Pacific Herring Reproductive Investment (*Clupea pallasii*): A Factor in Their Decline?

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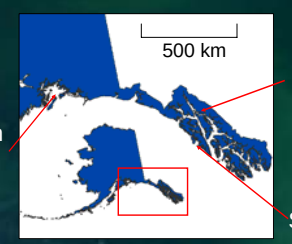
Introduction

Problem:

Herring populations in Prince William Sound (PWS) and Lynn Canal (LC) have been depressed since the 1980's while the population in Sitka Sound (SS) is robust and sustaining record harvest levels. Causes underlying the population declines are unknown.



Background:

Depressed recruitment may limit recovery of PWS herring. Potential agents for depressed recruitment remain unknown (disease, predation…?), but it is likely their combined effects are reflected in herring energy dynamics. We postulate that adult herring facing environmental stress will have higher energy expenditures over winter, resulting in decreased energy available for reproduction, consequently effecting offspring survival rates.

Objectives

1. Compare overwinter energy expenditure of adult herring in 3 Gulf of Alaska stocks: Prince William Sound and Lynn Canal (depressed stocks), and Sitka Sound (robust stock)

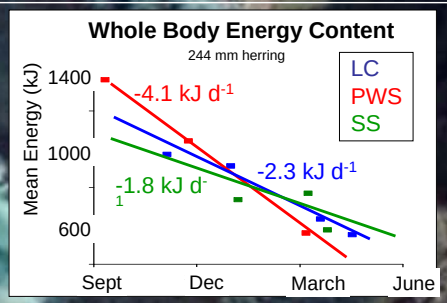
2. Compare gonad condition (energy, fat and protein content) of pre-spawning herring from the 3 herring stocks.

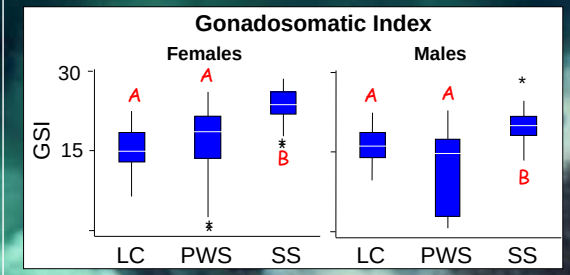
Methods

1. Collect adult (age 3+) herring before and after winter (pre-spawning) from each of the 3 stocks
2. Measure energy content and proximate composition (lipid, protein, water, ash) of whole fish and gonads

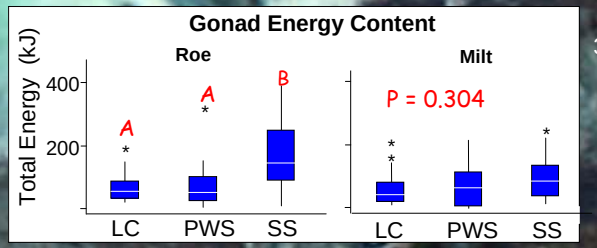
Results

1. PWS herring incur the greatest overwinter energy expenditures, nearly twice the rate of herring in Southeast AK stocks. Though PWS herring began winter with greater energy stores than fish in Southeast AK, their high rate of energy expenditure caused all stocks to be in relatively similar condition at winter's end.





2. Gonadosomatic Indices (GSI) of pre-spawning herring were higher in the robust stock (SS) than the depressed stocks (PWS & LC).



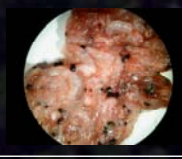
3. Relative composition of gonads did not vary amongst stocks, (energy density, %lipid and %protein). Thus, spawning herring in SS had larger gonads conferring more energy, lipid and protein.

4. Herring in PWS and LC forage more frequently than in SS, perhaps to compensate for increased energy expenditures.

% of Stomachs With Prey Remains

PWS	SS	LC
67%	27%	62%

Identifiable Prey:
Euphausiids
Copepods
Pteropods



Summary

Adult herring in PWS (and to a lesser degree LC) incur high overwinter energy expenditures at the expense of gonad condition. In contrast, fish in SS have the lowest rate of energy expenditure over winter, resulting in the largest, best provisioned gonads prior to spawning. Frequency of winter foraging is highest in the declining populations, perhaps to offset energy loss. Causes for the differential energy expenditures amongst herring stocks are unknown (disease, predation…?), but are likely factors in the population declines.

Acknowledgements

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