Predator and Prey Availability: A Study of the Impact of Prey Accessibility and Watershed Conditions on the Growth Rates of Subyearling Chinook Salmon in the Salish Sea

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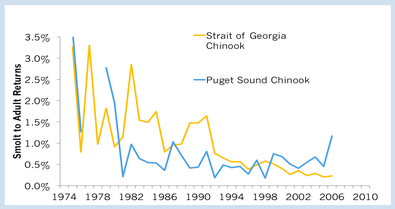
Why Salmon?

- Chinook salmon are an important natural resource to Washington State, with far-reaching impacts on the economy, ecosystems, and culture.
- These fish have a complex life history, growing up In streams, heading to the ocean, and returning to the same streams to reproduce and die

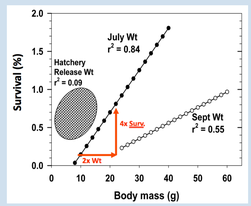
The Salish Sea Marine Survival Project

- Compared to other parts of the Northwest, Chinook from the Salish Sea have a very low survival rate
- Salish Sea Marine Survival Project was created to discover which factors play a role in the low survival rates



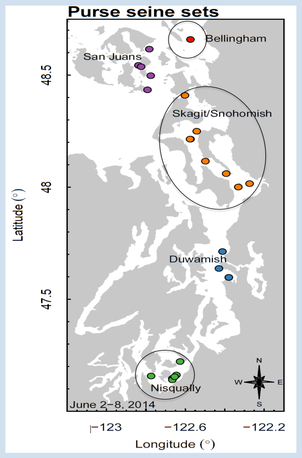
Growth Rate Impacting Survival

- In a study done by Beauchamp and Duffy, it was found that growth rate has a potentially significant impact on survival rates.
- The larger a fish is, the greater the chance that it will survive to reproductive age.
- Scale size was used as a measure of fish growth, and scale size will also be used in this growth study.



Duffy & Beauchamp 2011 CJFAS 68:232-240

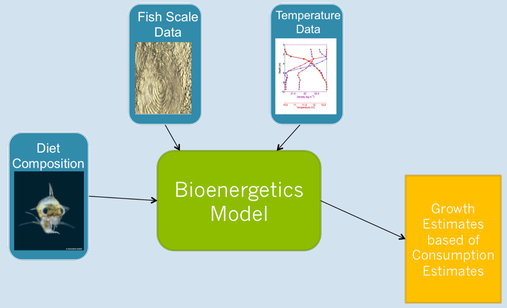
Study Set Up



- The Chinook samples were caught using a commercial fishing vessel, a purse seiner, from May to August in the summer of 2014.
- 6 cruises were done, and each time fish were sampled for diet, scales, and size on the boat, and then frozen for later analysis in the lab.
- In the wet lab, diet samples were sorted and weighed based on prey category, and scales were mounted and read like rings on a tree to determine the size of the fish when caught.

The Bioenergetics Model

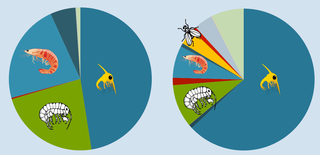
- The data collected through this study was put into a bioenergetics model, which output the projected growth estimates and feeding rates of the salmon over the course of the collection period
- Factors going into this were diet composition, size estimates as derived from scales, and temperature of the watersheds
- Hatchery born (CWT=coded wire tag) Chinook and wild born Chinook (UM=unmarked) were kept separate in case their origins impacted their life histories and diet preferences.



Components of the Bioenergetics Model: Diet Composition

Nisqually Early July Diet Proportions

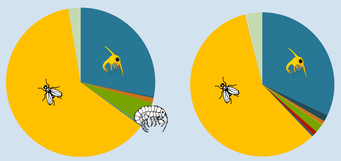
% Diet Overlap: 67%



UM Chinook CWT Chinook

Snohomish Early July Diet Proportions

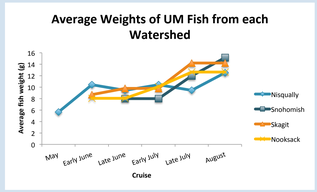
% Diet Overlap: 92%

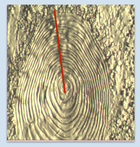


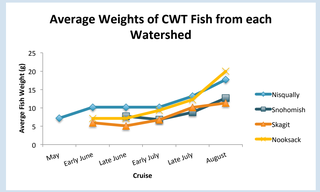
UM Chinook CWT Chinook

- In the lab, diet items were analyzed and categorized based on prey type, the most common consistently being insects, euphasids, larval crab, and hyperiids.
- The average diet proportions for each watershed were calculated for every cruise, and CWT and UM data remained separate.
- Schoener's Index was used to calculate the percent overlap of the CWT and UM diets to determine if the samples could be combined for further analysis.
- The pie charts on the left represent the variation observed in the diet proportions between watersheds, and between CWT and UM fish in the overlaps in diet items.

Components of the Bioenergetics Model: Fish Size







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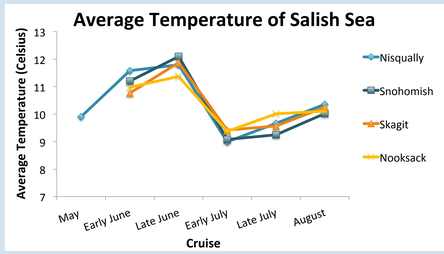
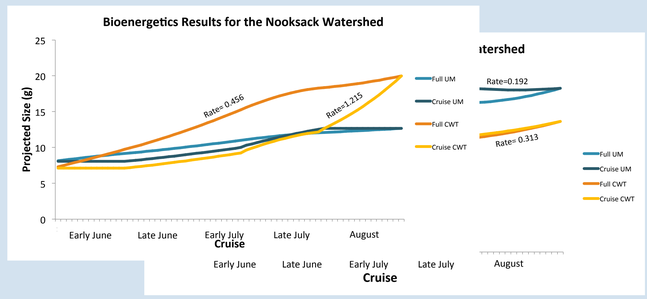
The Bioenergetics Model



- Multiple temperature readings were taken in each watershed throughout the cruises.
- The average temperature for the first 10m each watershed per cruise was used as the temperatures



Conclusions that can be Drawn

Some watersheds are more productive than others
- Most productive= Nooksack in August for CWT fish
- Least Productive= Skagit in Early July for CWT fish

Overall, no significant difference between UM and CWT fish off-shore experiences

Many factors at play in determining growth rate
- Compare results to actual prey availability
- Look at summer 2015 samples