

Energetic differences in young of the year walleye pollock across the Gulf of Alaska

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Background:

Young of the year (YOY) pollock need to allocate energy for growth and lipid storage to maximize their overwinter survival

Question:

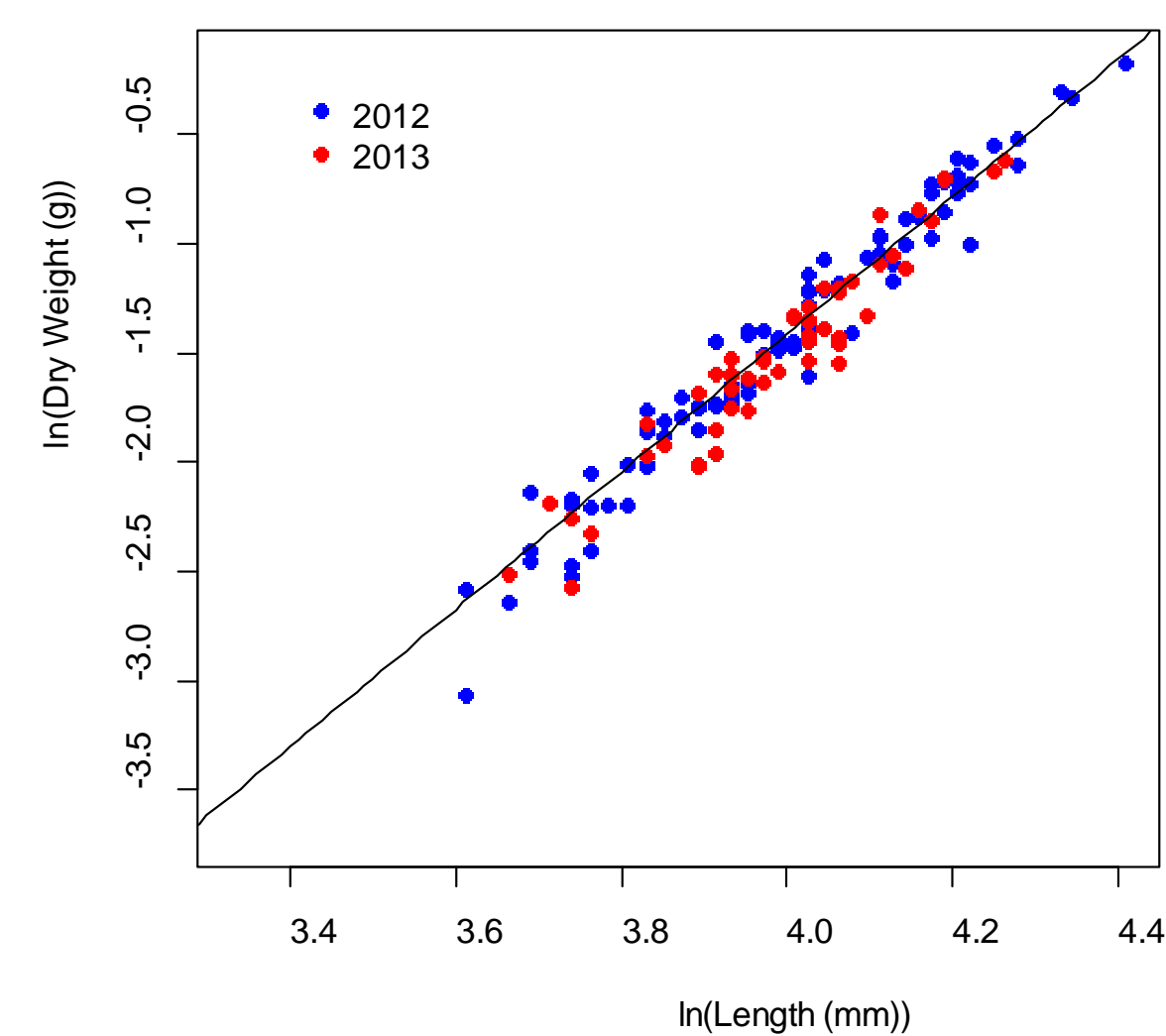
Does the nutritional condition of pollock differ between study years and Gulf of Alaska (GOA) regions?

Objectives:

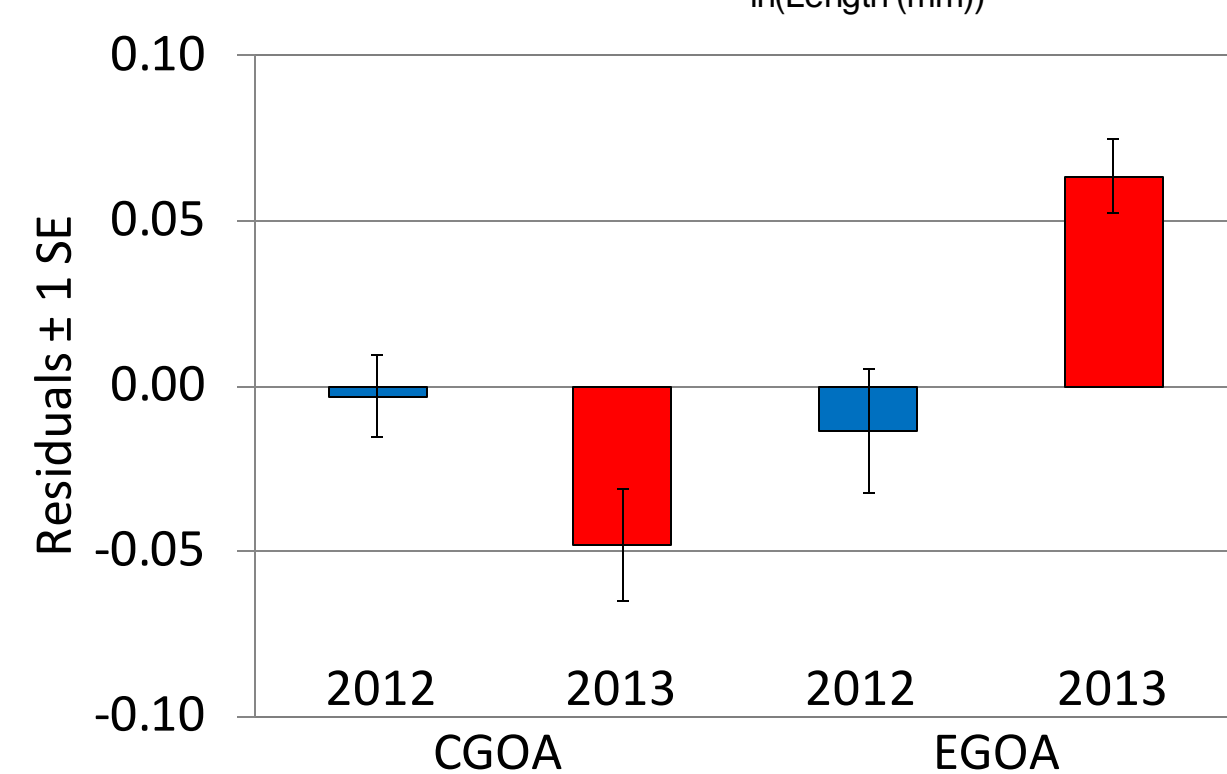
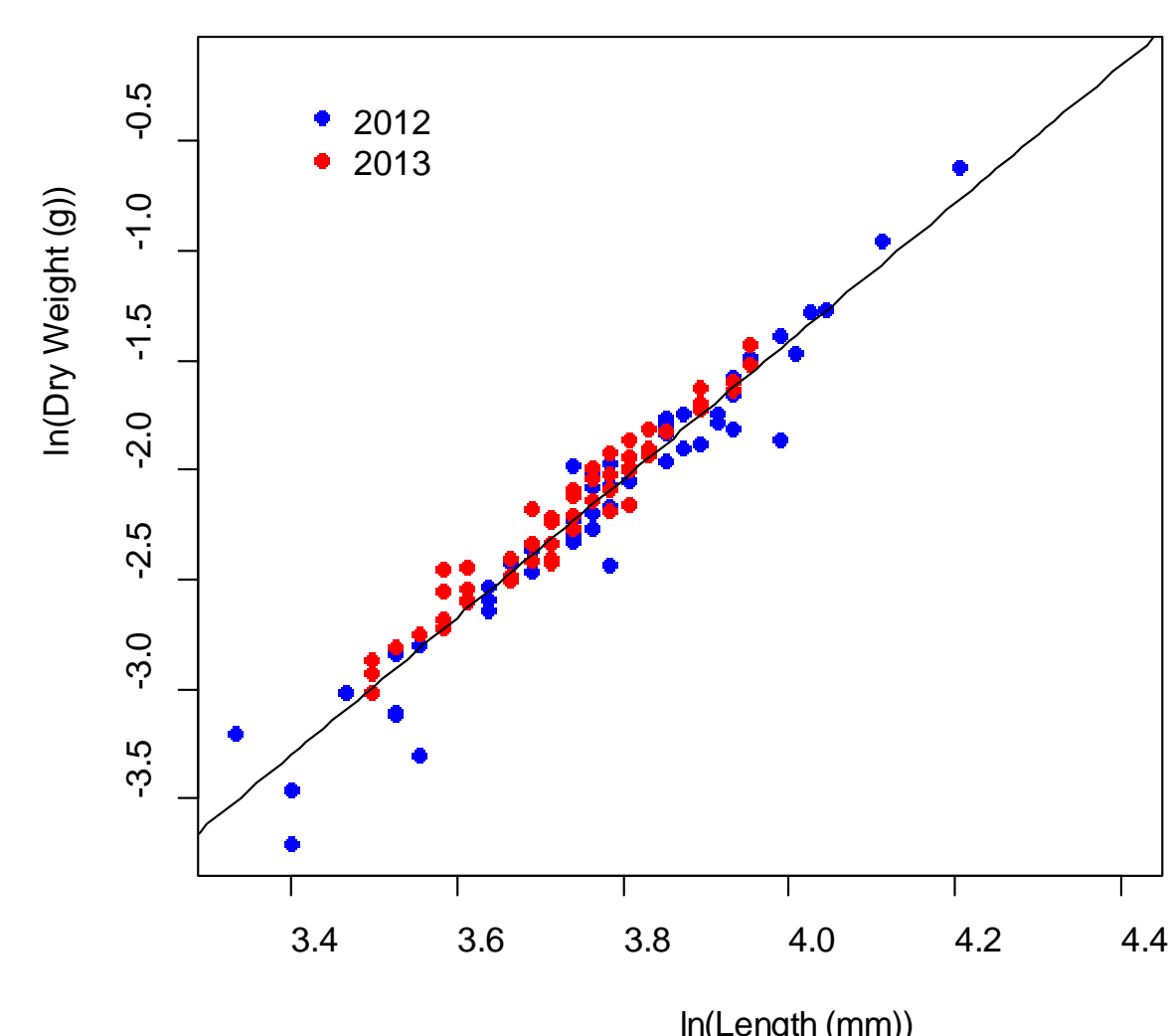
Compare body condition (dry weight/length residuals), energy storage, and diet composition across years and regions

Dry Weight/Length Residuals and Total Energy Content

CGOA Pollock



EGOA Pollock



Linear regression of YOY pollock dry weights to lengths.

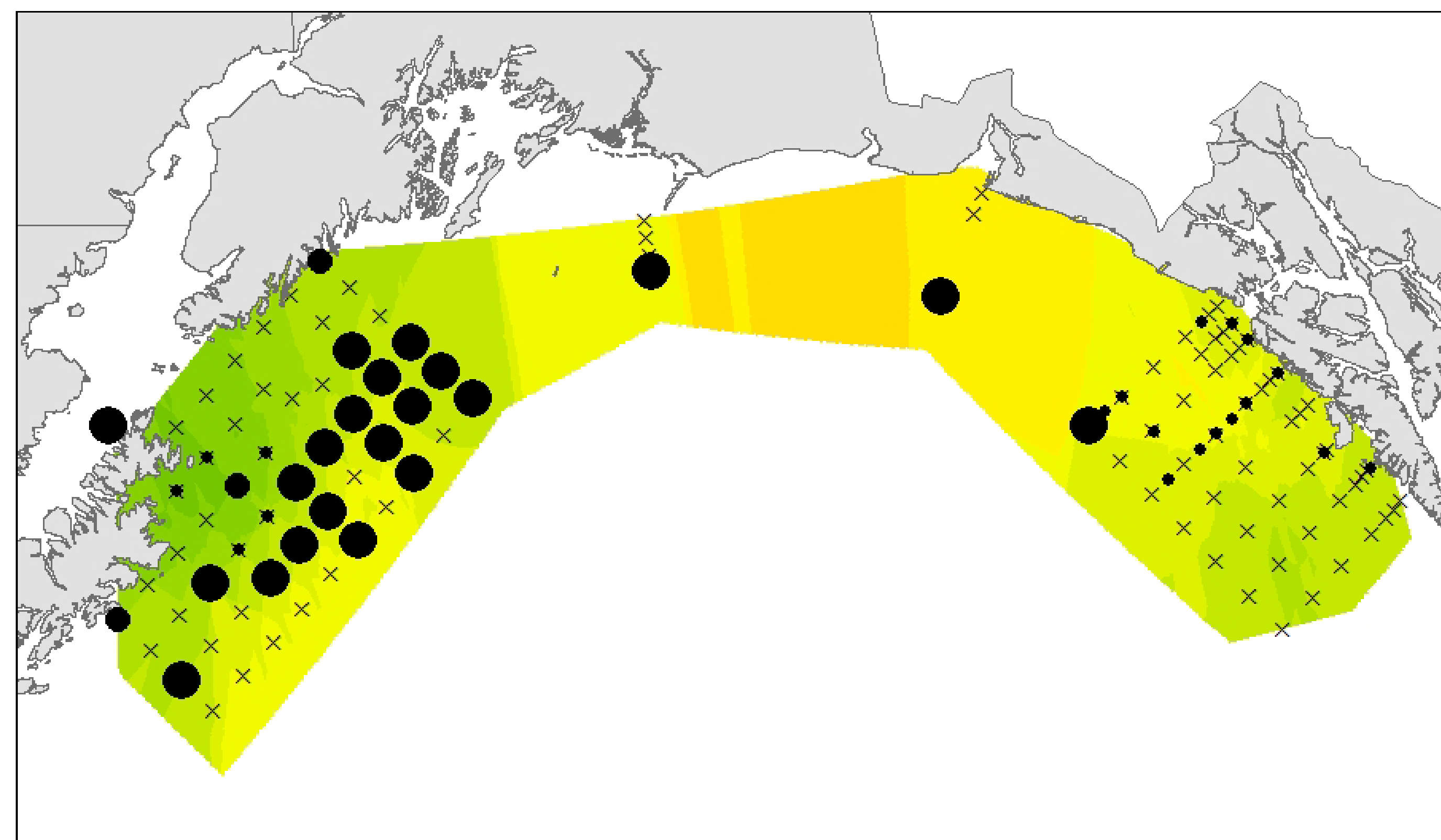
Comparing 2013 to 2012:

- Body condition was similar in the CGOA
- Body condition was better in the EGOA** (more positive residuals in 2013)

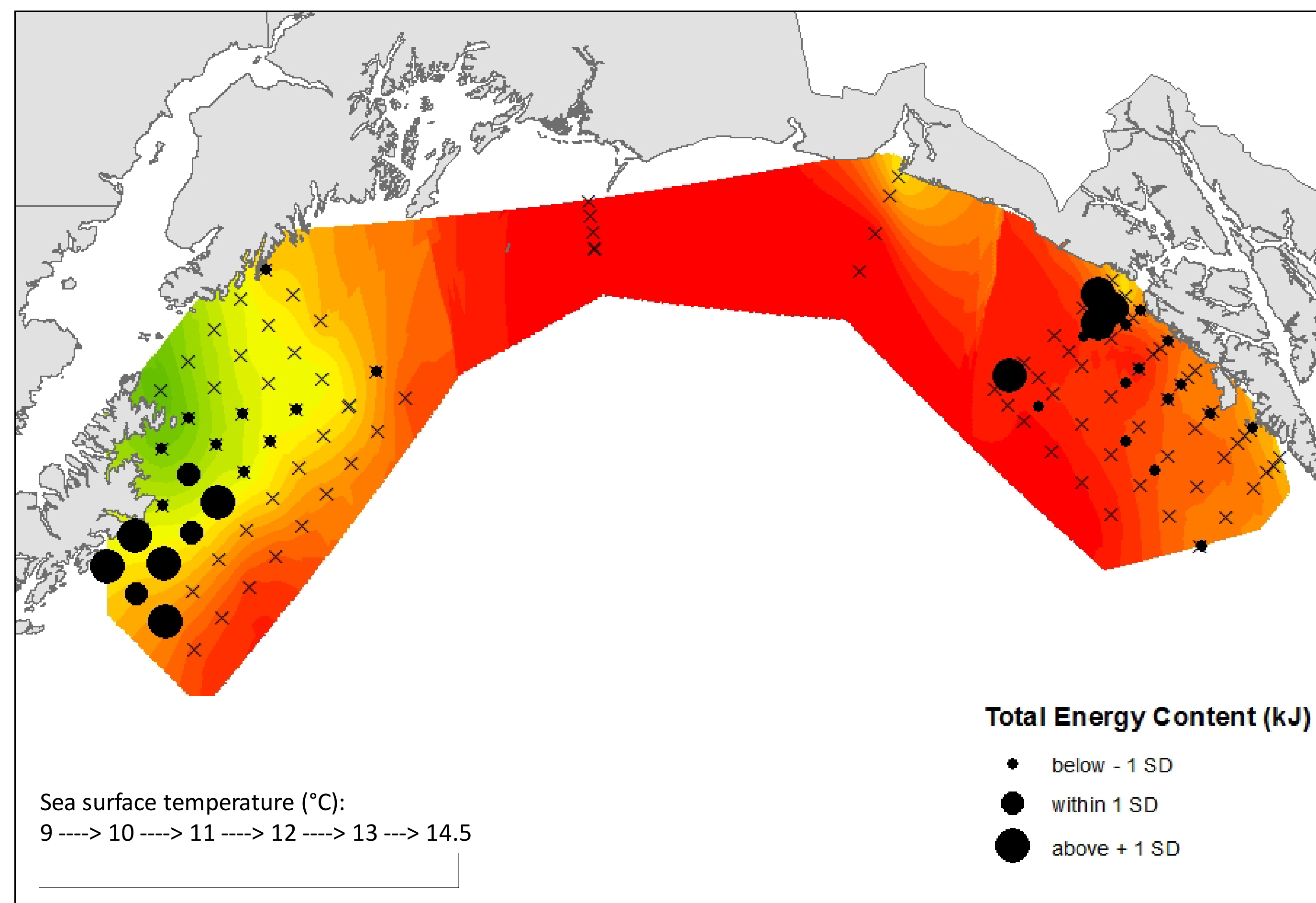
- The EGOA in 2013 had the significantly highest body condition** compared to the other year-region groups

Note: pollock were longer in the CGOA relative to the EGOA because the EGOA was sampled in July while CGOA was sampled in August

2012



2013



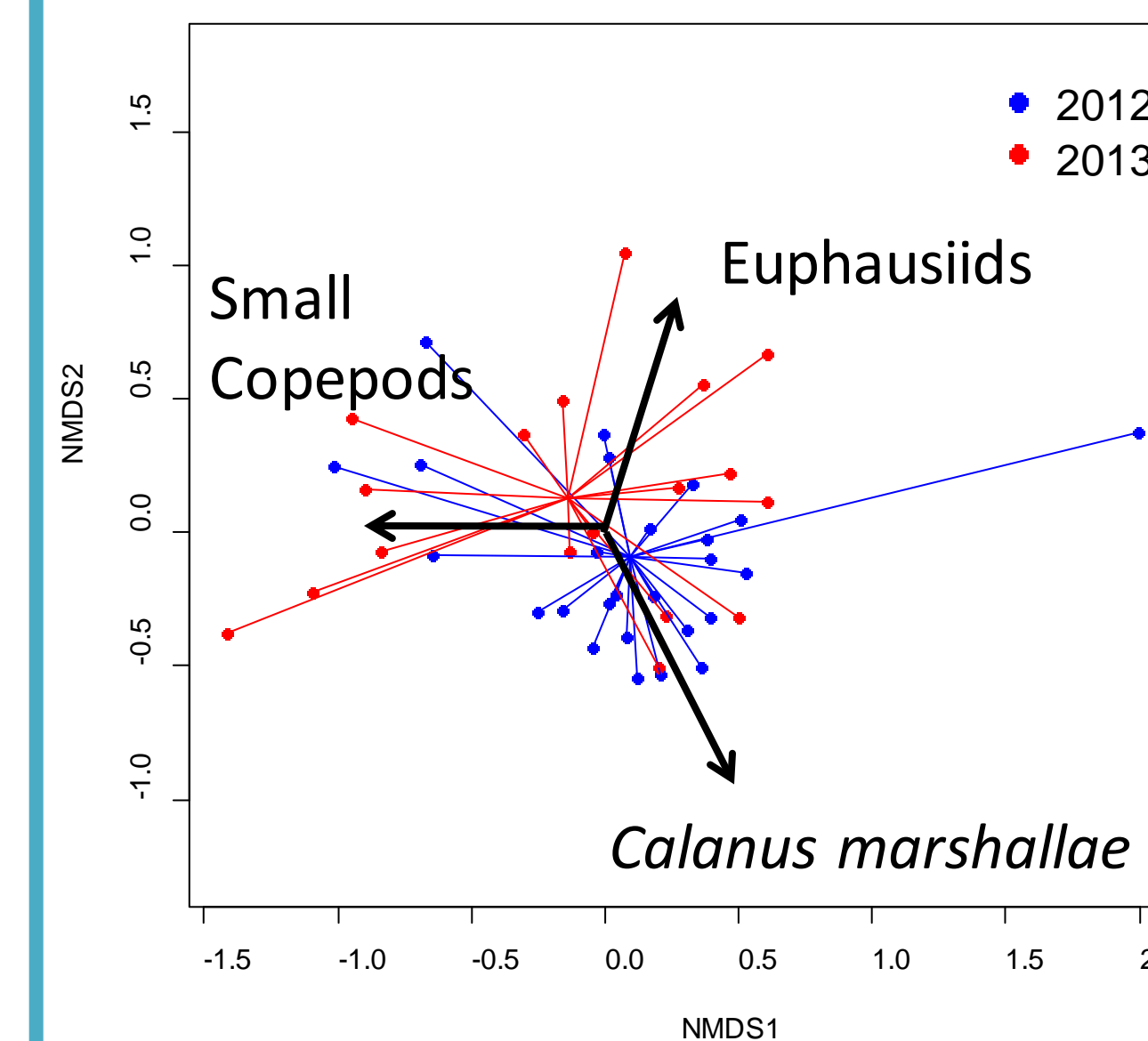
Total energy content (kJ) of YOY pollock in 2012 and 2013 overlaying the observed sea surface temperature.

Comparing 2013 to 2012:

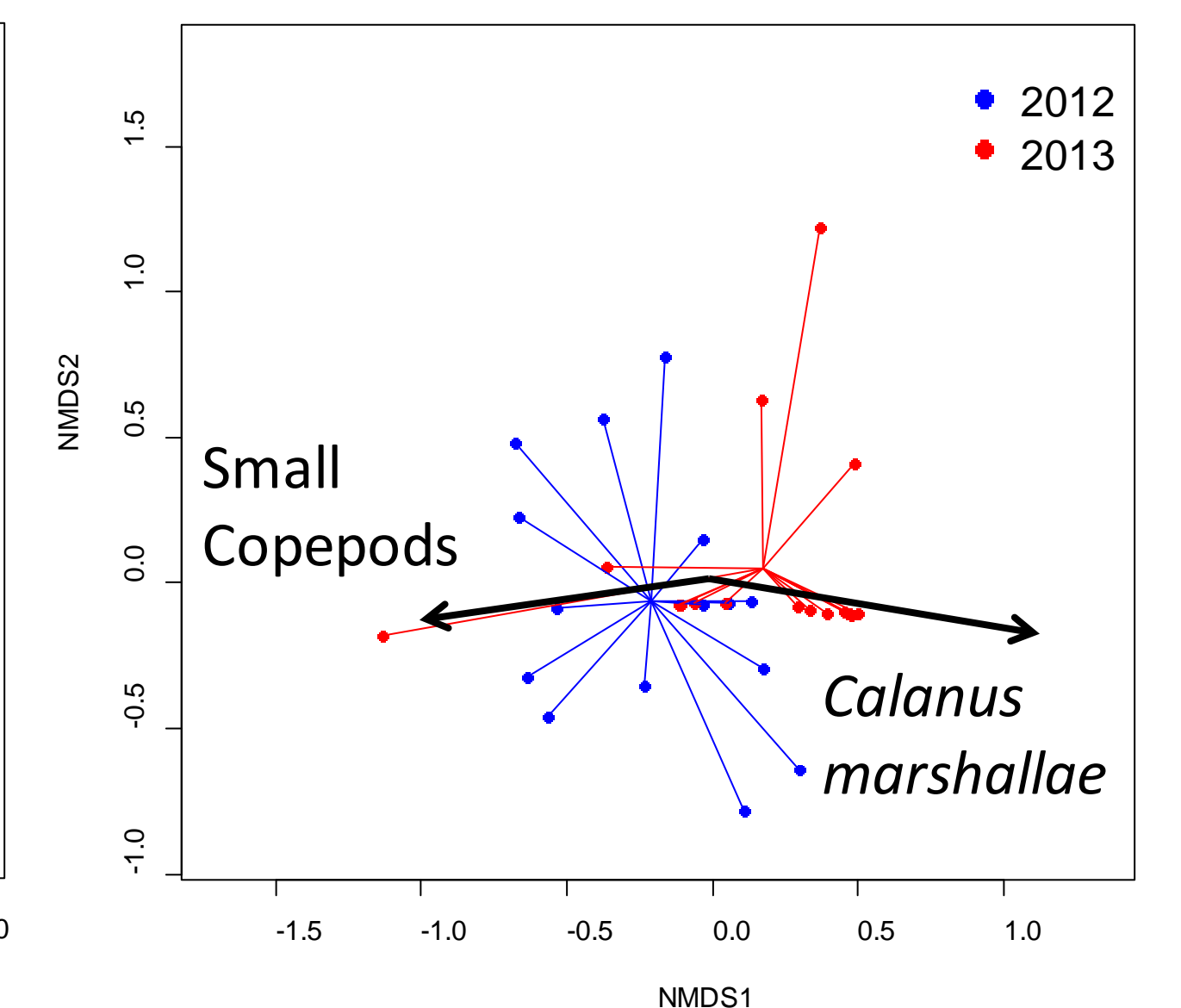
- The GOA was significantly warmer** in both regions
- Average total energy content in the central GOA was significantly lower
- Average total energy content in the eastern GOA was higher, though not statistically different

Diet Composition

CGOA Pollock



EGOA Pollock



Nonmetric multidimensional scaling of YOY pollock diet composition. Comparing 2013 to 2012:

- diets in the central GOA shifted away from *Calanus marshallae*** toward small copepods and euphausiids
- diets in the eastern GOA shifted towards *Calanus marshallae***, away from small copepods

Summary

CGOA pollock were fatter and more energetically rich than EGOA pollock in 2012

That pattern switched in 2013 with EGOA pollock having better nutritional condition.

These changes were likely driven by diet rather than by the gulfwide increase in sea surface temperature.

***Calanus marshallae* were predominant prey items in energetically rich pollock.**

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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.

The heat is on: Comparing growth potential ‘hot spots’ of young of the year walleye pollock and Pacific cod in the Gulf of Alaska

gulfofalaska.nprb.org

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Background:

Variations in temperature and food supply can affect young of the year walleye pollock and Pacific cod growth

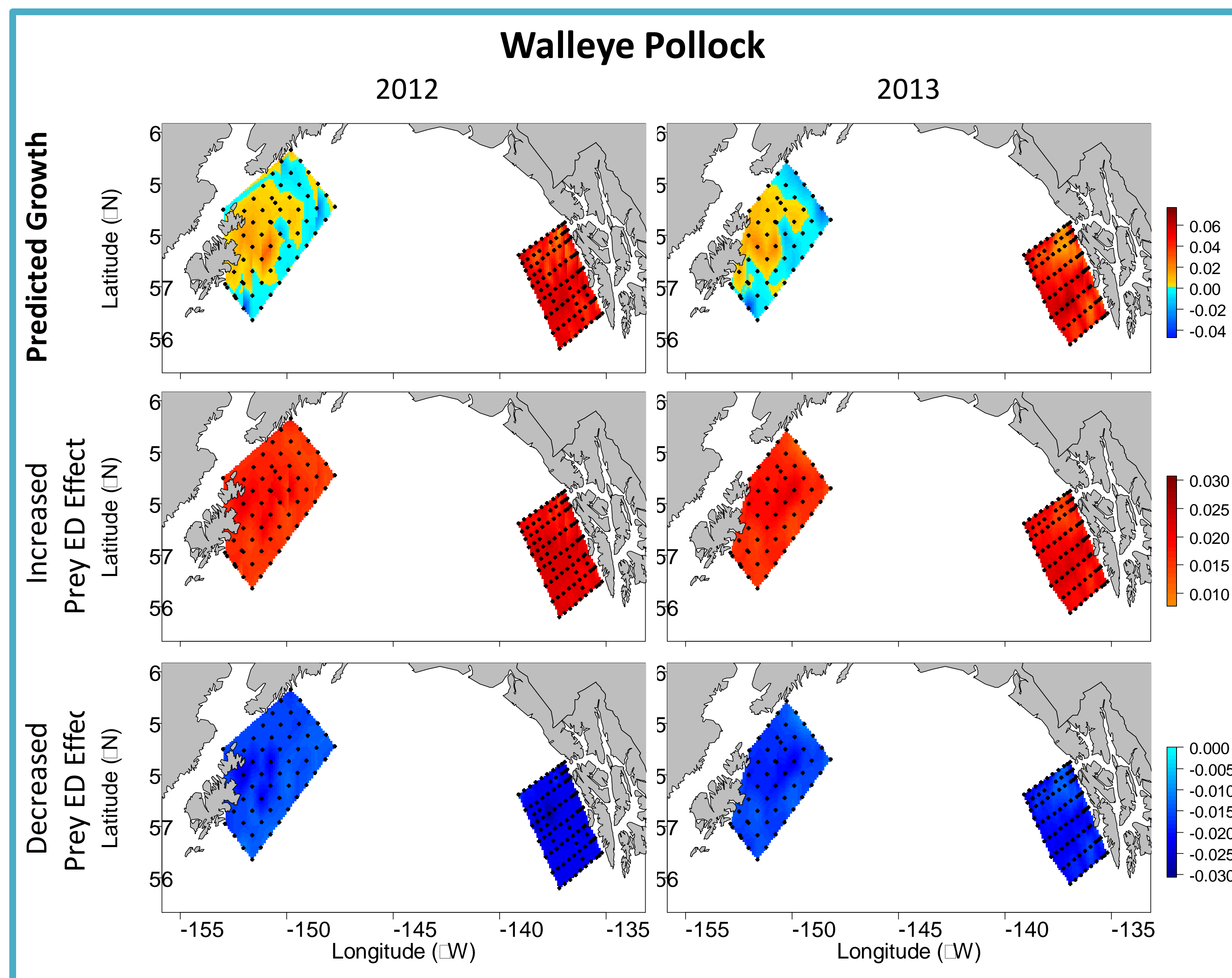
Questions:

- What affects predicted growth the most?
- Are there areas of competition between YOY pollock and P. cod in the GOA?

Objectives:

- Use bioenergetics models to predict YOY growth
- Find areas of high growth potential or ‘hot spots’
- Compare those areas between species

Bioenergetics Models

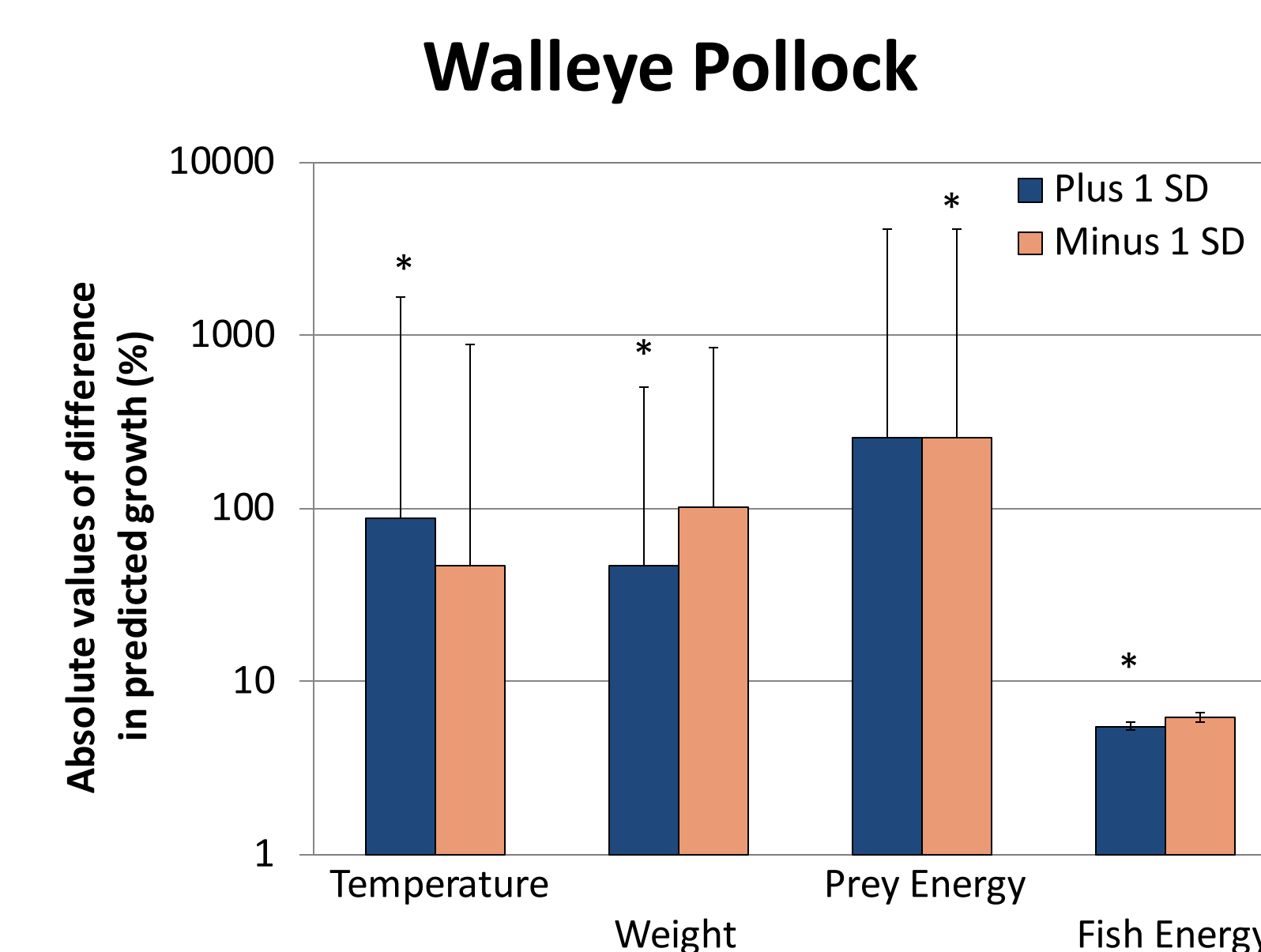


We used Wisconsin-type bioenergetics models parameterized for either juvenile pollock and cod (Cianelli et al., 1998; Siddon et al., 2013)

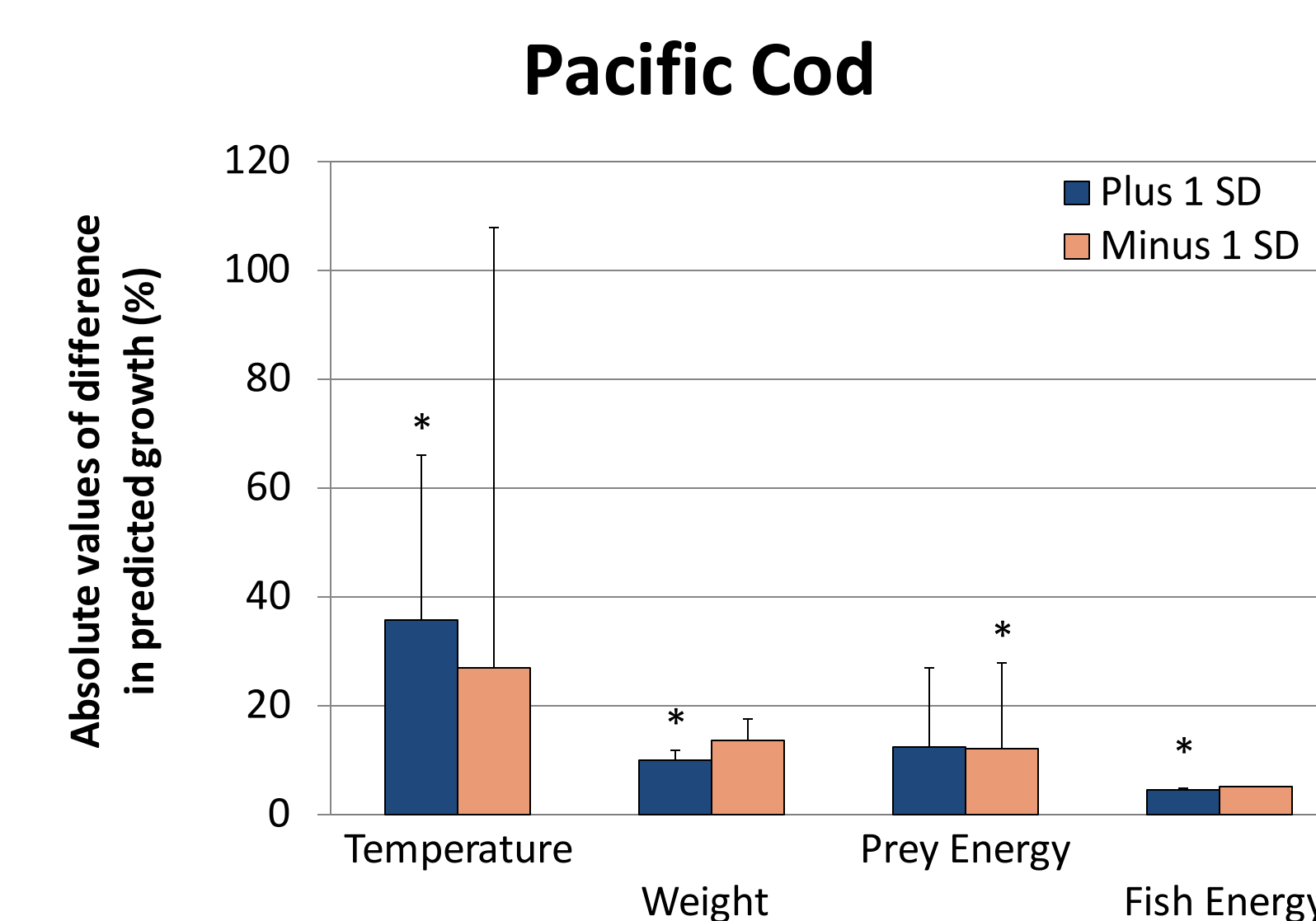
- Note: **cod consumption parameters** calculated from Sreenivasan and Heintz (*in prep*)

Sensitivity Analysis

To test effects of variables on growth, we measured the % difference in growth after increasing or decreasing each variable by 1 standard deviation. We found which variable caused the greatest change (below, * over bars indicate negative %) and plotted the spatial effects of that change (left):



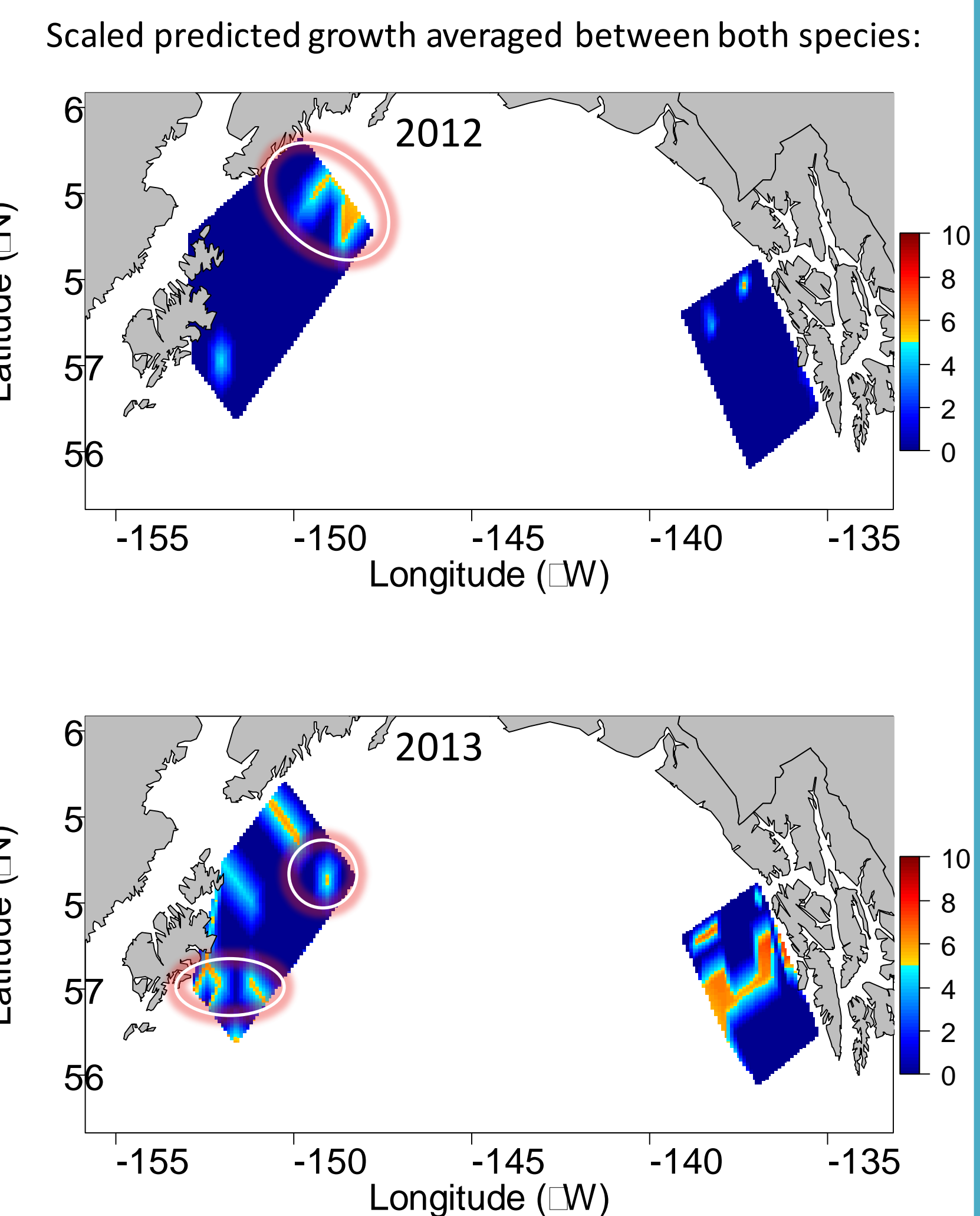
Predicted growth rate of pollock was most sensitive to prey energy density.



Predicted growth rate of cod was most sensitive to sea surface temperature.

Growth Hot Spots

We scaled the predicted growth rates for both species from 0 – 10 and compared areas with similar scaled growth:



Orange → red stations = Areas with high growth for both pollock and cod

Red circles = Areas with high pollock and cod catches per unit effort that align with high growth

Preliminary Findings

Pacific cod had higher predicted growth rates (g/g/d) than walleye pollock.

Both GOA regions contained areas where both species had relatively high predicted growth rates.

Because very few cod were caught in the eastern GOA, **potential growth hot spots that would increase interspecific competition were only in the central GOA.**

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Cianelli et al. 1998. Development and application of a bioenergetics model for juvenile walleye pollock. *Journal of Fish Biology* 52: 879-898.
Siddon et al. 2013. Spatial match-mismatch between juvenile fish and prey provides a mechanism for recruitment variability across contrasting climate conditions in the eastern Bering Sea. *PLoS ONE* 8: e84526.
Sreenivasan and Heintz. In prep. Estimation of the relationship between growth, consumption, and energy allocation in juvenile Pacific cod (*Gadus macrocephalus*) as a function of temperature and ration. *For DSR II*.

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