Influences of Size, Condition, and Diet on Winter Mortality of Juvenile Pacific Herring in Prince William Sound

Fletcher Sewall [1]
Ron Heintz[2]
Johanna Vollenweider[2]
[1]Under contract to:
[2]NMFS, NOAA, Alaska Fisheries Science Center
Auke Bay Laboratories
Juneau, AK
fletcher.sewall@noaa.gov

Objective

Describe seasonal trends in size, condition, and diet of YOY (young-of-the-year) herring in Prince William Sound (PWS).

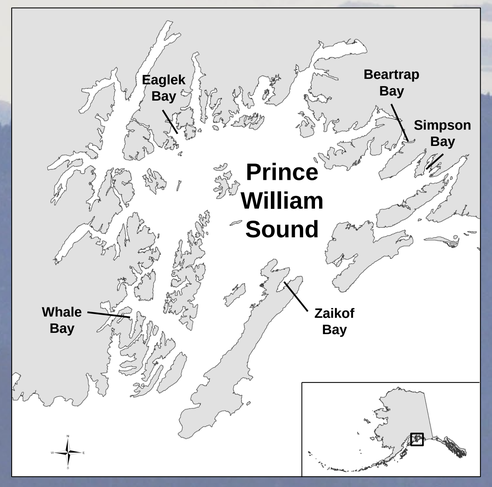
Background

- **Herring recruitment can be strongly influenced by YOY winter mortality.**
- **Seasonal and size-related changes in lipid storage and diet are important for modeling winter mortality.**
- **This study is part of the PWS Herring Research & Monitoring effort.**

Photo: J. Moran

Methods

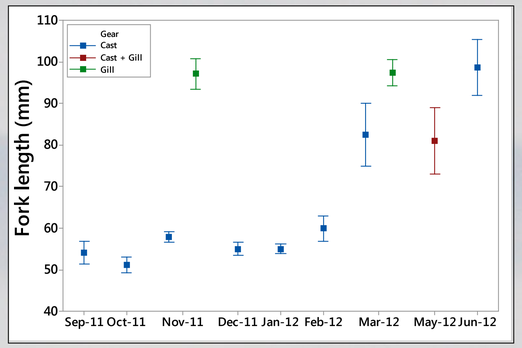
- **YOY herring collected monthly by cast net and gillnet from Simpson Bay in PWS, September 2011 – June 2012, and from an additional survey of multiple bays in November 2011.**
- **~20 fish from each monthly Simpson Bay collection, and ~100 fish from broader fall collection analyzed for:**
  - **i) Energy: whole body lipid content.**
  - **ii) Diet: counts, masses, and energy of prey in stomachs.**



Findings

Size-dependent Mortality

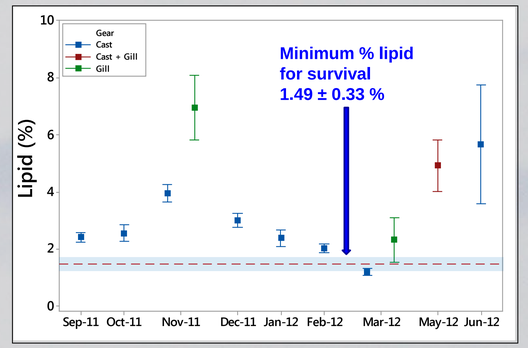
- **Small herring were rare by March, large herring persisted, suggesting size-dependent winter mortality.**



Length (95% C.I.) of YOY herring in Simpson Bay, September 2011 – June 2012.

Declining Condition

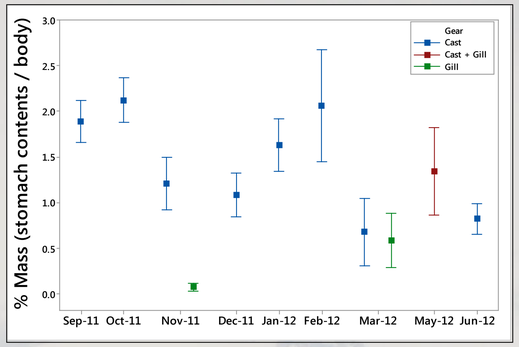
- **Lipid content peaked in November, declined through March. Smaller herring (cast net) had less lipid.**



Lipid content of YOY herring in Simpson Bay, September 2011 – June 2012.

Winter Foraging

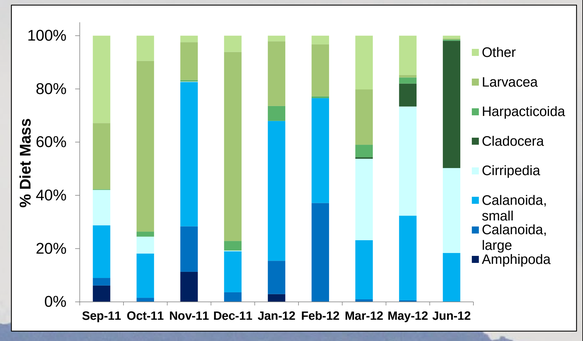
- **Herring foraged through winter, especially small herring, and increased foraging through Feb. as lipid decreased.**



Diet mass as % body mass of YOY herring in Simpson Bay, September 2011 – June 2012.

Diet Composition

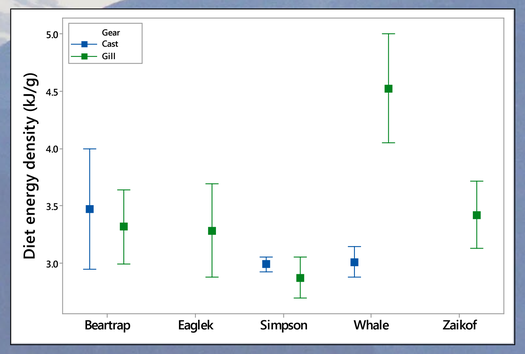
- **Diets changed seasonally, but herring in Simpson Bay rarely ate high-energy prey, such as euphausiids.**



Diet composition of YOY herring in Simpson Bay, September 2011 – June 2012.

Diet Quality

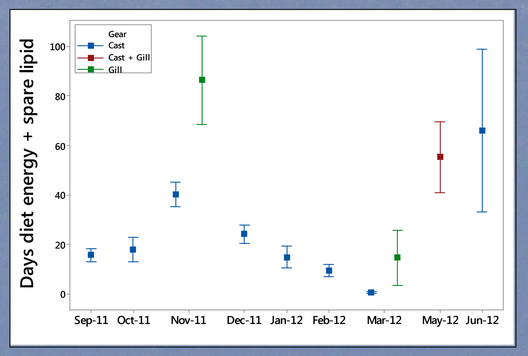
- **In fall, herring of all sizes in Simpson Bay ate energy-poor diets in comparison to other bays.**



Diet energy density of YOY herring by bay in PWS, Nov 2011.

Available Energy

- **For small herring, lipid stores and food intake were low by March = less than one day's worth of metabolic energy need.**



Days of available energy for YOY herring in Simpson Bay, September 2011 – June 2012.

Photo: J. Moran

Conclusions

YOY herring forage throughout winter.

Small, lean herring have greater foraging need.

Low fat stores and poor quality prey can result in few small herring surviving through March.

Small YOY herring incur higher predation risk to forage in late winter as they deplete their energy stores.

Herring survival through winter may vary on small scale, depending on local availability of high-quality zooplankton prey.

The recommendations and general content presented in this poster do not necessarily represent the views or official position of the Department of Commerce, the National Oceanic and Atmospheric Administration, or the National Marine Fisheries Service.

Acknowledgements: Funding provided by the EVOS Trustee Council (Projects 10100132-D, 12120111-M). We thank the Prince William Sound Science Center, Scott Pegau, Michele Buckhorn, Tom Kline, Megan Roberts, Jennifer Todd, Robert Bradshaw, Sarah Christiansen, Eamon Conheady, Keith Cox, Andrew Eller, Emily Fergusson, Hannah Findlay, Meghan Garrison, Kevin Heffern, Lia Heifetz, Tayler Jarvis, John Moran, Stella Mosher, Bonita Nelson, Tom Parker, Connor Pihl, Erik Pihl, Ann Robertson, Lawrence Schaufler, Ashwin Sreenivasan, and Wes Strasburger for assistance with this project.