



Herring Research and Monitoring

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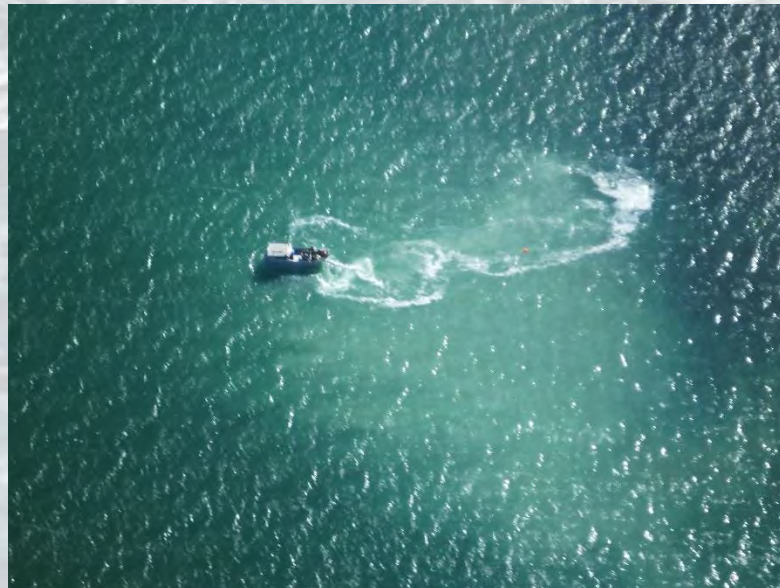


Goal and Objectives

- **Improve predictive models of herring stocks through observations and research**
- Provide information to improve the age-structure-analysis model
- Inform required synthesis effort
- Address assumptions in measurements
- Develop new approaches to monitoring

Design

- Builds on Sound Ecosystem Assessment (1996-1999) and PWS Herring Survey (2010-2013)
- Focused in Prince William Sound
- Mix of monitoring and process studies
- Dependent on Gulf Watch Alaska program



Projects

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

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

- *Herring Scale analysis*
- *Data visualization*

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

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

- *Coordination, Logistics, Education*

Provide information to improve age-structure-analysis model

Monitoring Projects

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



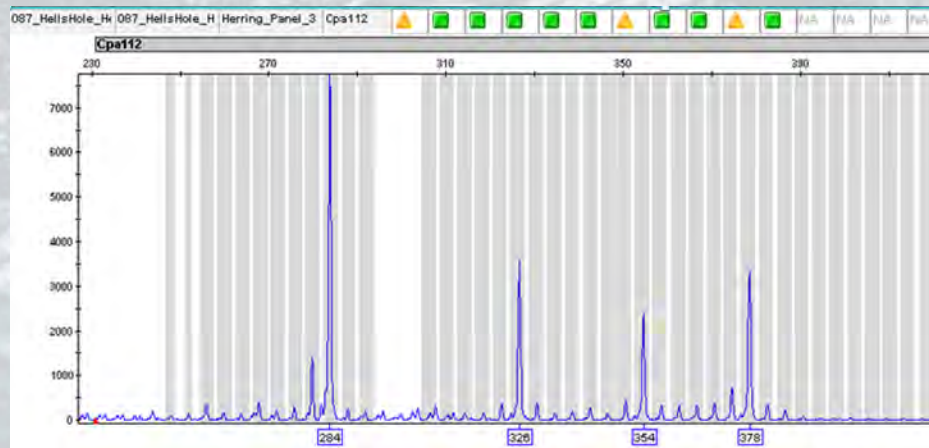
- Ichthyophonus ~30%, VHS ~0, VEN~0 (adults)
- Spawning strange in 2015
- Most years juveniles starving in spring
- 2013 and 2015 large numbers of age-1 schools

Provide information to improve age-structure-analysis model

Process Studies

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

- Preliminary genetics group east GOA herring, but separate from west
- Using Bayesian model to examine importance of various inputs.

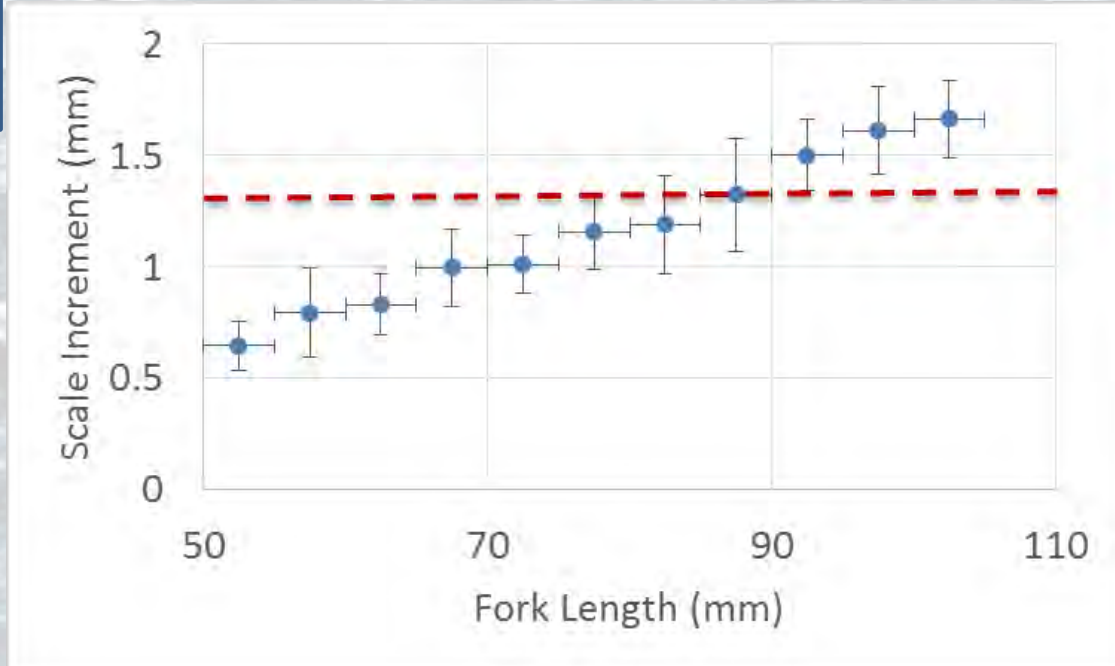


Inform required synthesis effort

Process Studies

- *Herring scale analysis*
- *Data Visualization*

- *Synthesis submitted*
- *Scale pattern suggests most survivors >75 mm*

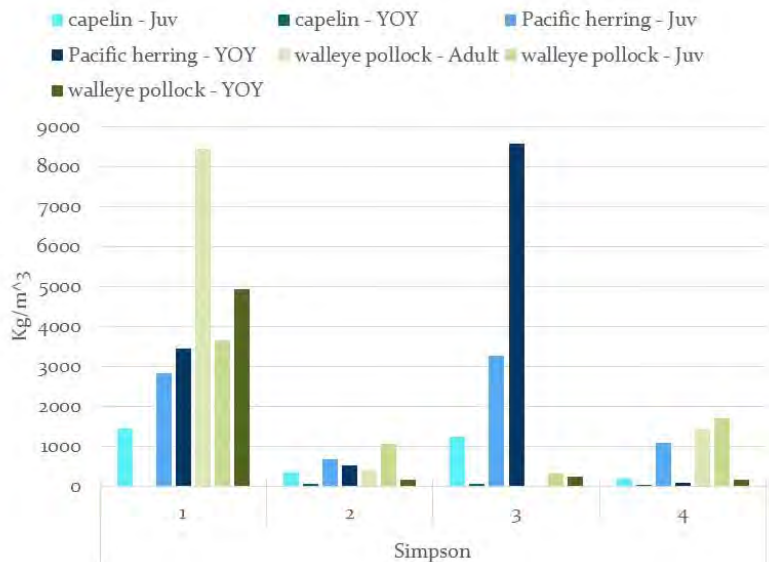


Address assumptions in measurements

Process Studies

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

Energy loss different than believed
Winter feeding and spatial patterns
Large differences between weeks
Size change when ice present
Transmission of Ichthyophonus



Develop new approaches to monitoring

Process Studies

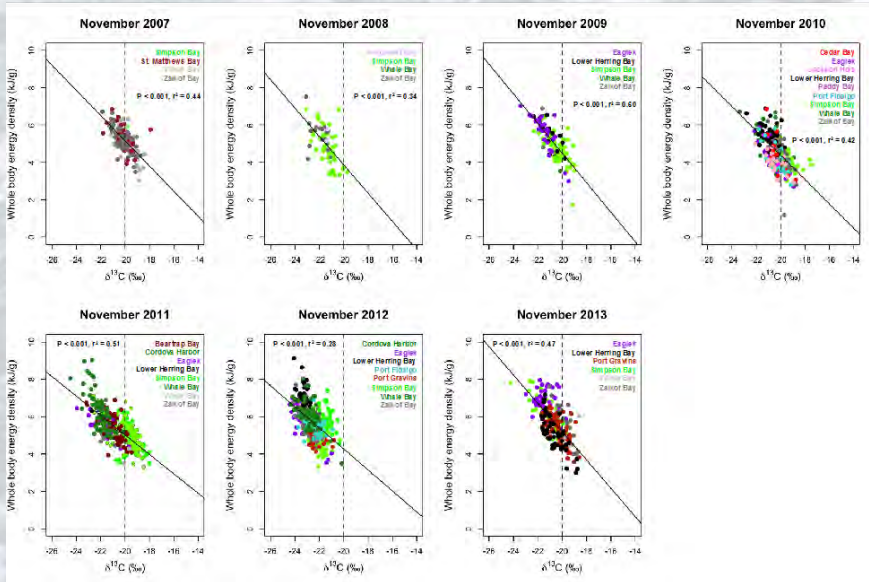
- *Herring tagging*
- *Disease forecasting*
- *Non lethal sampling*

- *Fish tagged in Gravina were observed for several months*
- *New tools for VHS and VEN monitoring*
- *Age-0 herring observed under ice*



Coordination, Synthesis, Outreach

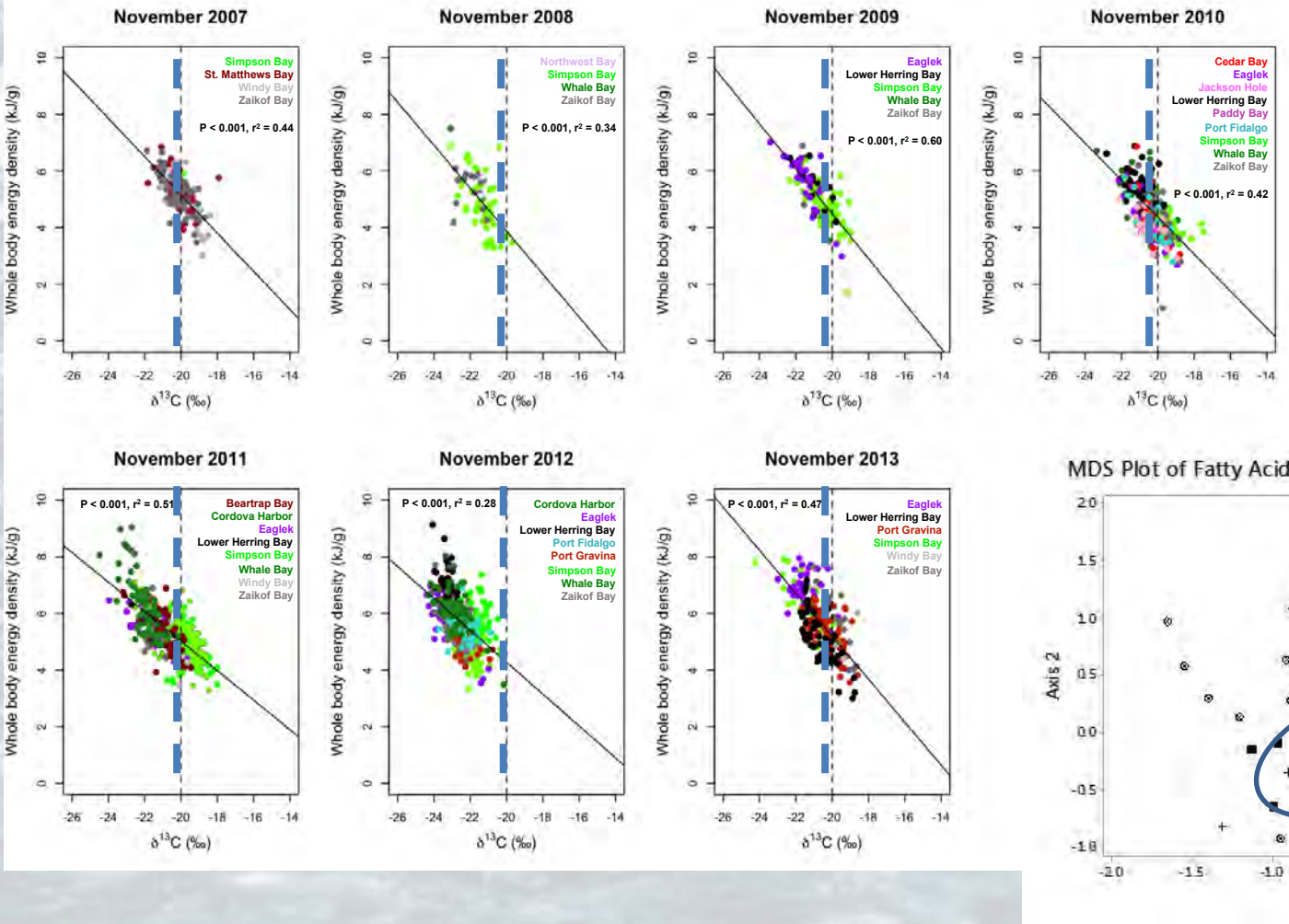
- *Programmatic synthesis*
- *Coordination*
- *Outreach*
- 2nd synthesis in 1.5 years
- Work with fishing fleet
- Website and education



<http://pwssc.org/research/fish/pacific-herring/>

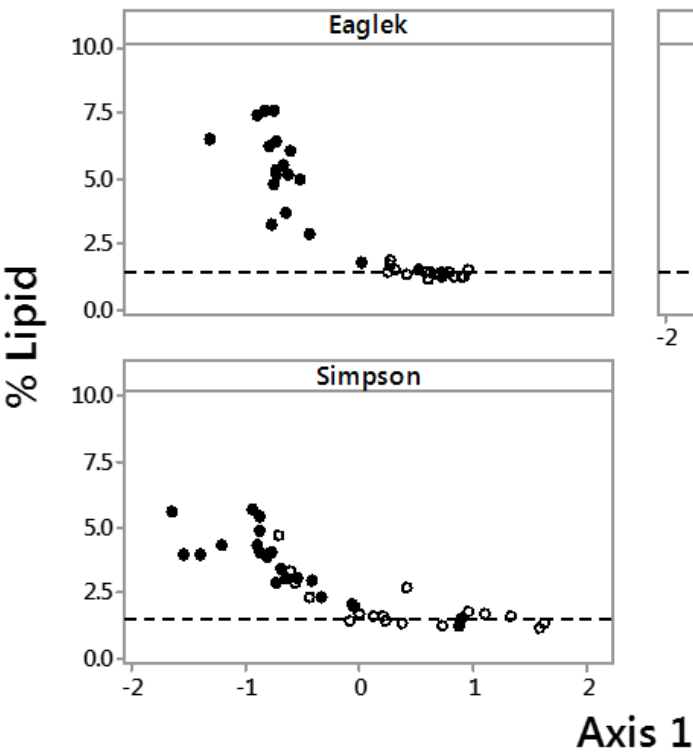
Synthesis Findings

- Spatial and temporal patterns in condition*

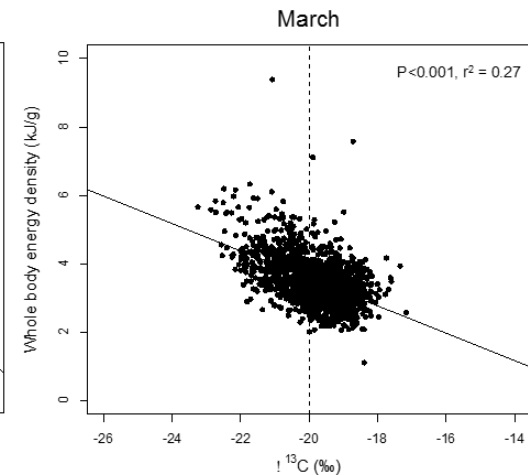
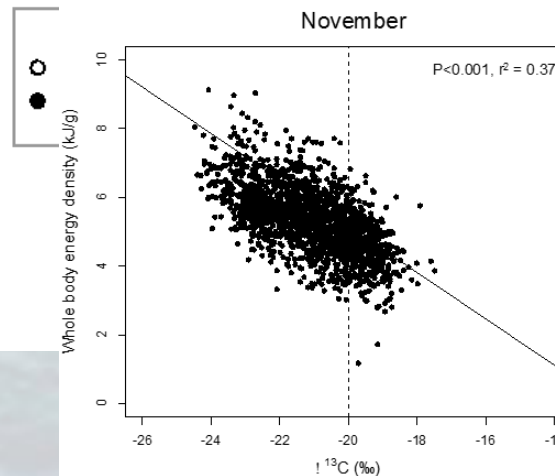


- *Critical energy and lipid levels*
- *Overwinter feeding*

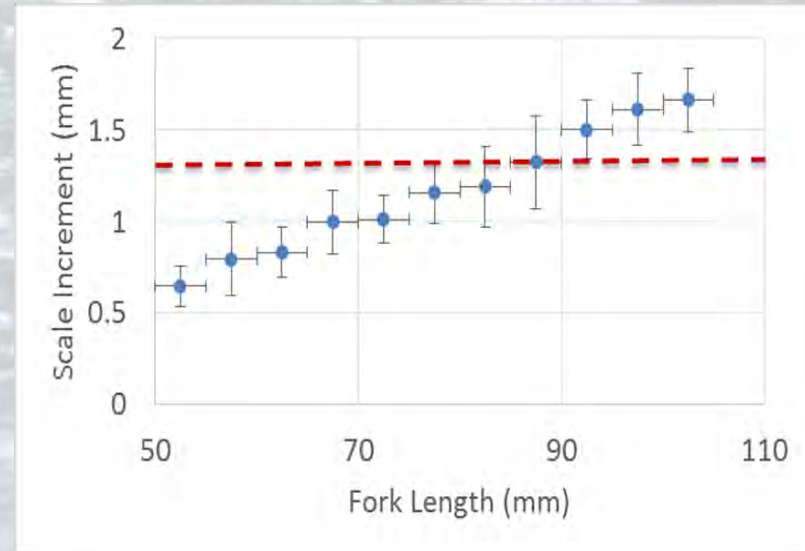
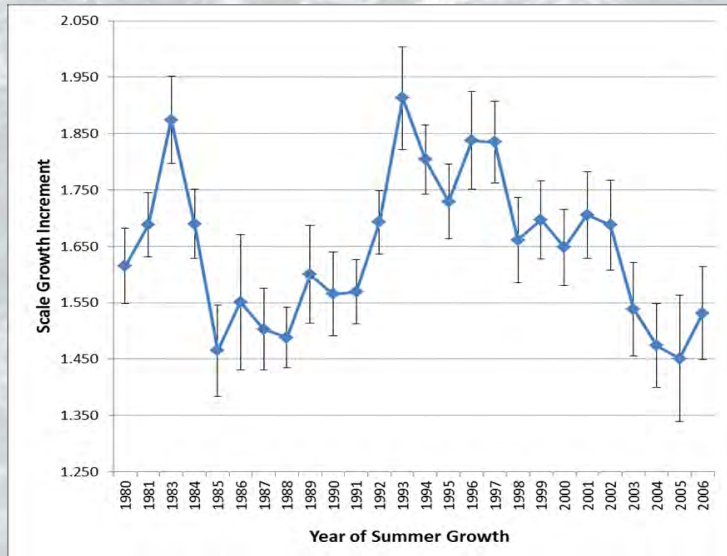
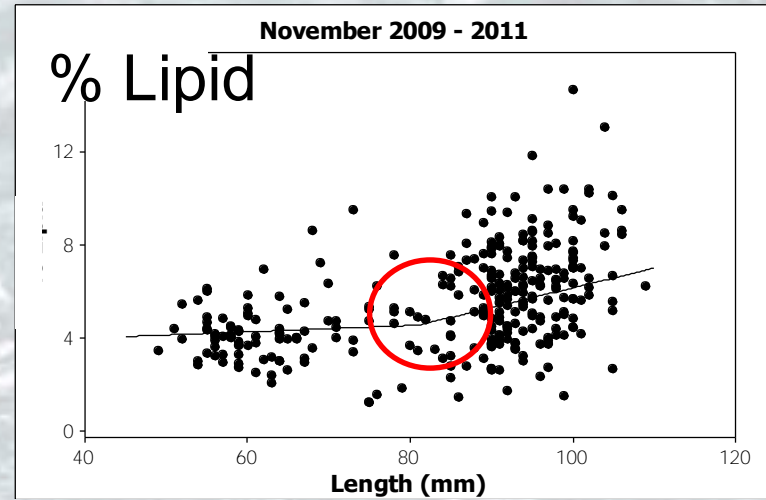
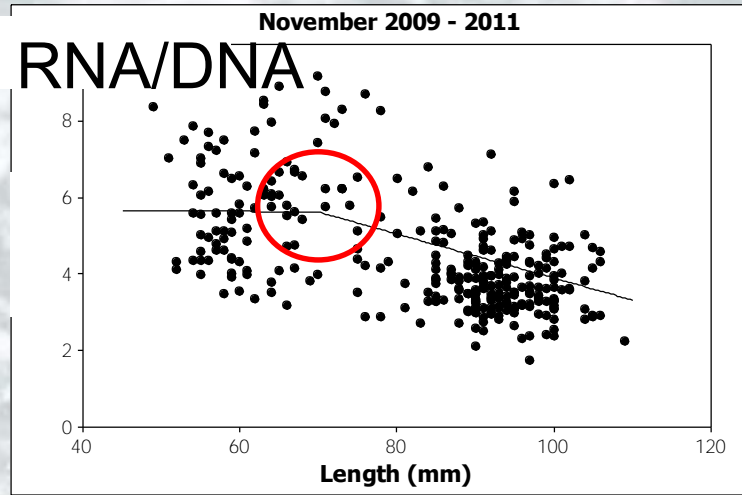
Lipid Content of Herring Collected in Winter 2010-2011



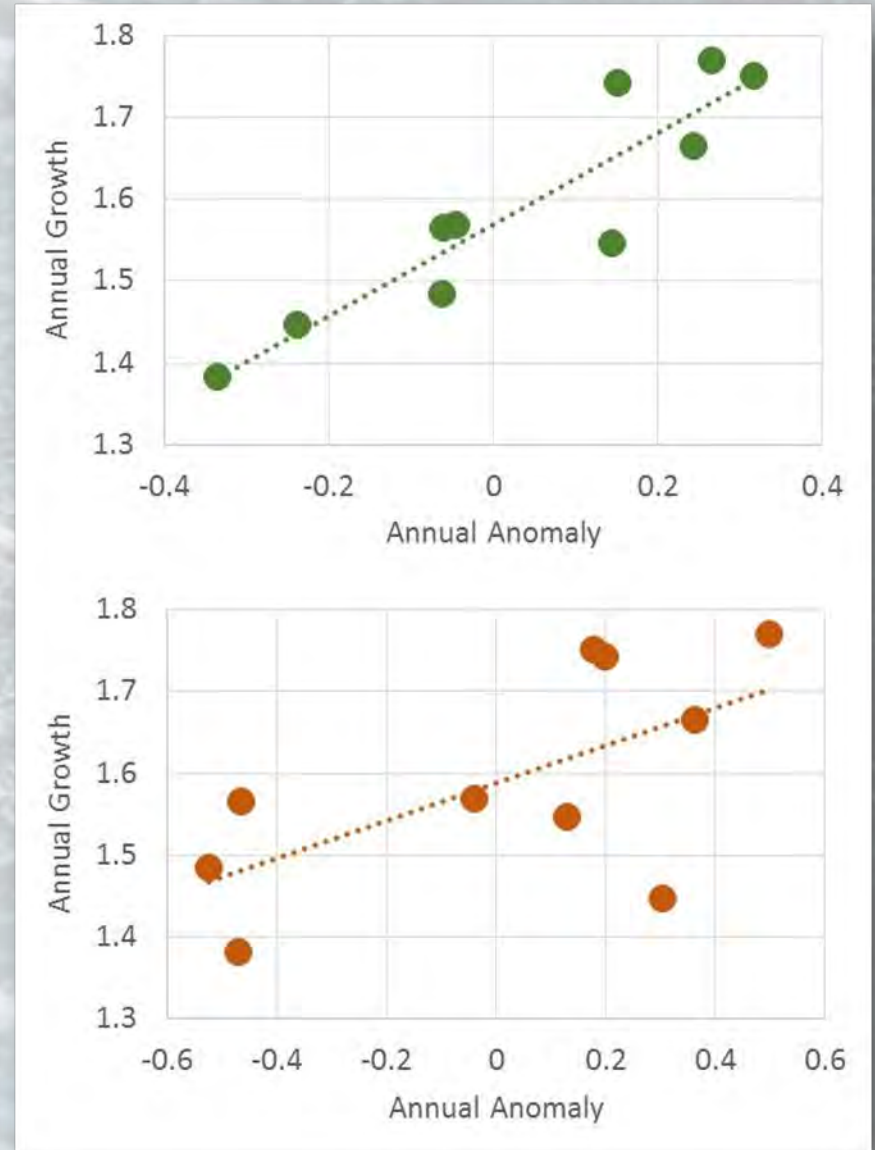
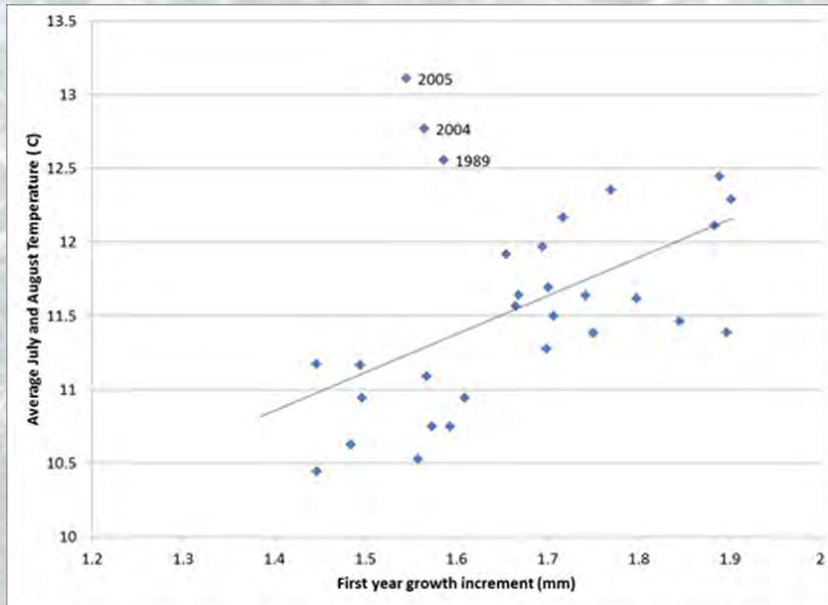
Panel variable: location



- *Size dependence*

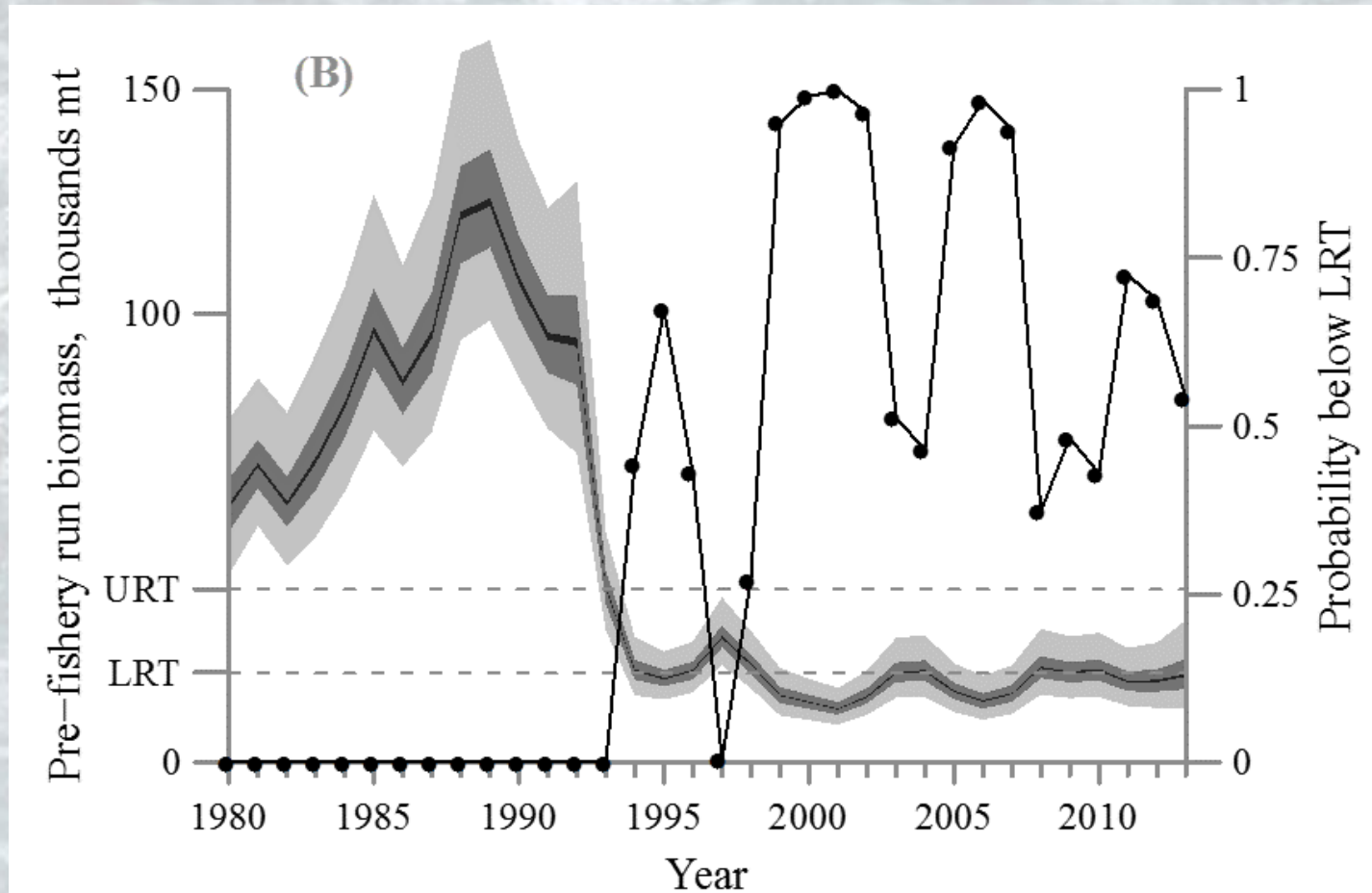


- *First year growth related to temperature and diatom abundance*

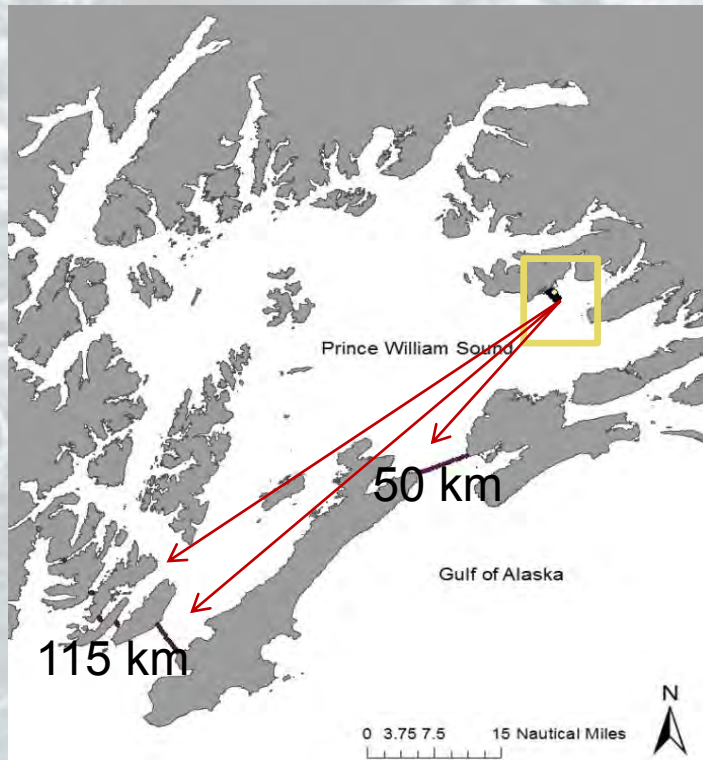


- *Model*

- *Probability of reaching management thresholds*
- *helping to identify important inputs*

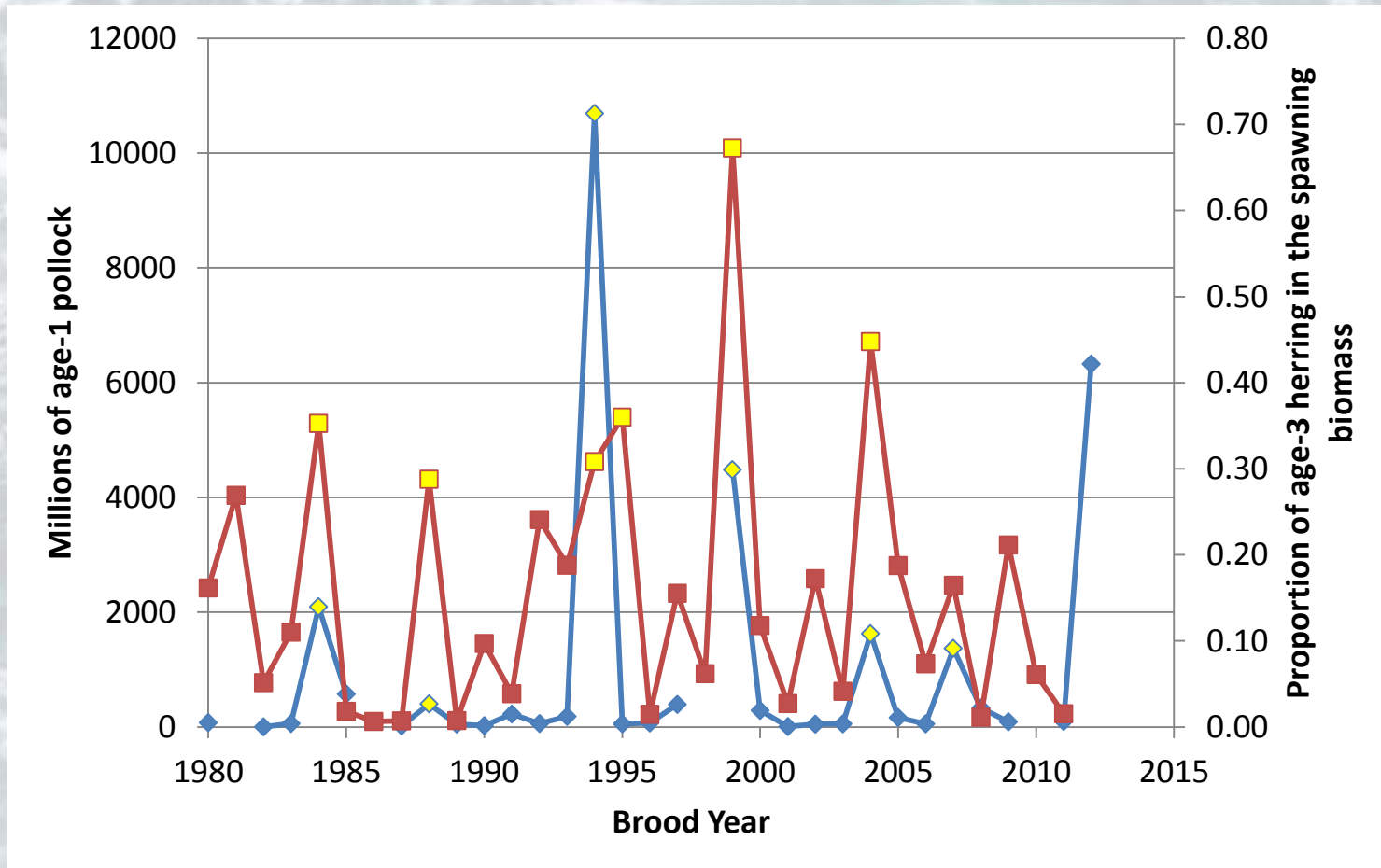


- *Adult herring spend a lot of time in Southern Montague Strait*
 - *Fish detected from April until July*
 - *Fish detected from September through December*



| <u>n=69 fish</u> | <u>% Detected</u> |
|-----------------------|-------------------|
| Hinchinbrook Entrance | 20% |
| Montague Strait | 51% |
| Southwest Passages | 31% |

- *Ties between Pacific herring and Pollock recruitment?*



Status

- *Ask ADF&G for official answer*
- *2015 population down*
 - *Warm winter temperatures?*
- *2015 age-3 recruitment?*

