

The Origins of Lake Washington Sockeye Salmon

What Can Genetic Data Tell Us?

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Lk. Wash. Sockeye circa 1900

- Reports of “red fish” in Lake Washington by authors in 1896, 1897, and 1900, are now believed to be kokanee (WDF&W).
- 1907 Report (Dept. of Trade and Commerce): sockeye are “known to run” in the Lake Washington system.

Lk. Wash. Sockeye, 1920's, 30's

- Cobb (1927): “Baker River has the **only** run of Sockeye salmon to be found in any Washington stream debouching into Puget Sound.”
- Rounsefell & Kelez (1938) “The Skagit River, the **only** sockeye stream in Puget Sound....”

Four Years After the Plants From Baker Lake

- Royal & Seymour (1940) report:
 - 9,099 sockeye returned to Issaquah Creek
 - 400 returned to the Cedar River
 - 2 were counted over a rack in Bear Creek
- Sockeye were observed in subsequent years in Issaquah Creek and the Cedar River.
- But Questions Remain...

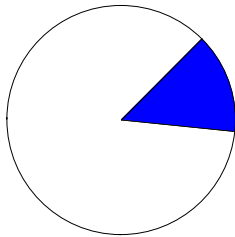
Conclusions from Recent Genetic Analyses

- The sockeye salmon spawning in Bear Creek and its tributaries are genetically “different” than the other sockeye in Lake Washington, Baker Lake, or Cultus Lake.
- Some have suggested a “native” origin for Bear Creek sockeye.

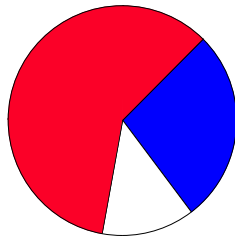
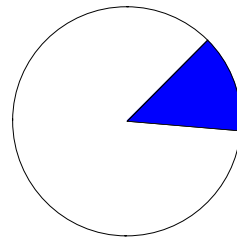
Estimated Gene Freq.

Bear
Creek

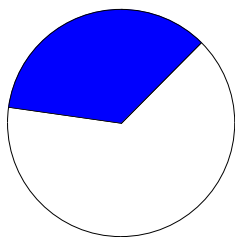
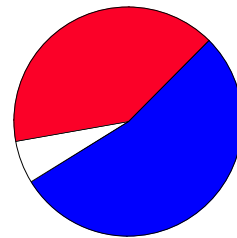
Baker
Lake



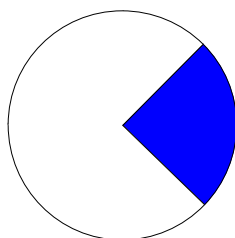
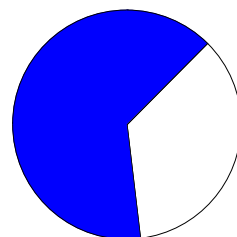
PGM-2*



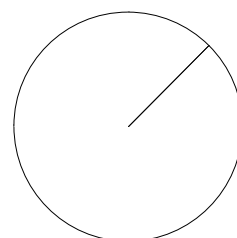
ALAT*



PGM-1*



LDH-A1*



A Statistical Approach to the Origin of Bear Creek Sockeye

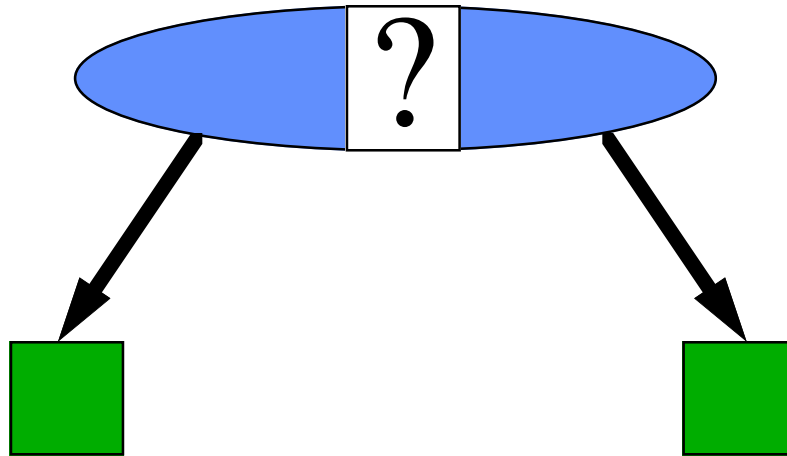
- The Testable Hypotheses are:
 - Bear Creek sockeye may have come entirely from Baker Lake.
 - Bear Creek sockeye may have come entirely from Cultus Lake.

- HEY! What about native origin?

Testing For Genetic Differences

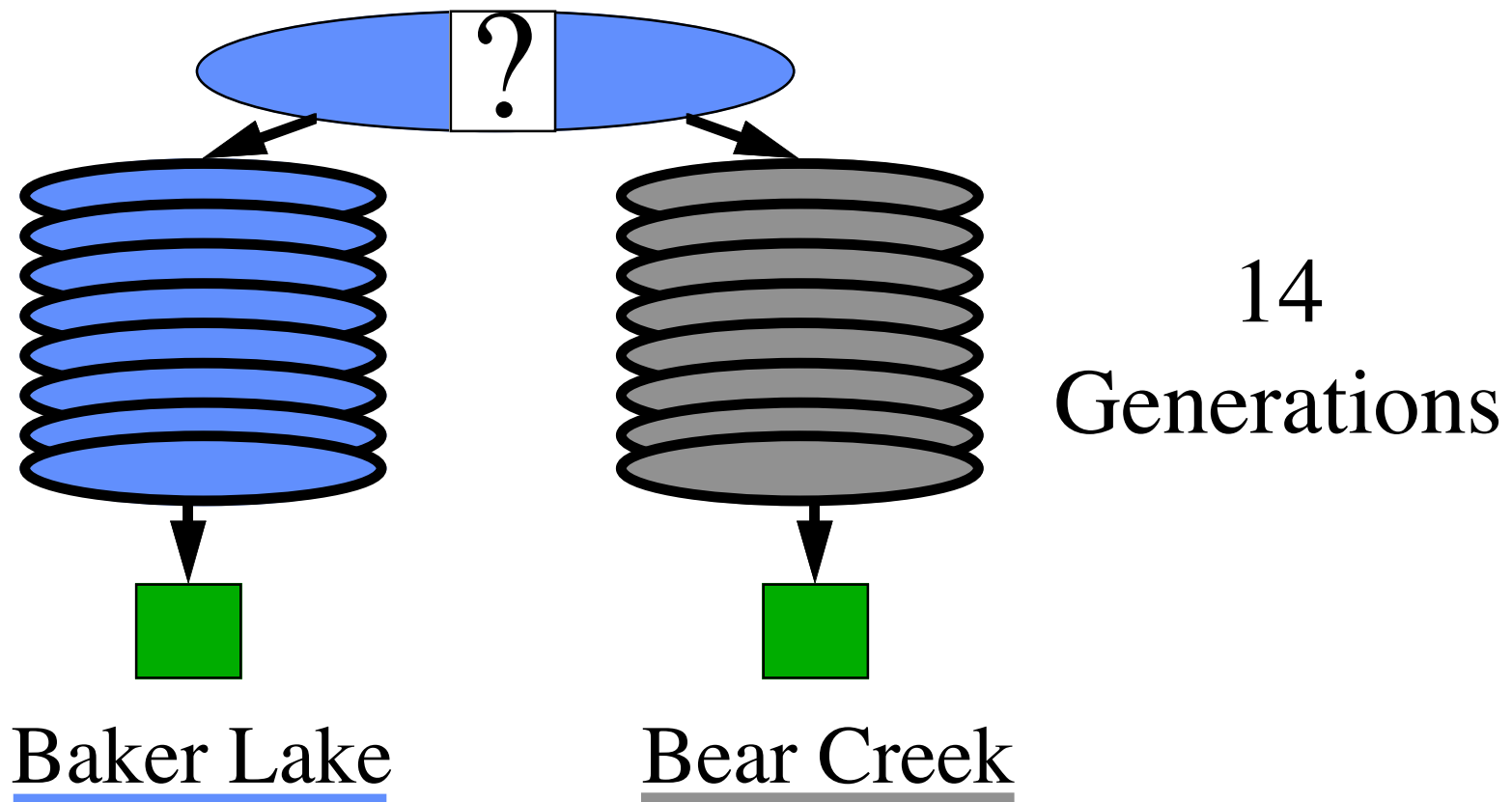
The Simple Case:

Population

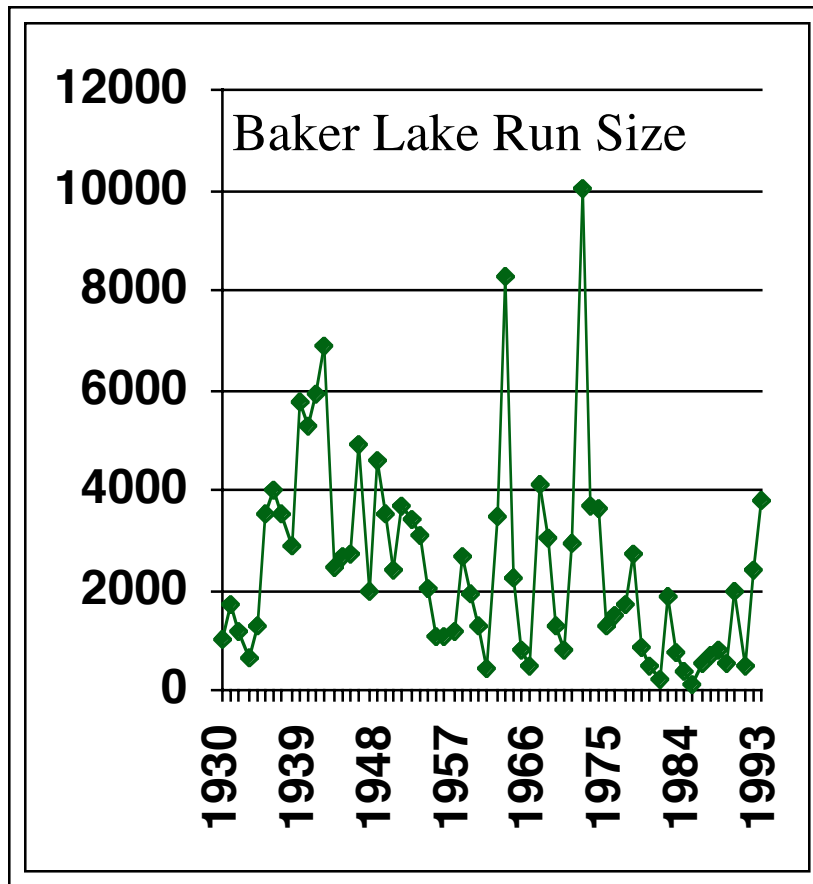


Genetic Samples

Testing For Genetic Differences: The Bear Creek Case



Effective Sizes of the Populations



Probable Lower Bounds
On Effective Size:

Baker: 250

Cultus: 800

Bear Creek: ???

Conclusions **If** The Effective Size of Bear Creek Were **100**

- The Bear Creek Population could **not** have come exclusively from the Baker Lake plantings, (**$p = .07$**).
- The Bear Creek Population could not have come exclusively from the Cultus Lake plantings, (**$p < .001$**).
- p-values increase quickly with smaller Bear Creek effective size.

We Do Not Know Bear Creek's Effective Population Size over the Time Period in Question

- Effective size heavily influenced by small run sizes.
- $N_e = 100$ --> 1940 Run Size = 50
- 2 fish were caught in Bear Creek in 1940.

Conclusions

- Due to the possibility of a small founding population, genetic data do not let us confidently reject the possibility that Bear Creek sockeye came from Baker Lake.
- This, however, is a reflection of the lack of power of the data in the face of a stringent statistical test.

Observations / Qualifications

- Bear Creek sockeye **are** differentiated both genetically and phenotypically from other Lake Washington stocks.
- If Bear Creek sockeye are from Baker Lake, then their population growth since the 1940's has been remarkable.
- If they are “natives” their recent population growth has still been remarkable.

Kamchatka?!

“...also, I KNOW that Kamchatka sockeye WERE possibly planted to Lake Washington in the late 60’s. I raised them from eggs shipped here, and I know that the person who was supposed to have destroyed them (200,000), later claimed that he didn’t (he is now deceased).”

–JM