Seasonal bioenergetics of walleye pollock (*Theragra chalcogramma*) in the southeastern Bering Sea

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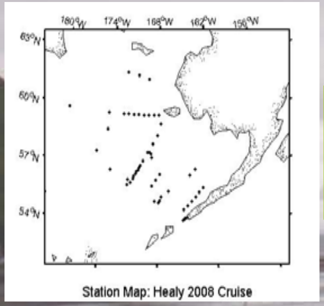
Photo: Andrew Eller

Introduction

As part of the BSIERP ichthyoplankton group, this project addresses variability in fish condition for walleye pollock (*Theragra chalcogramma*) and Pacific cod (*Gadus macrocephalus*). Differential allocation of resources (i.e., to growth or storage) may help predict survival through critical ontogenetic periods. Bioenergetics samples will be collected over three years, 2008-2010, to determine seasonal and interannual differences in energy density of age-0 fish as well as prey resources to examine environmental and trophic impacts on fish condition and survival.

Study Area



In July 2008, samples were collected in the southeastern Bering Sea during the BEST/BSIERP cruise aboard the USCG Healy.

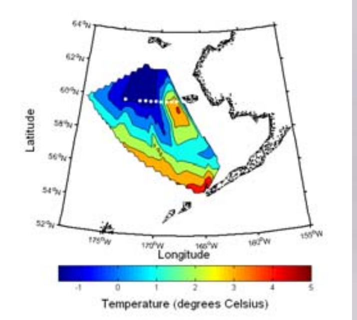
Photo: Elizabeth Calvert Siddon

Materials and Methods

- Samples are collected during the following annual surveys: NPCREP (spring), BEST/BSIERP and MACE (summer), FOCI (September), and BASIS (fall).
- Zooplankton are collected using a MOCNESS equipped with 500µm mesh.
- Meristic measurements and bioenergetic analyses are conducted at NOAA/NMFS Alaska Fisheries Science Center.


Photo: Elizabeth Calvert Siddon

Results



Examination of euphausiid samples along the MN line was conducted. Sampling locations included three stations outside the cold pool and six stations inside the cold pool (Fig. 1).

Figure 1. Extent of the cold pool (<2°C) based on minimum water temperatures during July 2008. MN line stations are overlaid.

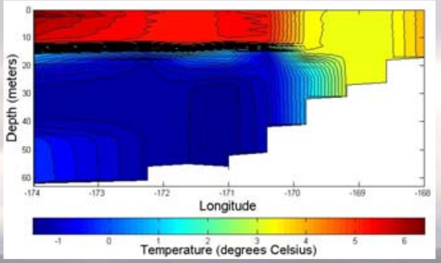


Figure 2. Vertical temperature profile along the MN line showing intense stratification of the cold pool.

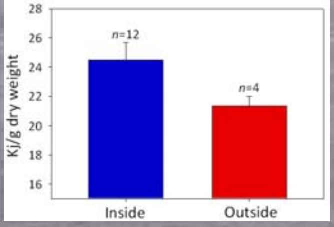


Figure 3. Euphausiid energy density relative to the cold pool.

- Euphausiids outside the cold pool (*n*=9) were significantly longer and heavier (p<0.0016) than euphausiids inside (*n*=35).
- Euphausiids outside the cold pool (*n*=4) had significantly lower energy density compared to inside (p=0.0003; Fig. 3).
- However, on a per-organism basis, euphausiids outside the cold pool contained more total energy.

	Mean	Standard deviation (±1 SD)
Length (mm)	10.8	1.51
Wet weight (mg)	8.83	4.06
% Dry mass	12.5%	3.34
% Lipid (dry mass)	11.4%	2.84
% Fat-free dry mass	88.6%	

Table 1. Meristic measurements for walleye pollock sampled during July 2008 (*n*=103 fish; *n*=6 composite samples for % lipid determination).

Walleye pollock collected near the Pribilof Islands showed unusually high lipid content (Table 1), the significance of which is currently unknown.

Discussion

Interannual variation in energy density (Fig. 4) may result from environmental differences, changes in prey quality or quantity, or interactive effects, affecting growth and survival of age-0 fish. In 2007, walleye pollock collected during fall showed higher energy density than previous years, suggesting adequate energy content for overwintering survival. Understanding what drives interannual changes in fish condition, particularly during the larval stage during which larvae are subject to local advection and current patterns, will help predict cohort survival and recruitment success.

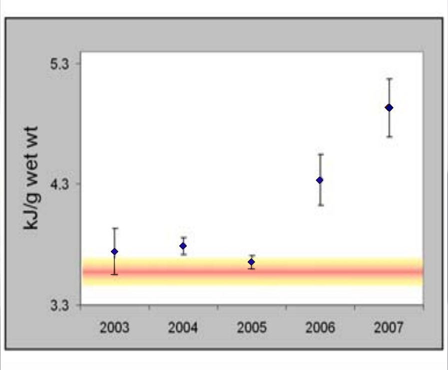


Figure 4. Energy density of walleye pollock collected during annual BASIS surveys. Horizontal band represents mean (±95% CI) energy density of age-1 walleye pollock sampled at the end of winter.

Outlook

Seasonal bioenergetic analysis of ichthyoplankton and prey species across multiple years will allow us to address environmental and trophic effects on survival of ago-0 fish. Combined with future work to develop a larval drift model for ichthyoplankton in the southeastern Bering Sea in conjunction with NOAA/AFSC, we will develop hypotheses regarding oceanographic influence on fish condition.

Acknowledgments

Thanks to NPRB and the BSIERP project as well BEST for allowing our participation in the Healy 2008 survey. Funding is provided by NPRB, NOAA/NMFS/AFSC, and UAF School of Fisheries and Ocean Sciences. Special thanks to Alexei Pinchuk for zooplankton identification and to Angela Feldmann for analysis of 2003-2006 BASIS data.

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