PWS Herring Research and Monitoring

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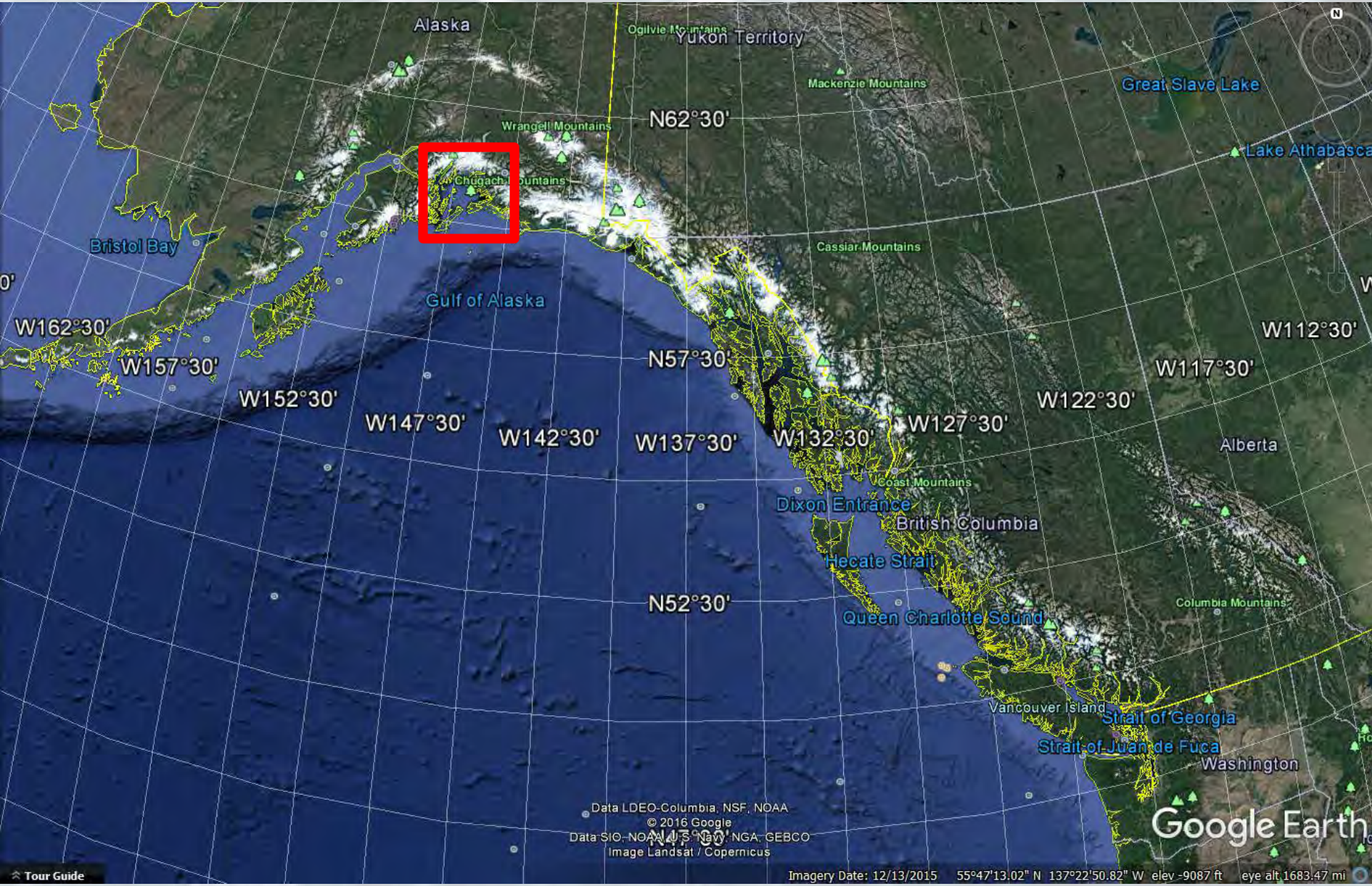
Alaska
Yukon Territory
Ogilvie Mountains
Mackenzie Mountains
Great Slave Lake
Lake Athabasca
Wrangell Mountains
Chugach Mountains
Bristol Bay
Cassiar Mountains
Gulf of Alaska
N62°30'
N57°30'
N52°30'
W162°30'
W157°30'
W152°30'
W147°30'
W142°30'
W137°30'
W132°30'
W127°30'
W122°30'
W117°30'
W112°30'
Alberta
Coast Mountains
Dixon Entrance
British Columbia
Hecate Strait
Queen Charlotte Sound
Columbia Mountains
Vancouver Island
Strait of Georgia
Strait of Juan de Fuca
Washington
Data LDEO-Columbia, NSF, NOAA
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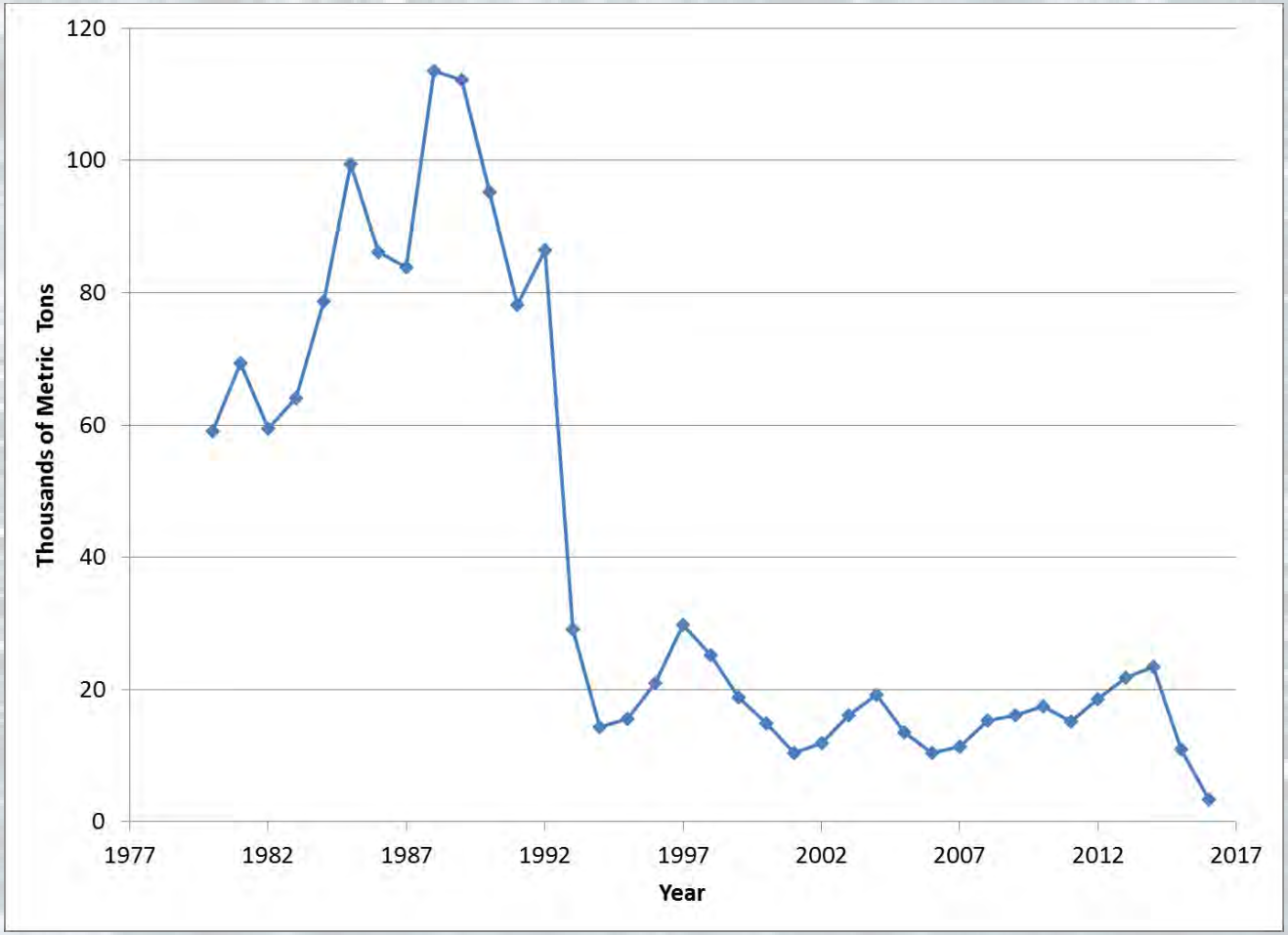
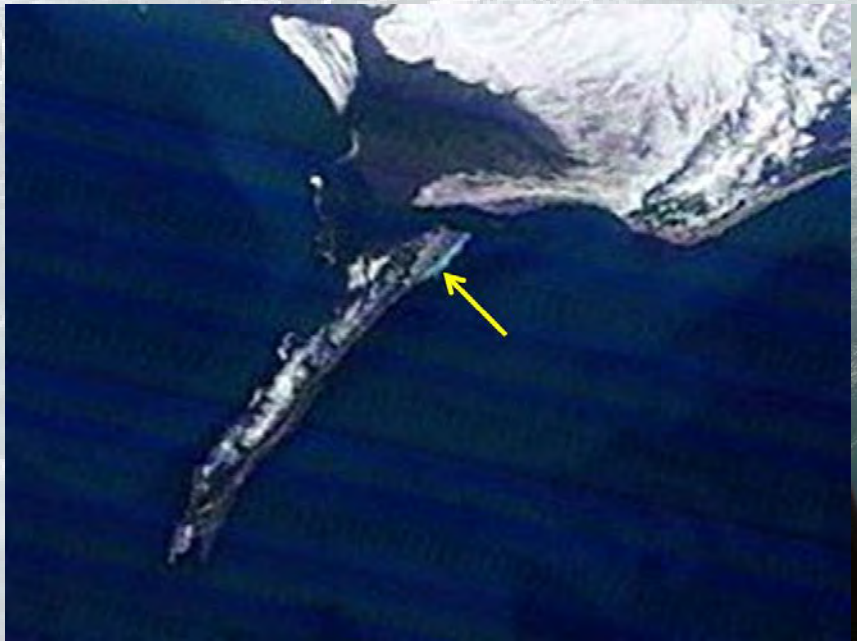
Data SIO, NOAA, U.S. Navy, NGA, GEBCO
Image Landsat / Copernicus
Google Earth
Tour Guide
Imagery Date: 12/13/2015 55°47'13.02" N 137°22'50.82" W elev -9087 ft eye alt 1683.47 mi

Why a herring program?



Design

- Began in 2012 – 20 yr study
- Builds on Sound Ecosystem Assessment (1996-1999) and PWS Herring Survey (2010-2012)
- Focused in Prince William Sound
- Mix of monitoring and process studies



Goal and Objectives

- **Improve predictive models of herring stocks through observations and research**

- Provide information to improve the age-structure-analysis model
- Synthesize existing information
- Address assumptions in measurements
- Develop new approaches to monitoring

Projects

- *Disease survey*
- *Adult biomass surveys*
- *Juvenile index*
- *Age 0 condition*
- *Age-1 aerial suvey*

- *Herring intensive*
- *Fatty acid analysis*
- *Acoustic intensive*
- *Acoustic validation*
- *Disease studies*

- *Determine age of first spawn*
- *Genetic stock structure*
- *Population modeling*

- *Herring tagging*
- *Disease forecasting*
- *Non lethal sampling*

- *Herring Scale analysis*
- *Data visualization*

- *Coordination*
- *Outreach*

Provide information to improve age-structure-analysis model

Monitoring Projects

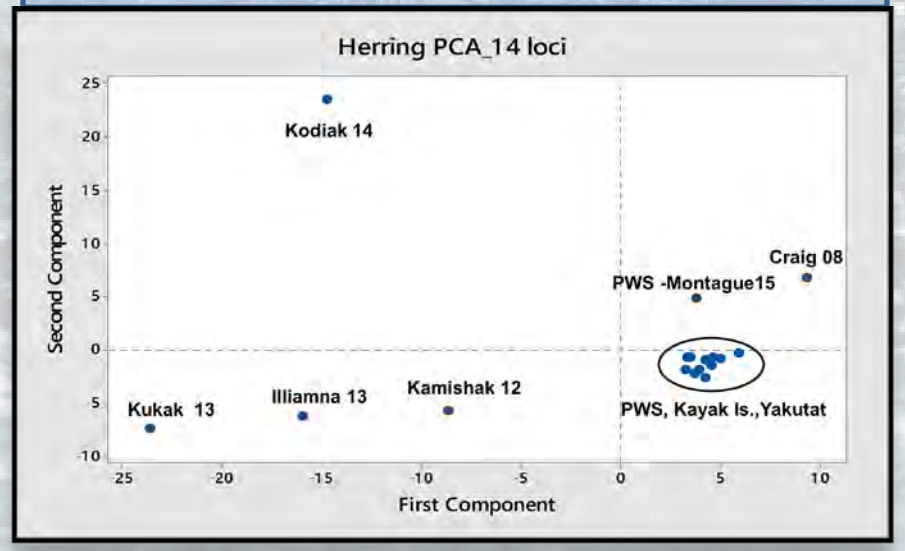
- *Disease survey*
- *Adult biomass surveys*
- *Juvenile index*
- *Age-0 condition*
- *Age-1 survey*

- Disease prevalence is within expected range
- Adult population collapse
- Age-0 condition high winter 2012-2013
- Peak in age-1 in 2013

Provide information to improve age-structure-analysis model

Process Studies

- *Determine age of first spawn*
- *Genetic stock structure*
- *Population modeling*



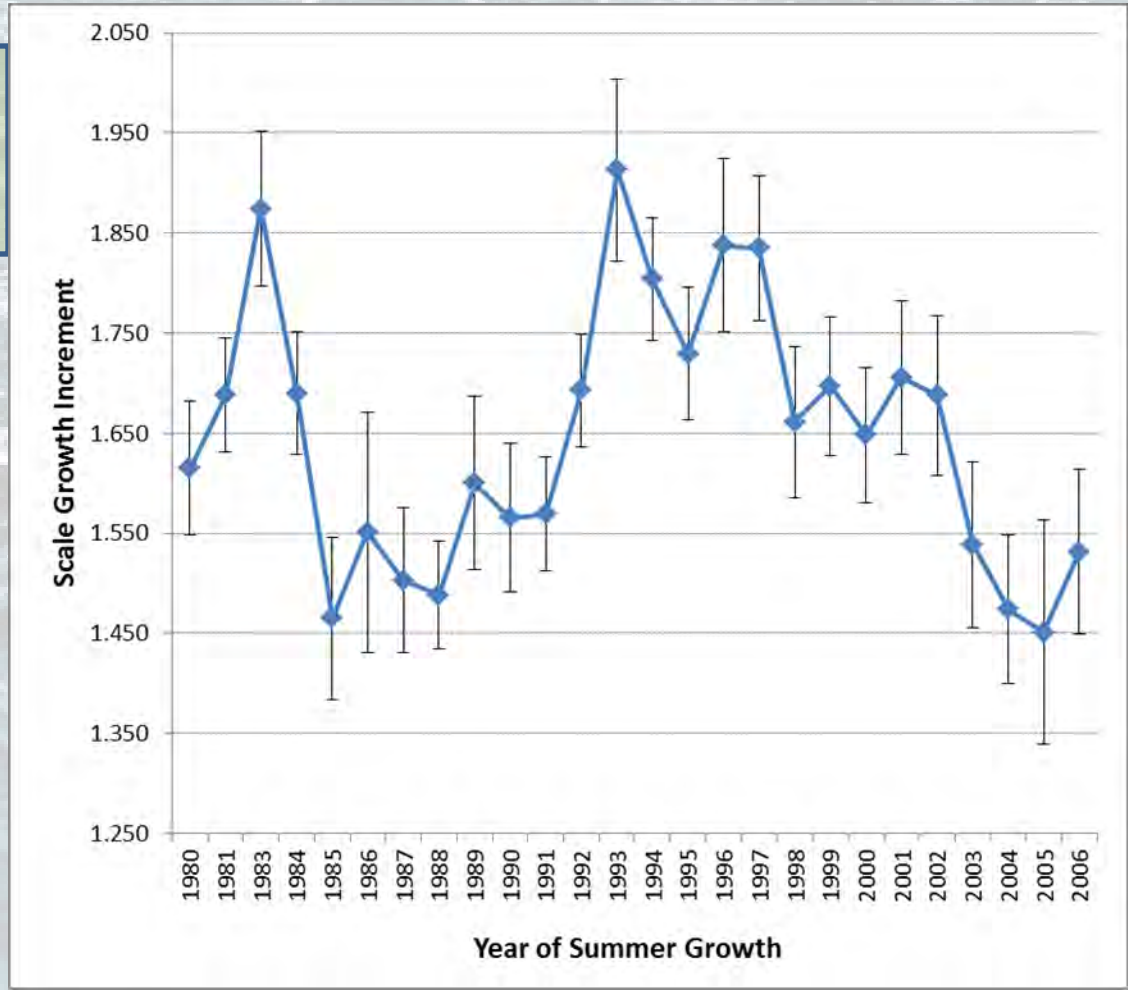
- Histology promising, scales didn't work
- **Genetic similar to east, different to west**
- ASA model rebuilt in Bayesian structure.
  - See John Trochta

Information for synthesis effort

Process Studies

- *Herring scale analysis*
- *Data Visualization*

- ***Over 7200 scales imaged and measured***



Address assumptions in measurements

Process Studies

- *Herring intensive*
- *Fatty acid analysis*
- *Acoustic intensive*
- *Acoustic validation*
- *Disease studies*

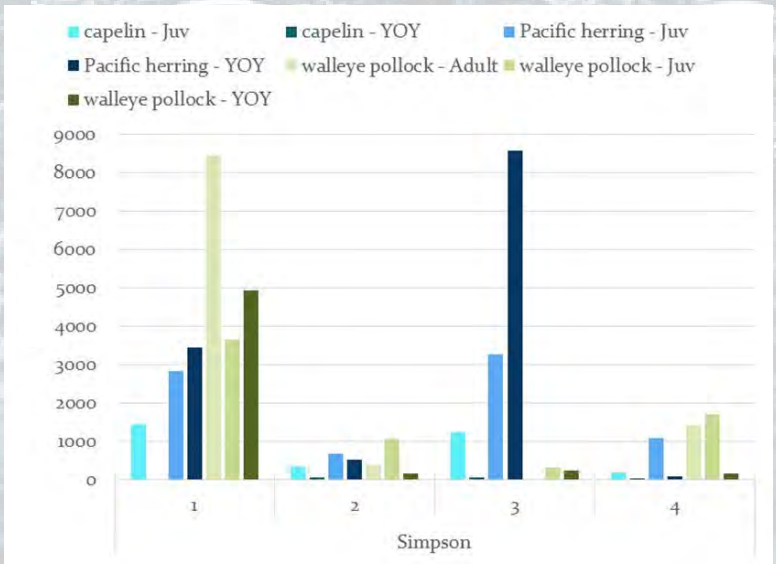
Energy loss different than modeled

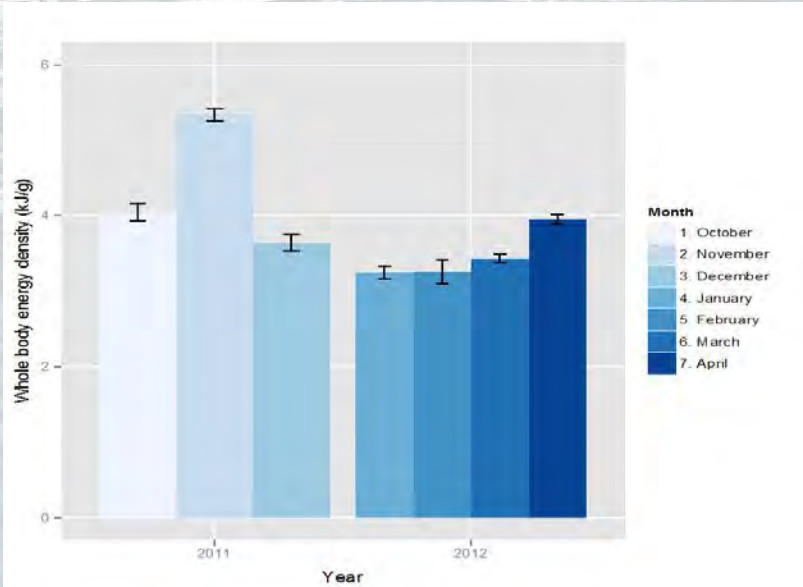
Winter feeding

Inconsistent survey results

Pacific herring dominate catch

Ichthyophonus and age



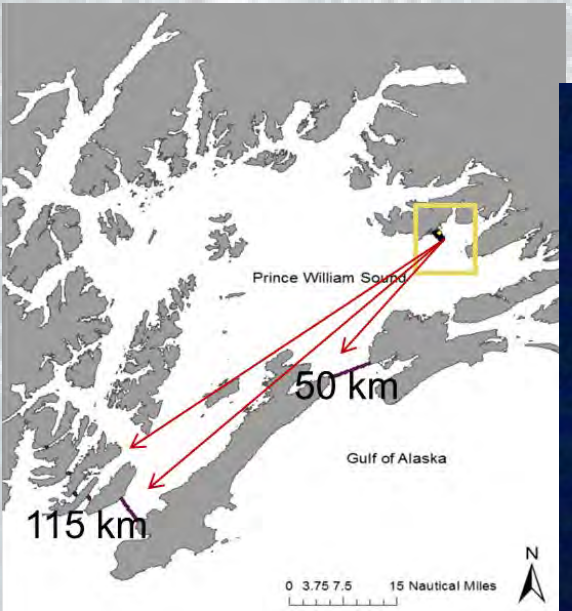


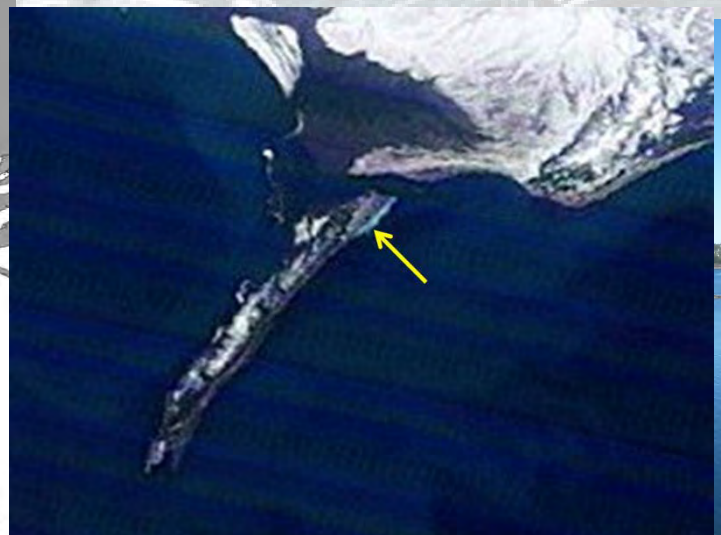
Develop new approaches to monitoring

Process Studies

- *Herring tagging*
- *Disease forecasting*
- *Non lethal sampling*

- *Tagged fish move fast*
- ***Detect VHSV antibodies***
- *Acoustic and trawl same size*
- *Spawn detection*





Coordination, Synthesis, Outreach

- *Programmatic synthesis*
- *Outreach materials*

PWS Herring Survey:
Growth and Energy Allocation
in Overwintering Herring

BACKGROUND

In winter, low plankton productivity means that herring are unable to obtain all the energy needed for metabolism through foraging. In order to survive, they must rely on energy stored in the form of fat. The energy that herring obtain from feeding contributes to growth of both fat and muscle, but the allocation of that energy varies throughout the year. For example, as herring feed on abundant plankton in the fall to prepare for winter, a higher proportion of their food energy is stored as fat. Therefore, herring populations that have the highest rates of growth in the fall may have the highest likelihood of surviving the winter.

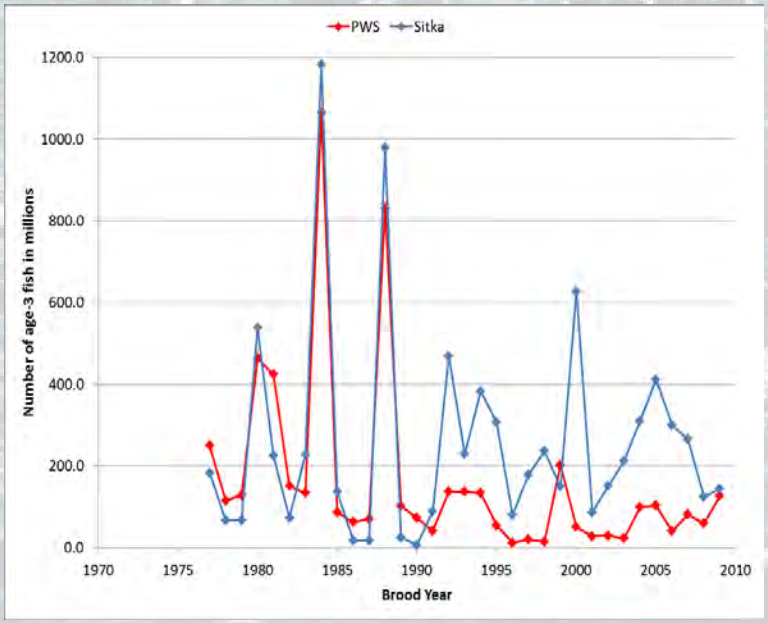
METHODS

Ron Heintz is leading a study to determine fall growth rates of juvenile herring and how their energy is allocated to fat and muscle. In the fall and spring, researchers collect age-0 herring from bays throughout Prince William Sound. The herring are analyzed to determine the amount of muscle and fat they contain, as well as their rate of growth. Their stomach contents are also examined to see if the amount and types of food the herring are eating correlate with the prey available in their habitat.

WHAT WE WILL LEARN

This study will help us learn whether fall growth is an indicator of winter survival. By comparing data from both fall and spring, we will be able to see how much of their fat stores juvenile herring use during the winter. Comparing results between different bays in PWS will help identify if certain areas are better herring habitat than others because of growth and food availability. Results from this study will also help test models of overwinter survival and aid in predictions of how herring populations may respond to changing environmental conditions.

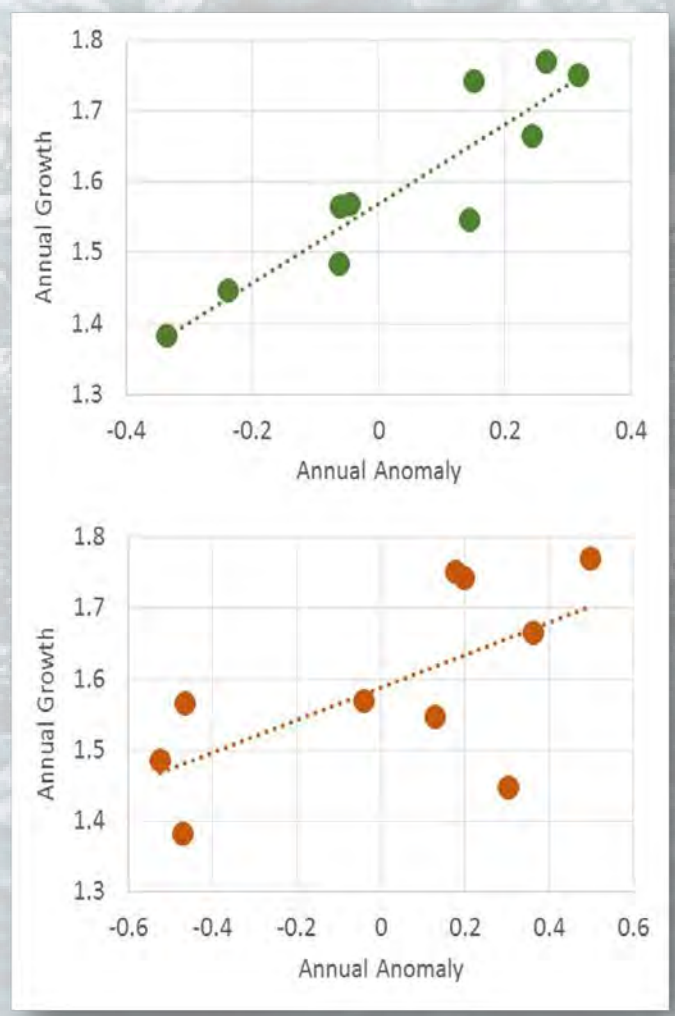
- Breadth of recruitment

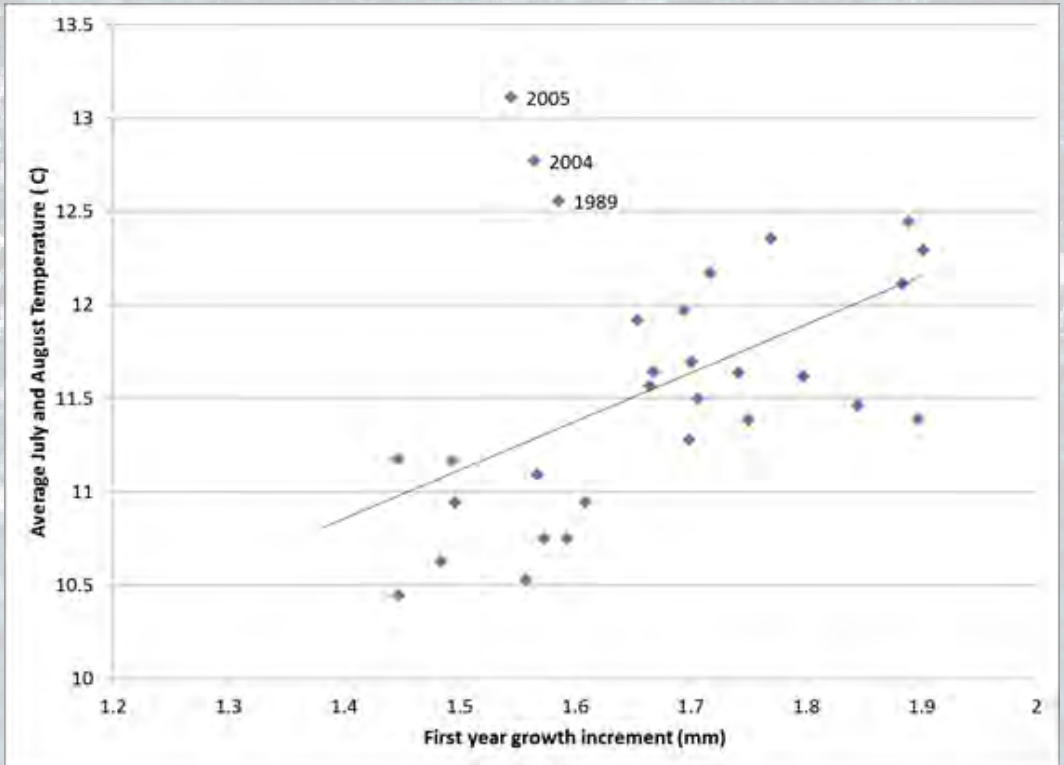


http://pwssc.org/research/?research_topic=herring

First Year Growth

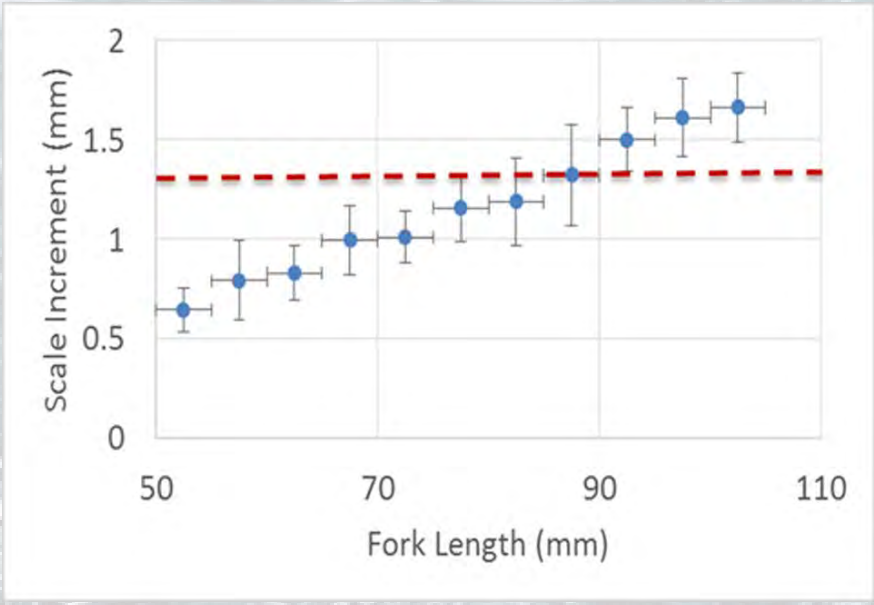
- Diatom abundance
- Summer water temperature
- Zooplankton

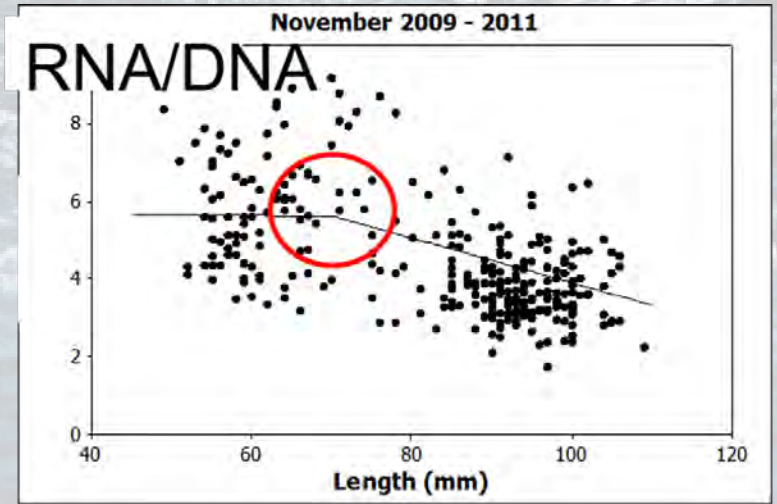


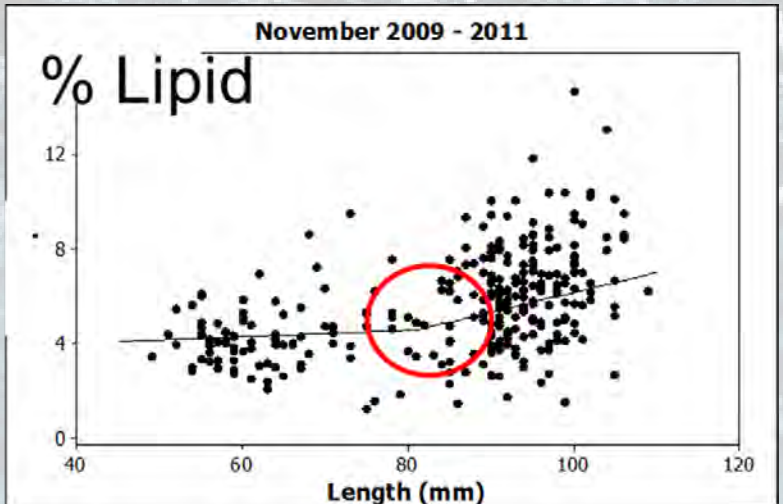


First Year Growth

- Critical size for survival
- Size relates to change in
  - Lipid storage
  - Growth







Winter Condition

- Minimum lipid level
- Typically at min in spring
- Overwinter feeding