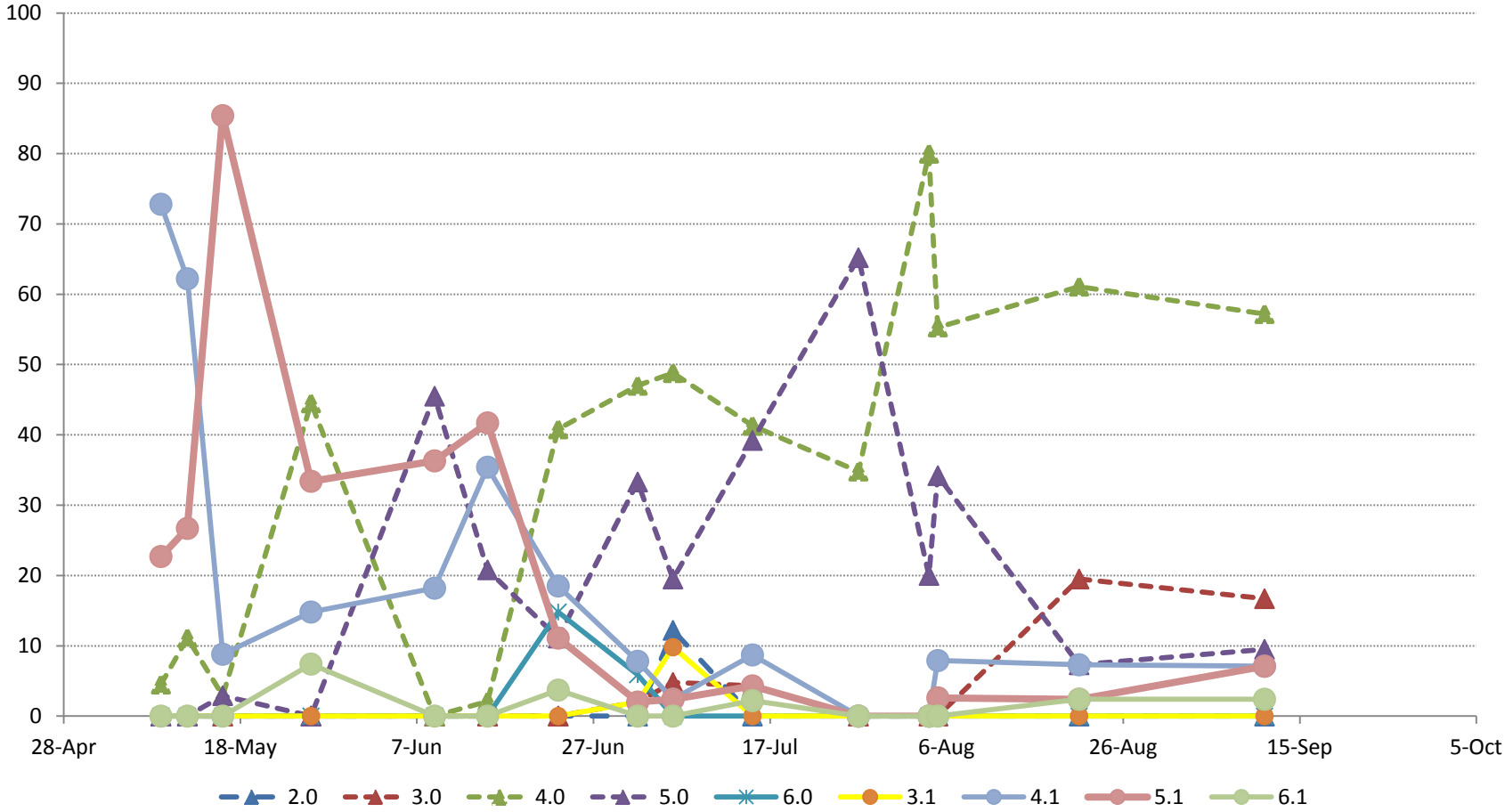
Questions ?



Specimen of male Chinook salmon. The largest males are used for breeding purposes.

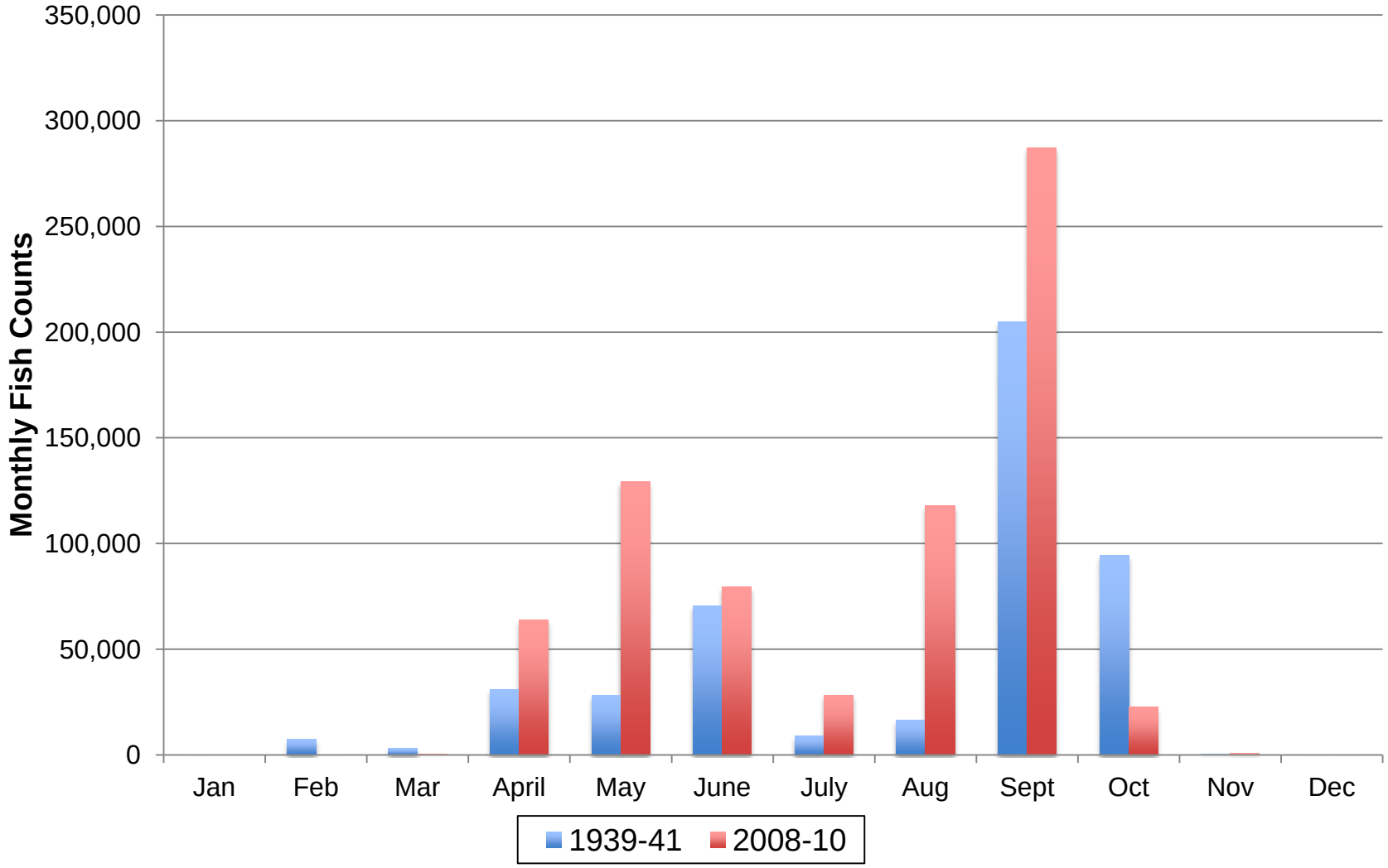
WDF 1913

Columbia River-Age Composition (optional slide)



Rich 1925, Sampled 1919-1921

Change in Abundance at Bonneville Dam (1939 – 2010)



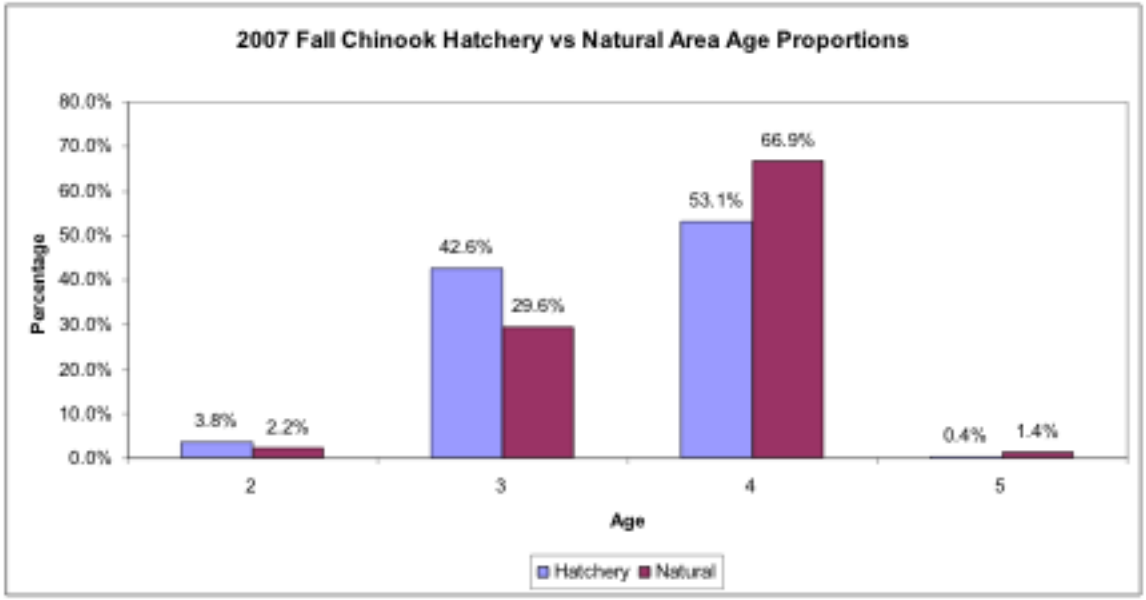
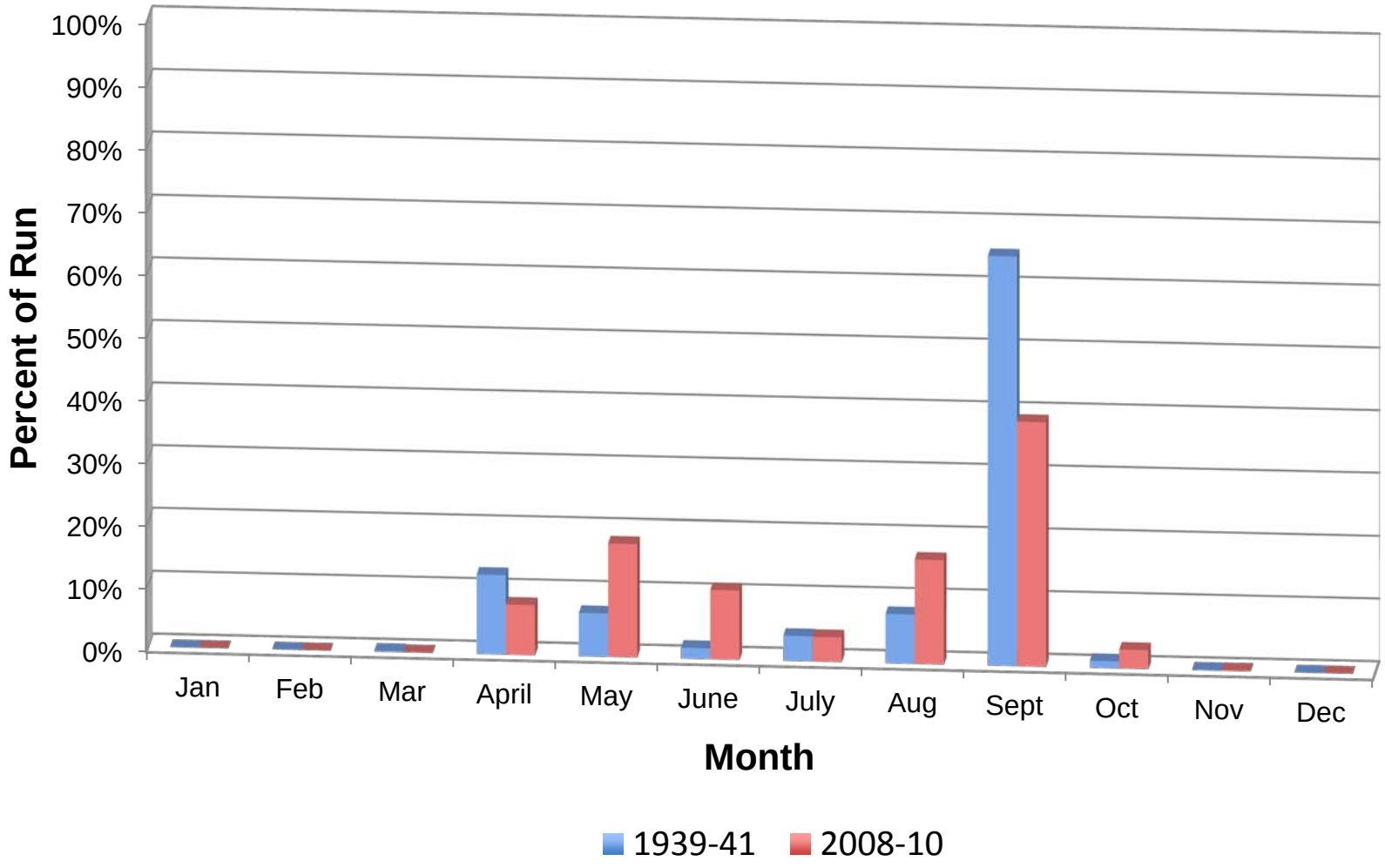
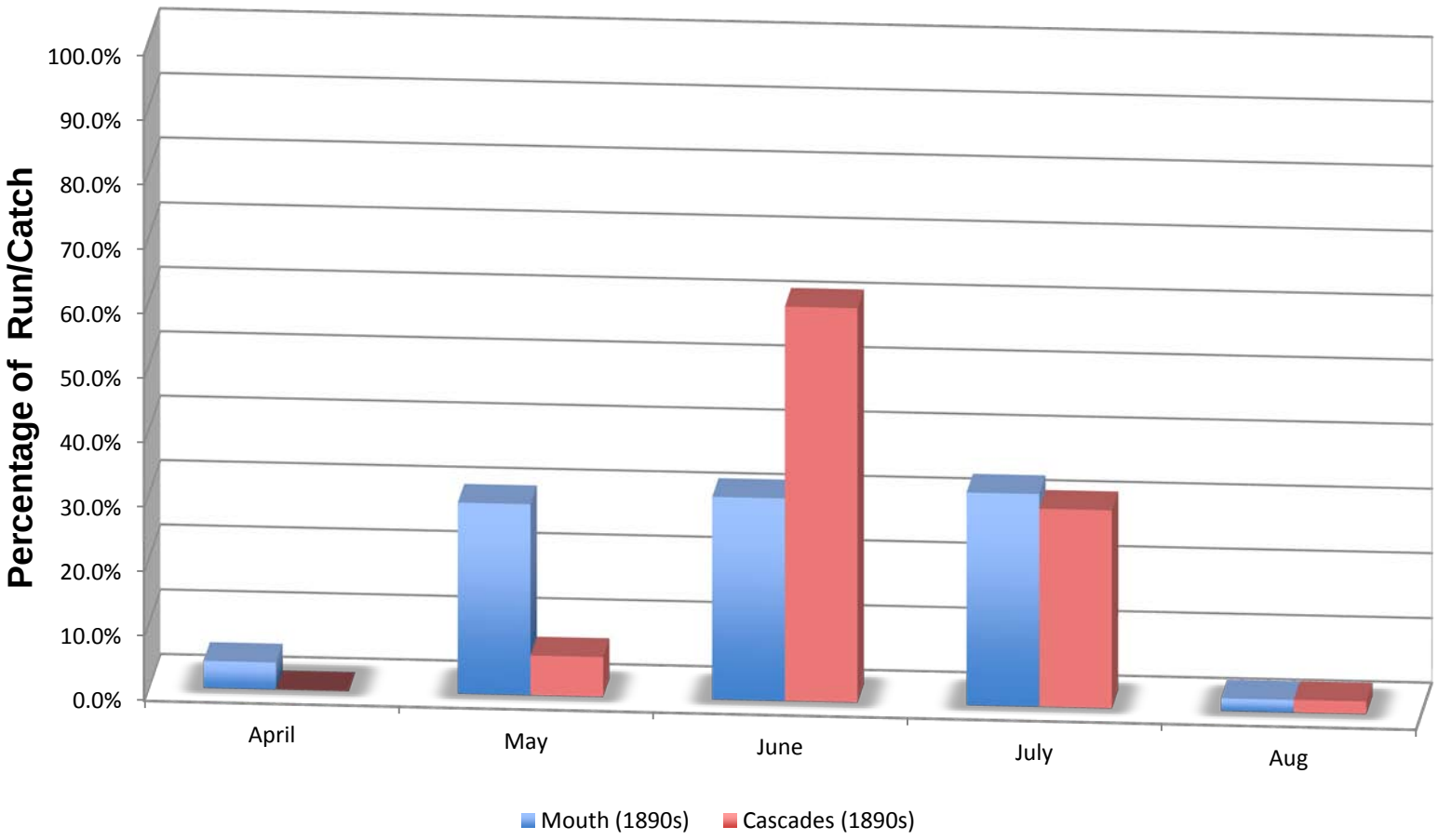


Figure 1: A comparison of the 2007 overall hatchery and natural area run size proportions at age. This illustrates the differences in age proportions for the two areas and contributions from the 2002 through 2005 broods. Battle Creek was removed from the analysis because the age proportions were derived from CNFH.

Change in Run Distribution at Bonneville Dam (1939 – 2010)



Diversity in Spring-Run Timing Distribution of Columbia River Chinook Salmon