

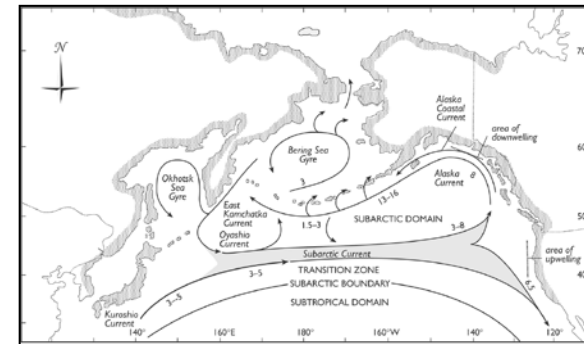


NOAA
FISHERIES

Alaska Fisheries
Science Center

Defining Critical Periods for Yukon River Chinook Salmon

PICES Workshop Nov. 3, 2016



Ed Farley¹ (Presenter)

Co-authors: Ellen Yasumiishi¹, Kerim Aydin¹, Kelly Kearney¹, Albert Herman², and Kathrine Howard³

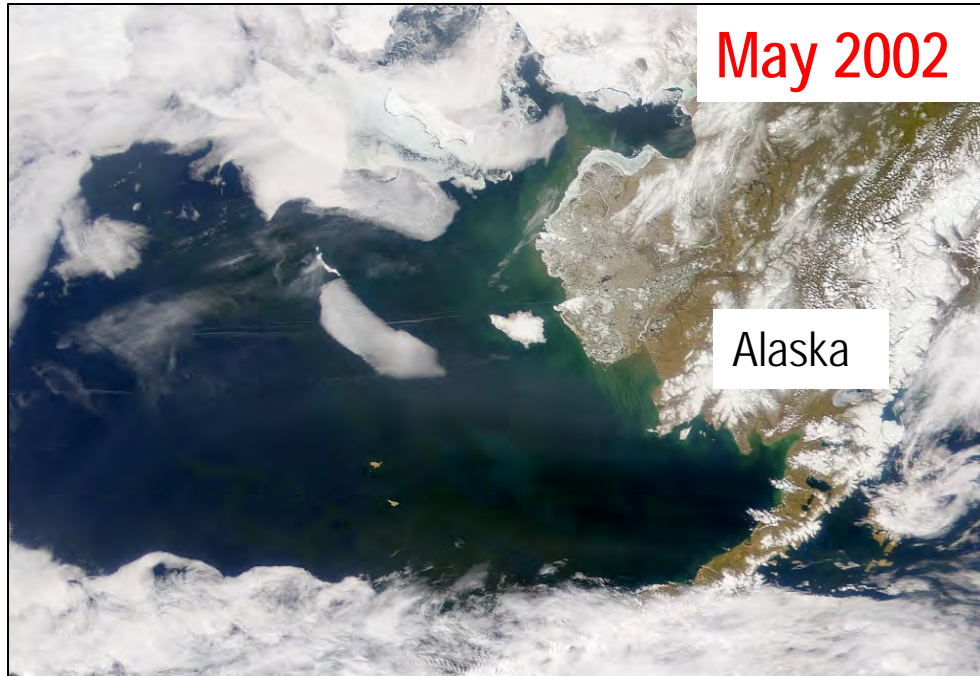
- ¹Alaska Fisheries Science Center
- ²Pacific Marine Environmental Laboratory
- ³Alaska Department of Fish and Game

North Pacific Research Board #1423

The role of the northern Bering Sea in modulating Arctic environments

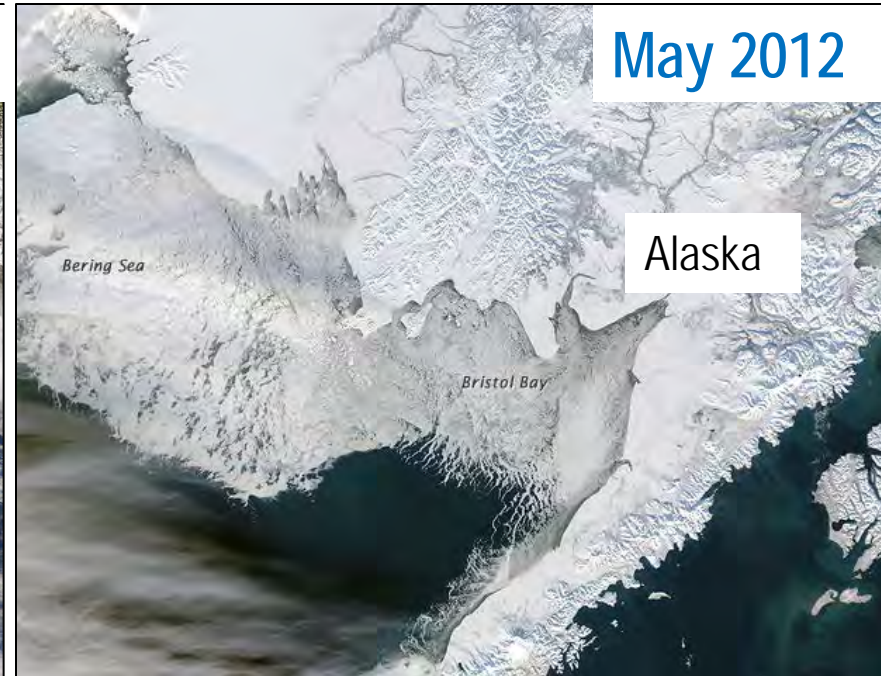
Early Ice Retreat

2002 to 2005



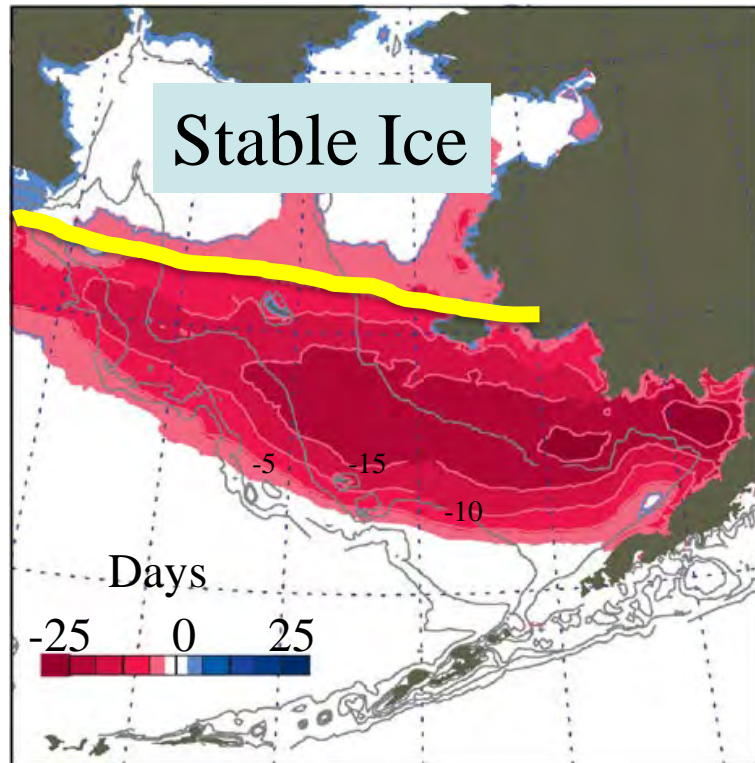
Late Ice Retreat

2007 to 2012

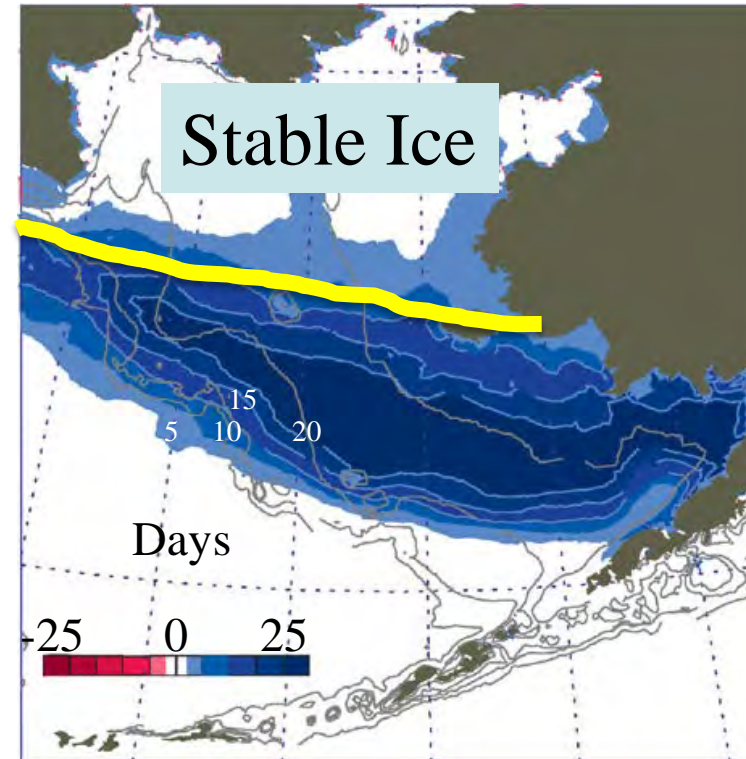


Future Ocean Conditions: The North Will Remain Cold and Dark

Warm years
(2001-2005)



Cold years
(2007-2010)

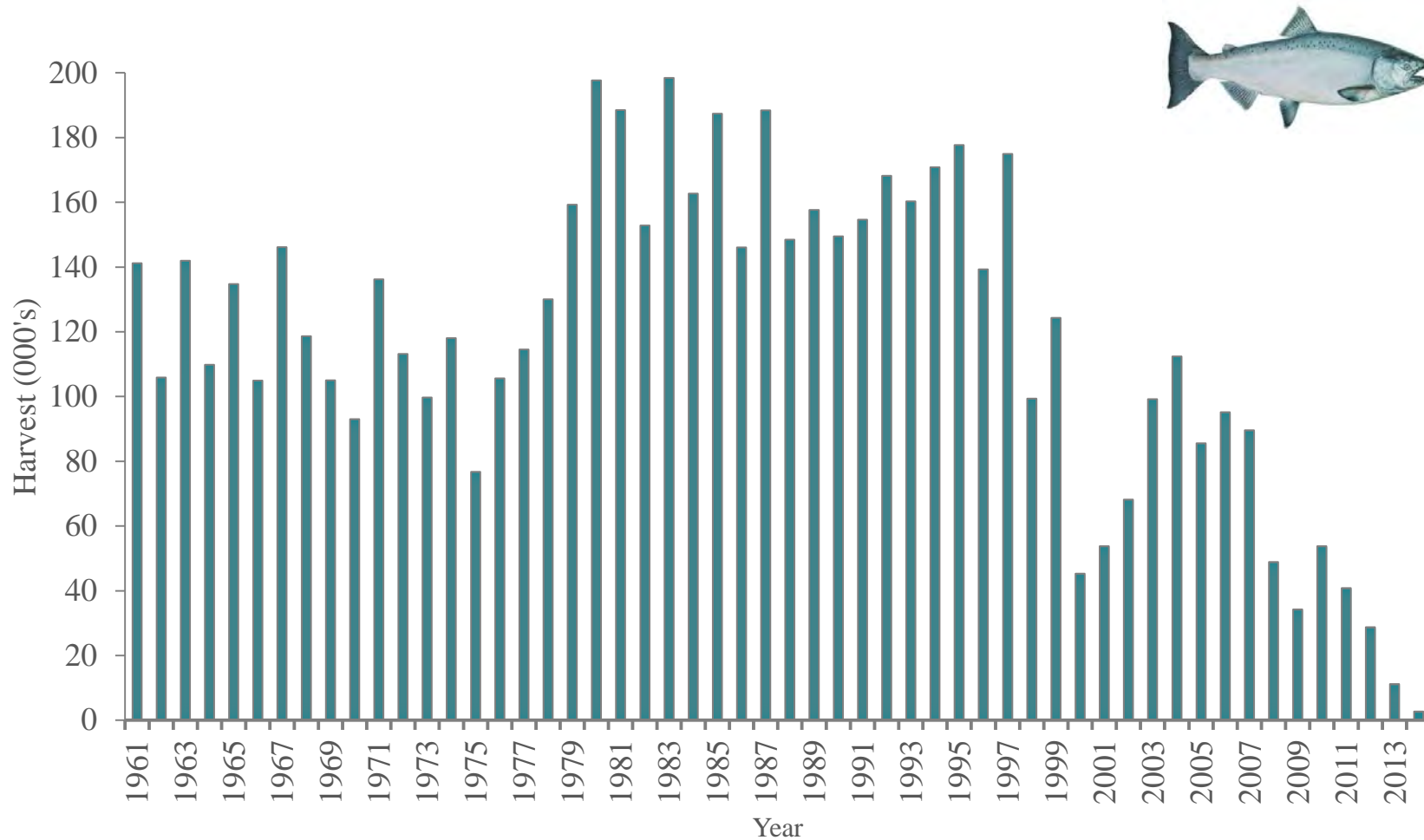


Stabeno, P.J., E.V. Farley, Jr., N.B. Kachel, S. Moore, C. Mordy, J. Napp, J. Overland, A. Pinchuk, and M. Sigler. 2012. A comparison of the physics of the northern and southern shelves of the eastern Bering Sea and some implications for the ecosystem. *Deep Sea Res. II* 65-70:14-30.

Yukon River Basin



Issue: Yukon River Chinook Salmon Harvest (1961-2014)



JTC. (Joint Technical Committee of the Yukon River US/Canada Panel). 2015 Yukon River salmon 2014 season summary and 2015 season outlook. Alaska Department of Fish and Game, Division of Commercial Fisheries, Regional Information Report 3A15-01, Anchorage.

Critical Size and Period Hypothesis and Climate

Critical Periods

First Spring

Faster growing Chinook
escape predation

Spring bloom timing,
production and temperature

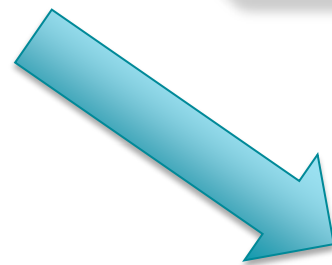
First Winter

Larger and more energetic
Chinook survive winter

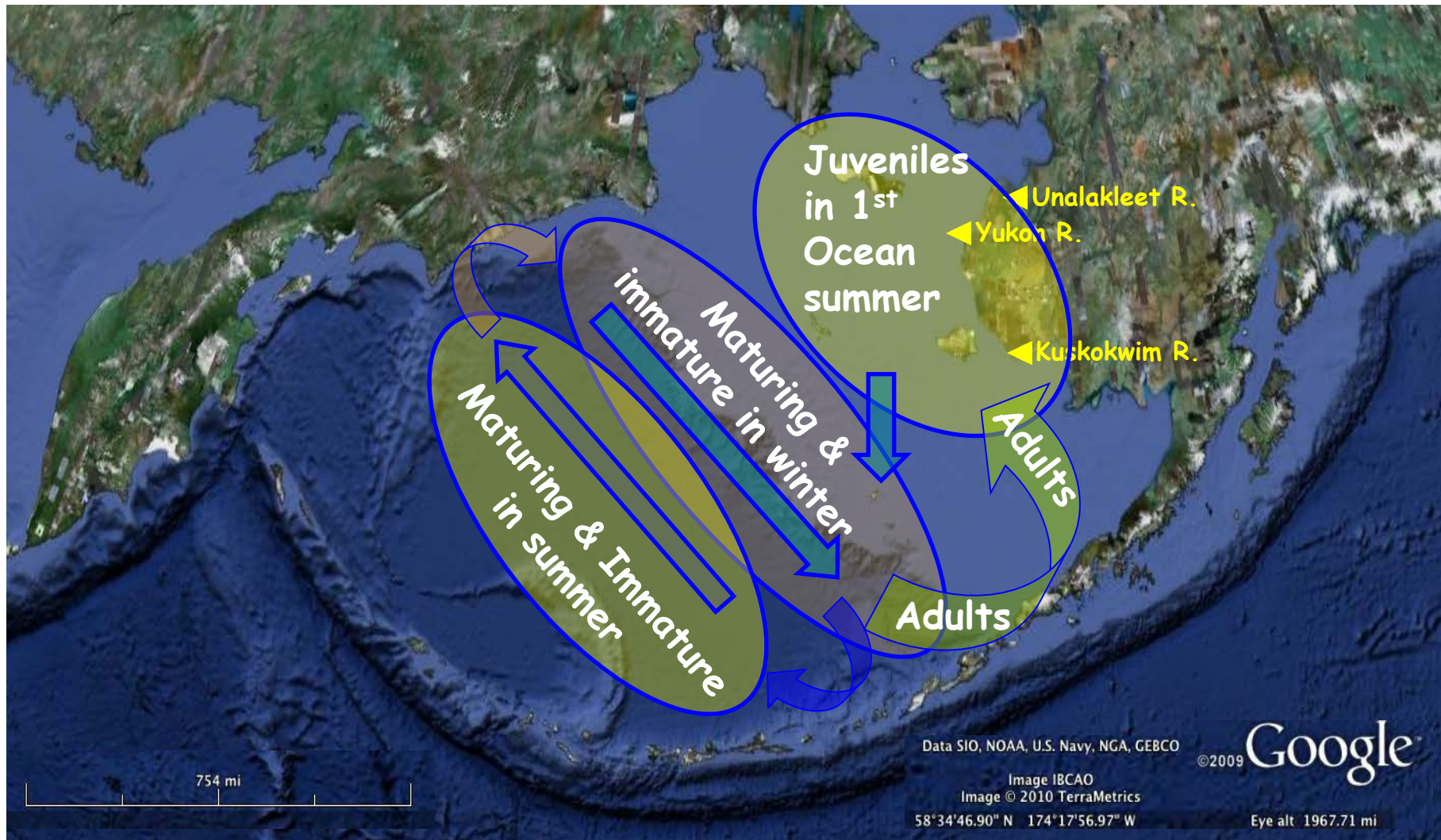
Summer production, prey
quality and temperature



Climate

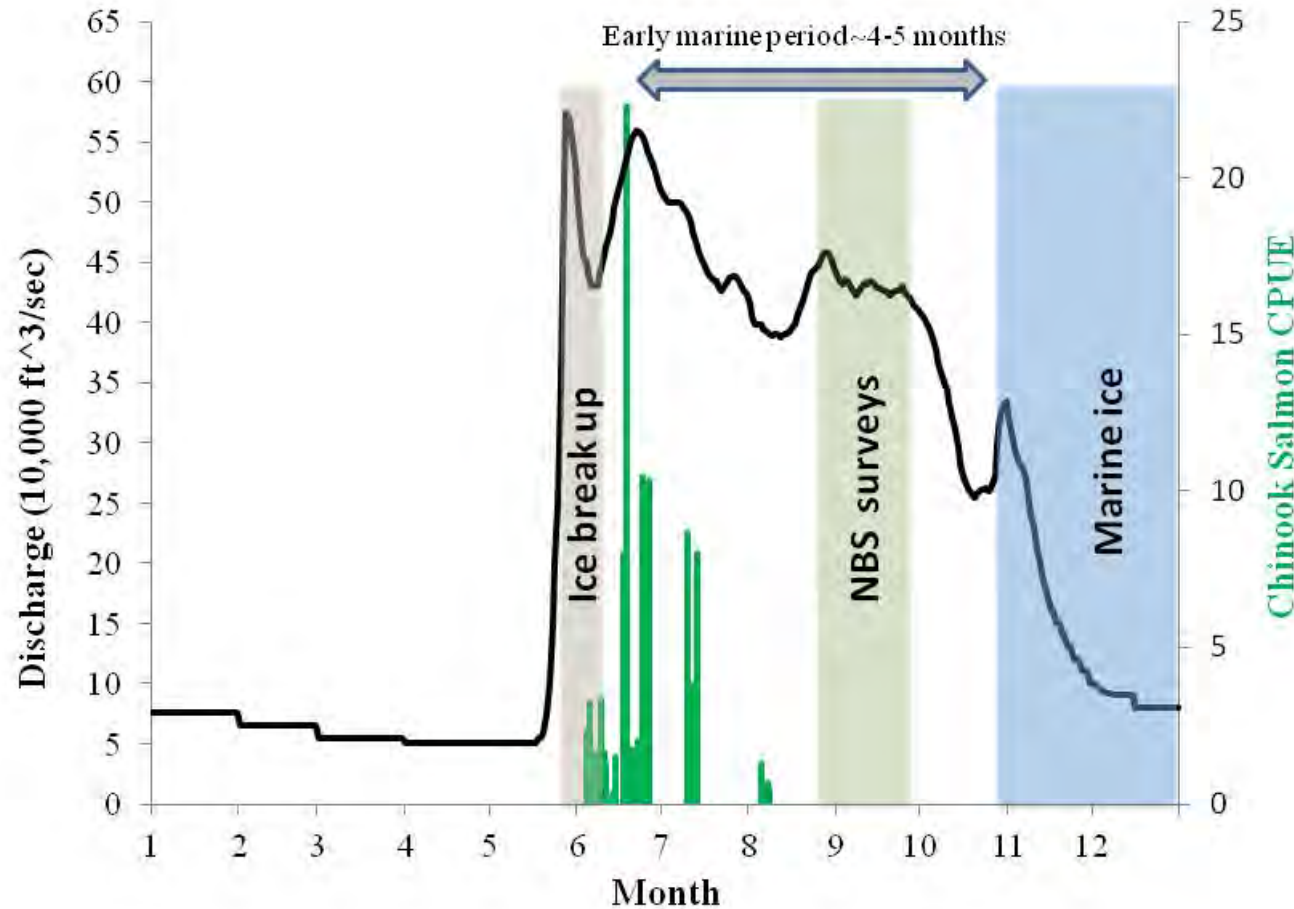


Conceptual model Western Alaska Chinook salmon



Provided by Kate Myers

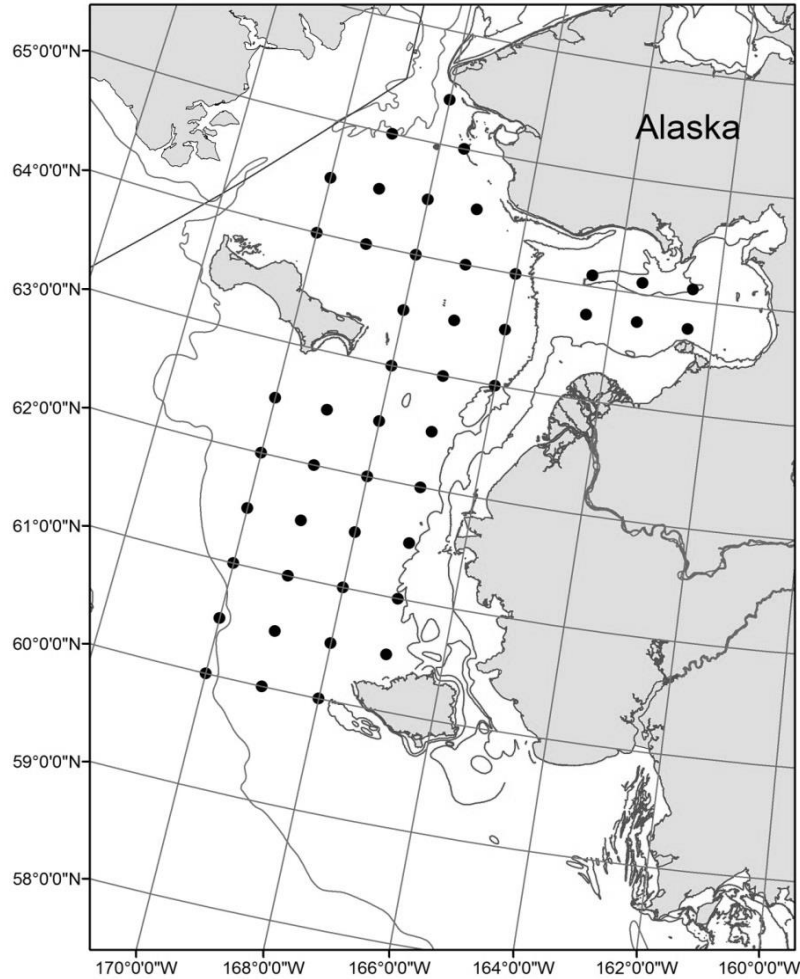
Marine Entry and Early Marine Period of Yukon River Chinook Salmon



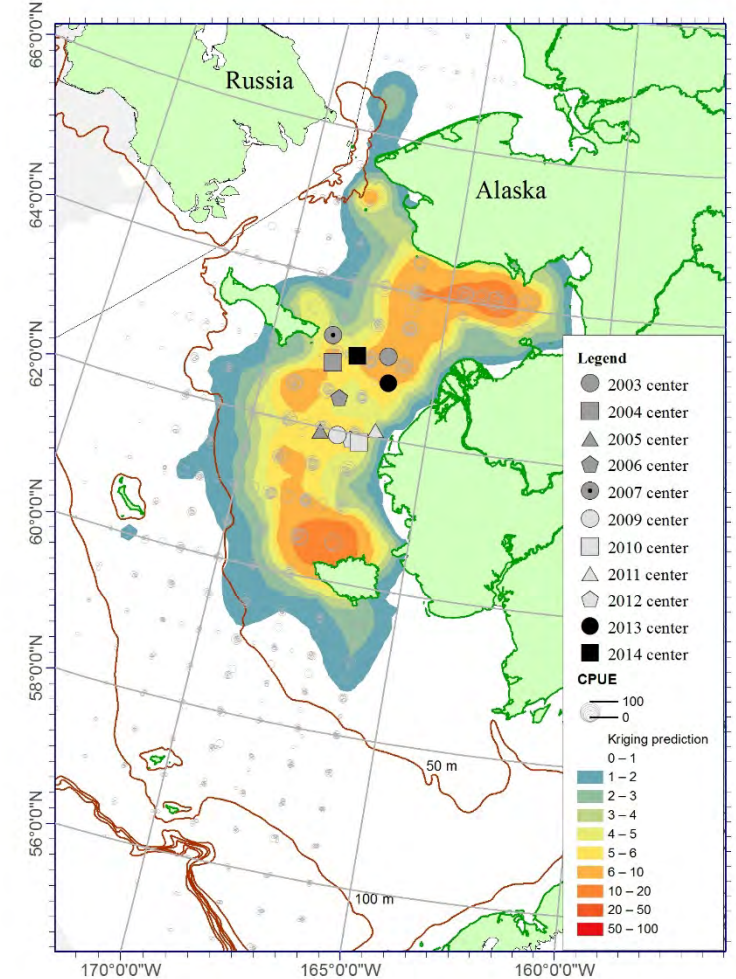
Murphy, J., K. Howard, A. Andrews, L. Eisner, J. Gann, W. Templin, C. Guthrie, J. Moss, D. Honeyfield, K. Cox, and E. Farley. 2014. Yukon river Juvenile Chinook Survey. Alaska Sustainable Salmon Fund (AKSSF) Final Report. 129 p. (Available at www.akssf.org)

Limited Time Series Northern Bering Sea Surface Trawl Survey (2002 – present)

Stations (late August – September)



Juvenile Chinook Salmon Distribution

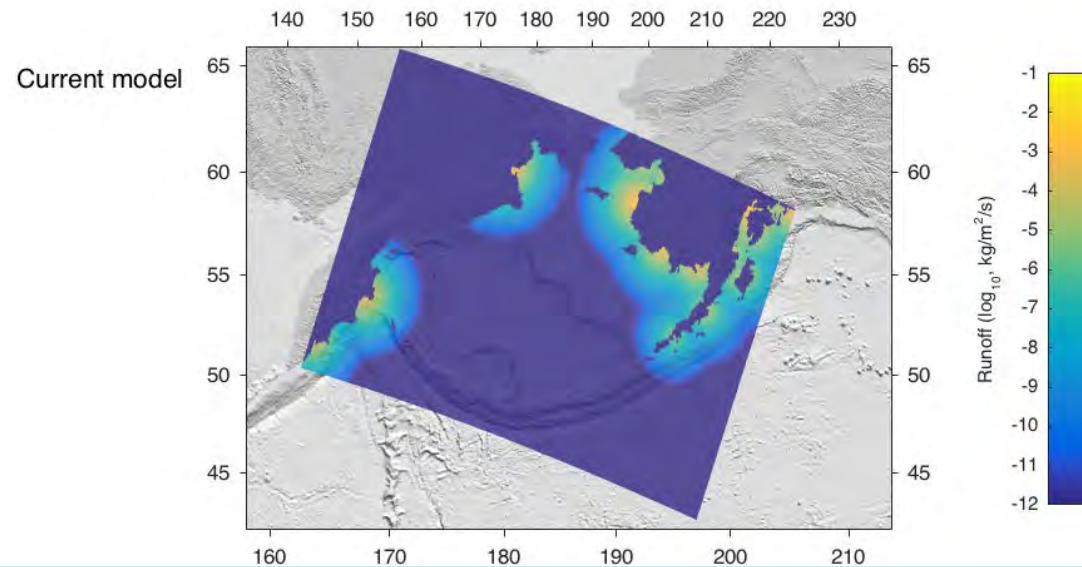
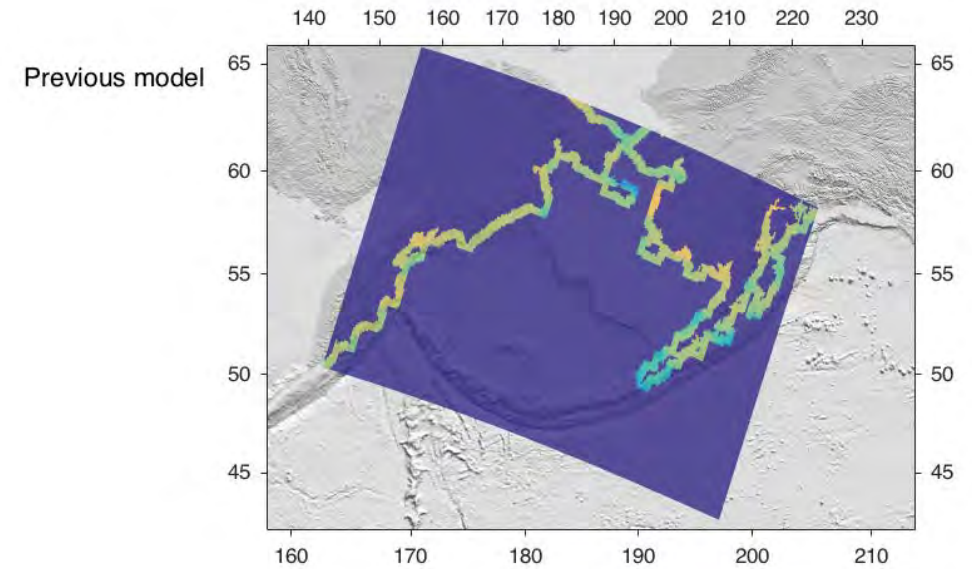
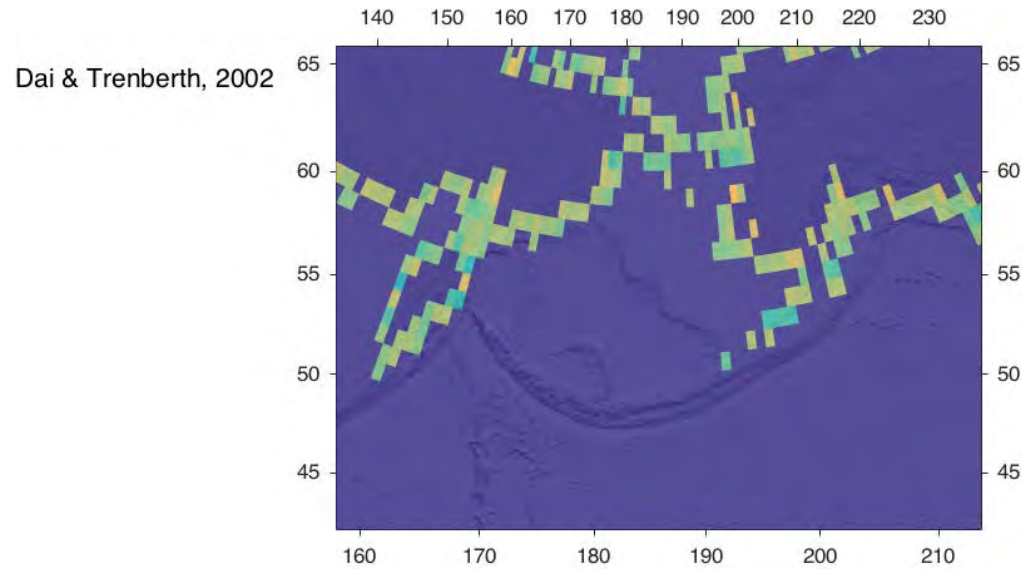


Murphy, J., K. Howard, K. Ciciel, J. Gann, W. Templin, C. Guthrie. *In Press. Juvenile Chinook Salmon abundance in the northern Bering Sea: implications for future returns and fisheries in the Yukon River. Deep Sea Research II.*

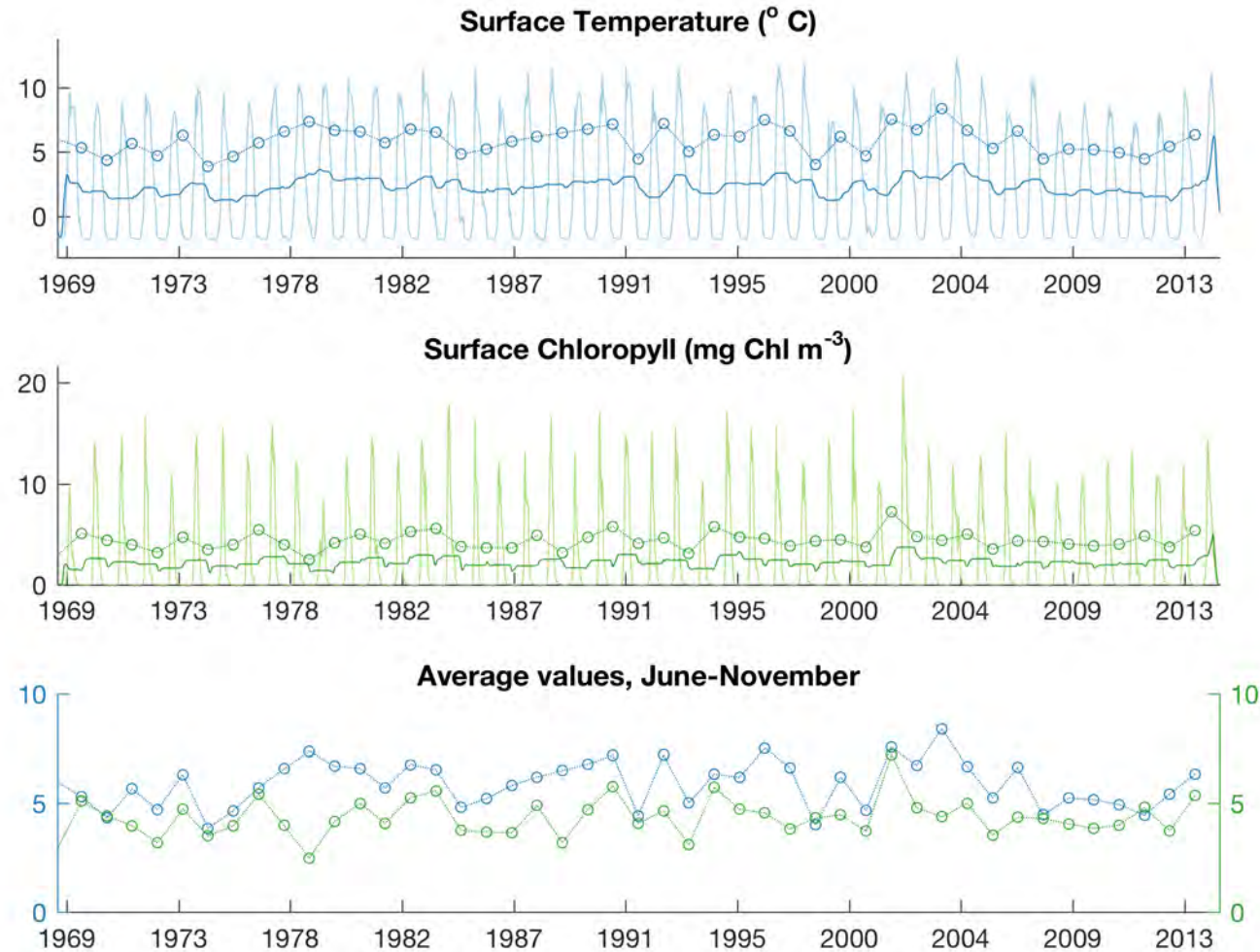
North Pacific Research Board Proposal Objectives

- **Extend Integrated Ecosystem Model into the Northern Bering Sea (Al Herman, Kelly Kearny, Kerim Aydin)**
- **Develop annual indices (1970 – 2012) of size-selective mortality during first summer at sea (model and actual – Ellen Yasumiishi, Ed Farley)**
- **Identify key processes/mechanisms that affect growth rate of Yukon River Chinook salmon during critical periods (Ellen, Ed, Katie Howard, Kerim, Kelly, Al)**
- **Test key processes/mechanisms in forecast models (Ed, Katie, et al.)**

Temporally Averaged Freshwater Runoff Values

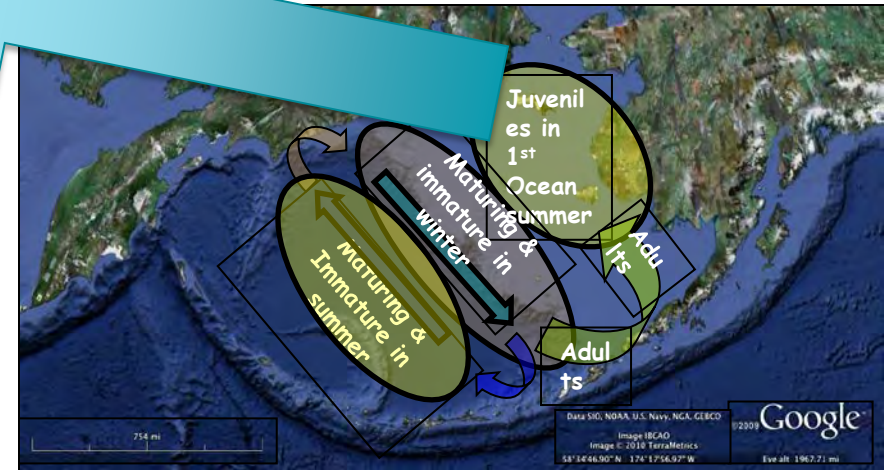
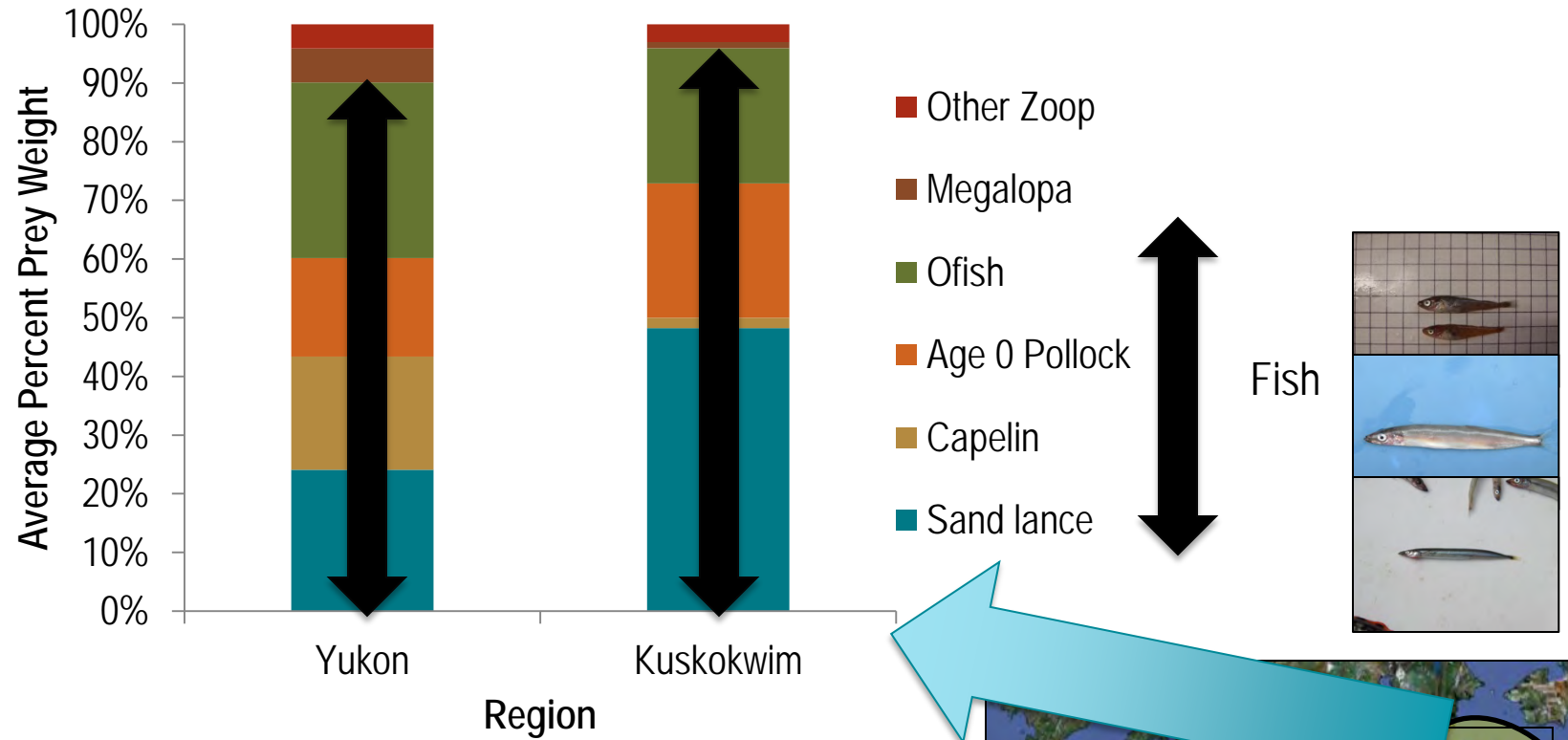


Hindcast (model) of Sea Surface Temp and Chl a



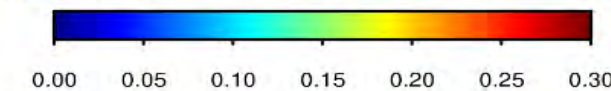
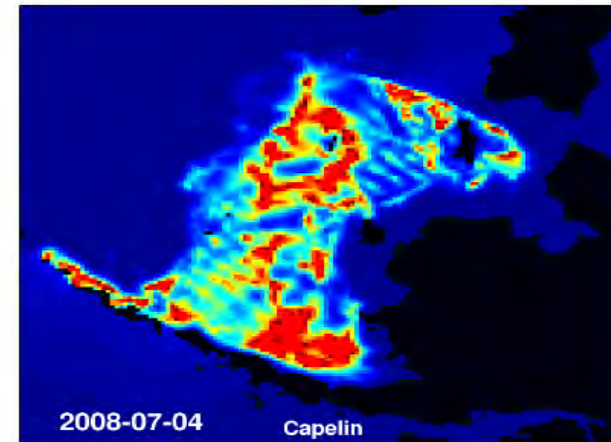
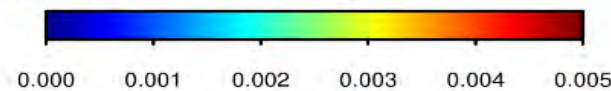
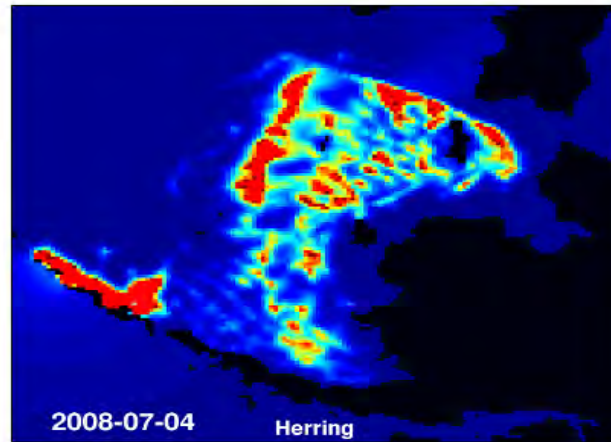
Data provided by Kelly Kearny

Juvenile Chinook Salmon Diet

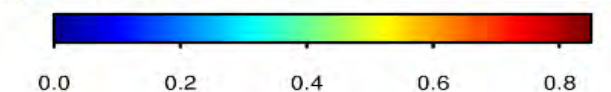
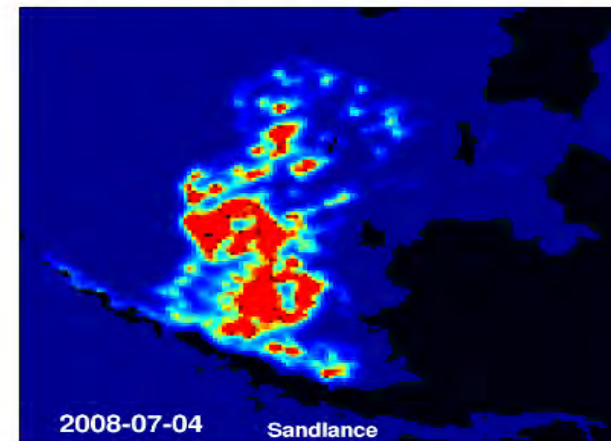
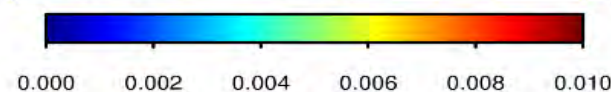
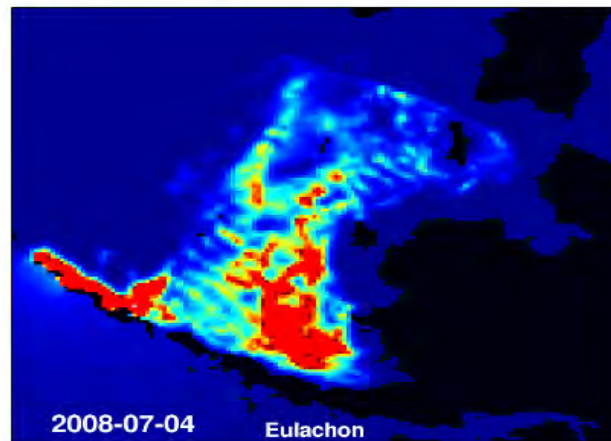


Farley et al. 2009

Modeled output on Relative Distribution of Forage Fishes during 2008



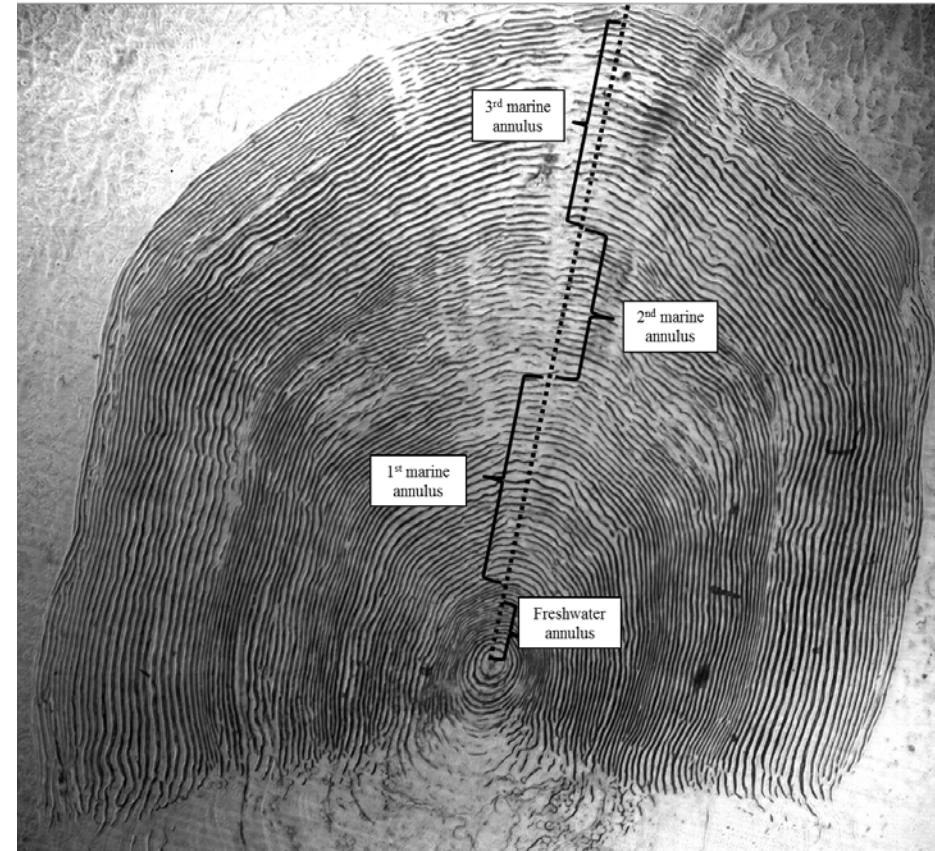
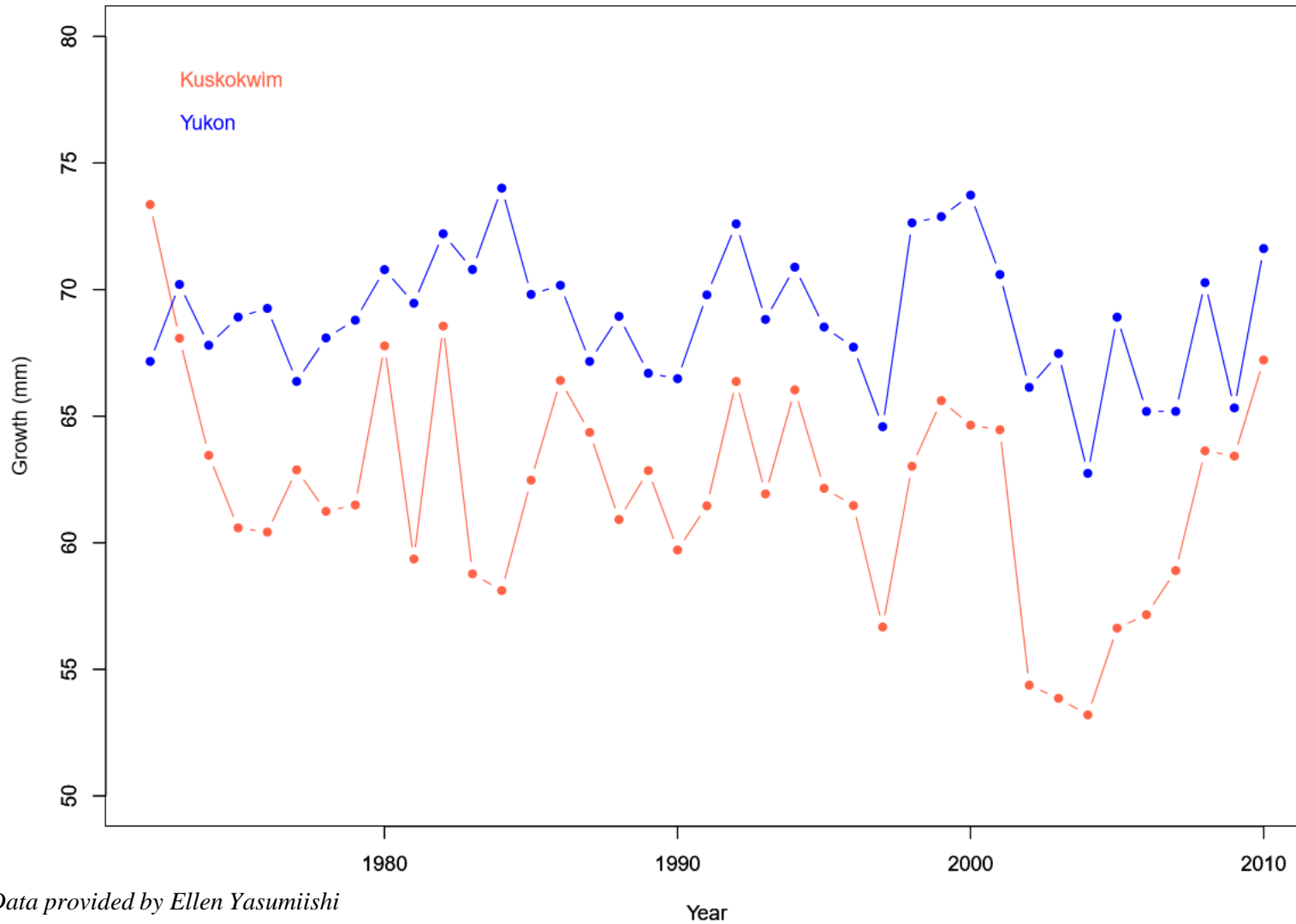
numbers/m³



Data provided by Kelly Kearny

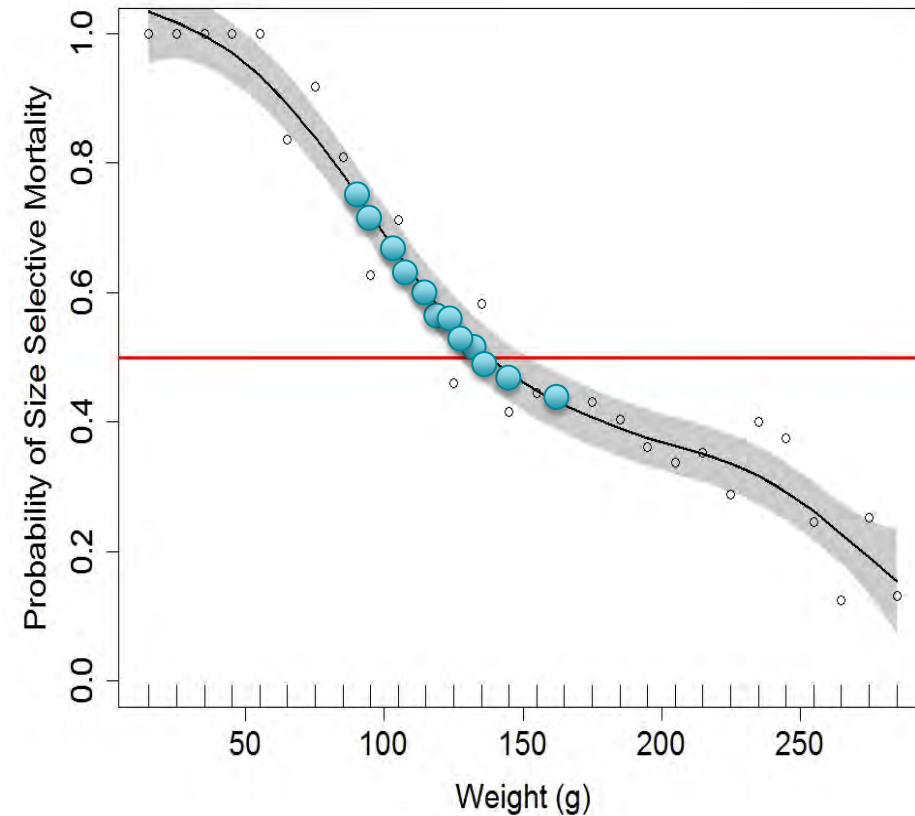
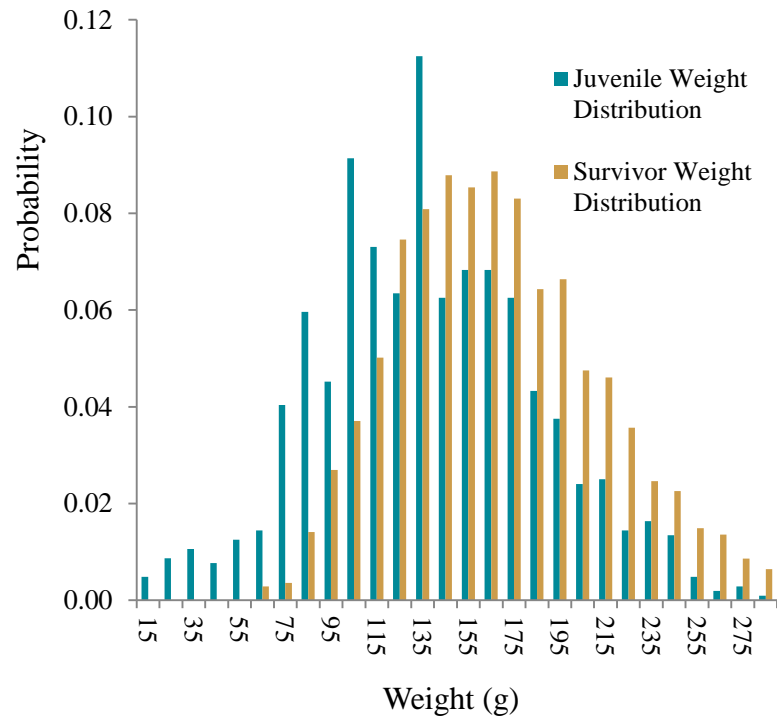
Juvenile Chinook Salmon Size

Summer period



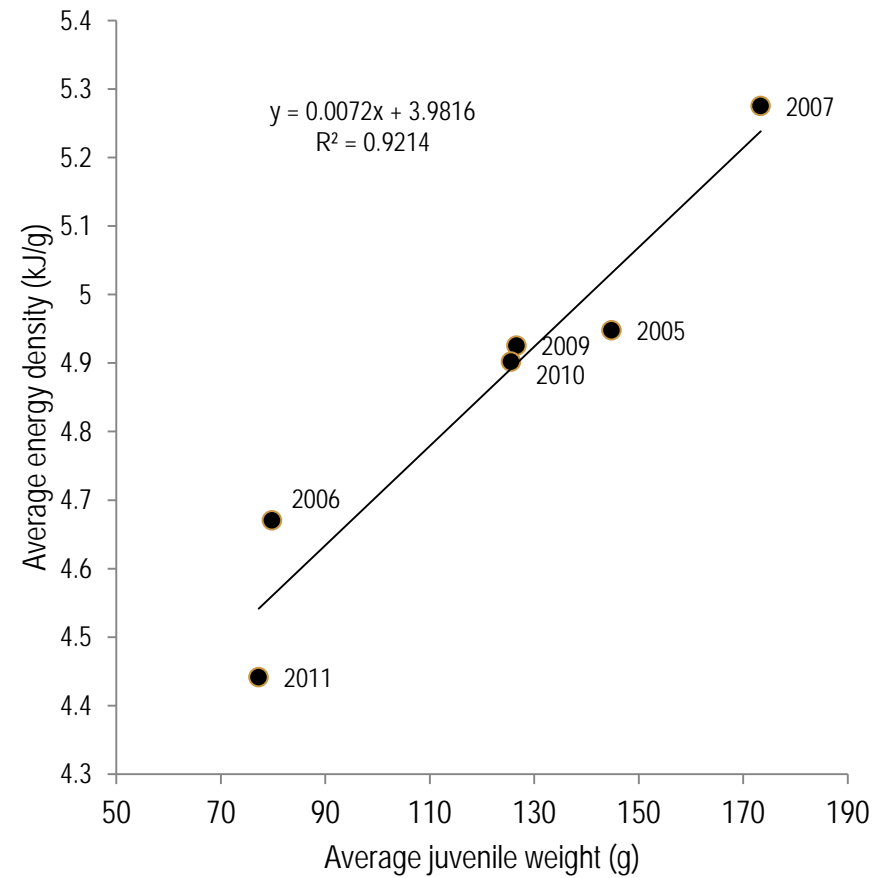
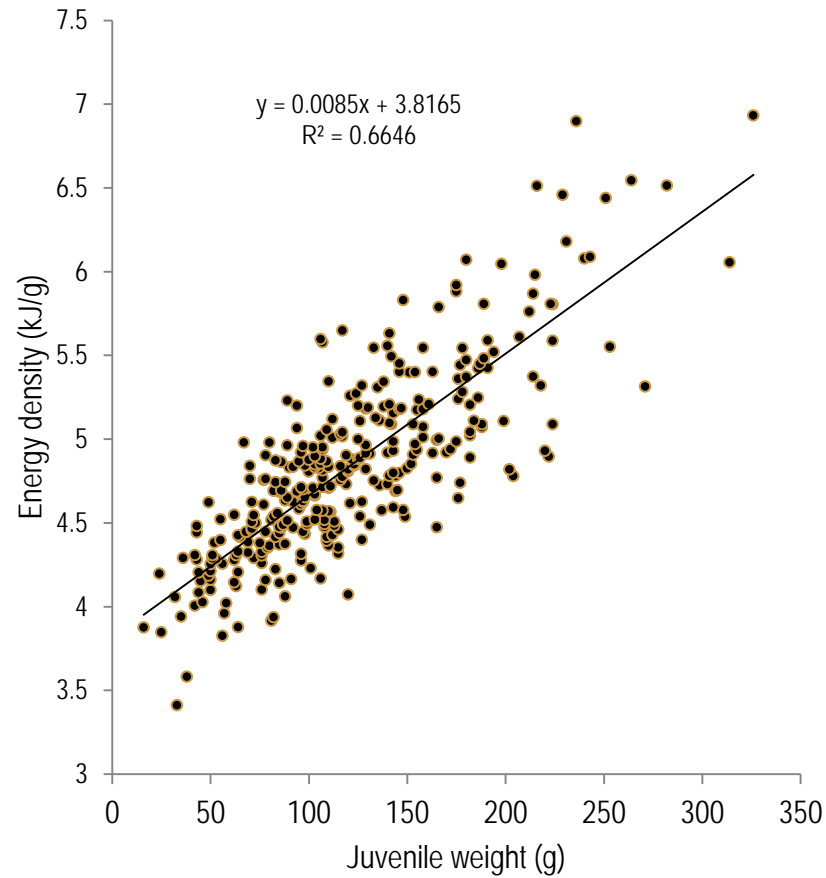
Data provided by Ellen Yasumiishi

Size-Selective Mortality of Yukon River Juvenile Chinook Salmon



Murphy, J., Howard, K., L. Eisner, A. Andrews, W. Templin, C. Guthrie, K. Cox, and E. Farley. 2013. Linking abundance, distribution, and size of juvenile Yukon River Chinook salmon to survival in the Northern Bering Sea. *N. Pac. Anad. Fish. Comm. Tech. Report 8:25-30.*

Energy allocation of juvenile Chinook Salmon in northern Bering Sea



Murphy, J., Howard, K., L. Eisner, A. Andrews, W. Templin, C. Guthrie, K. Cox, and E. Farley. 2013. Linking abundance, distribution, and size of juvenile Yukon River Chinook salmon to survival in the Northern Bering Sea. *N. Pac. Anad. Fish. Comm. Tech. Report* 8:25-30.

Bering Aleutian Salmon International Survey

BASIS



R/V Tinro (Russia)

Black Squares



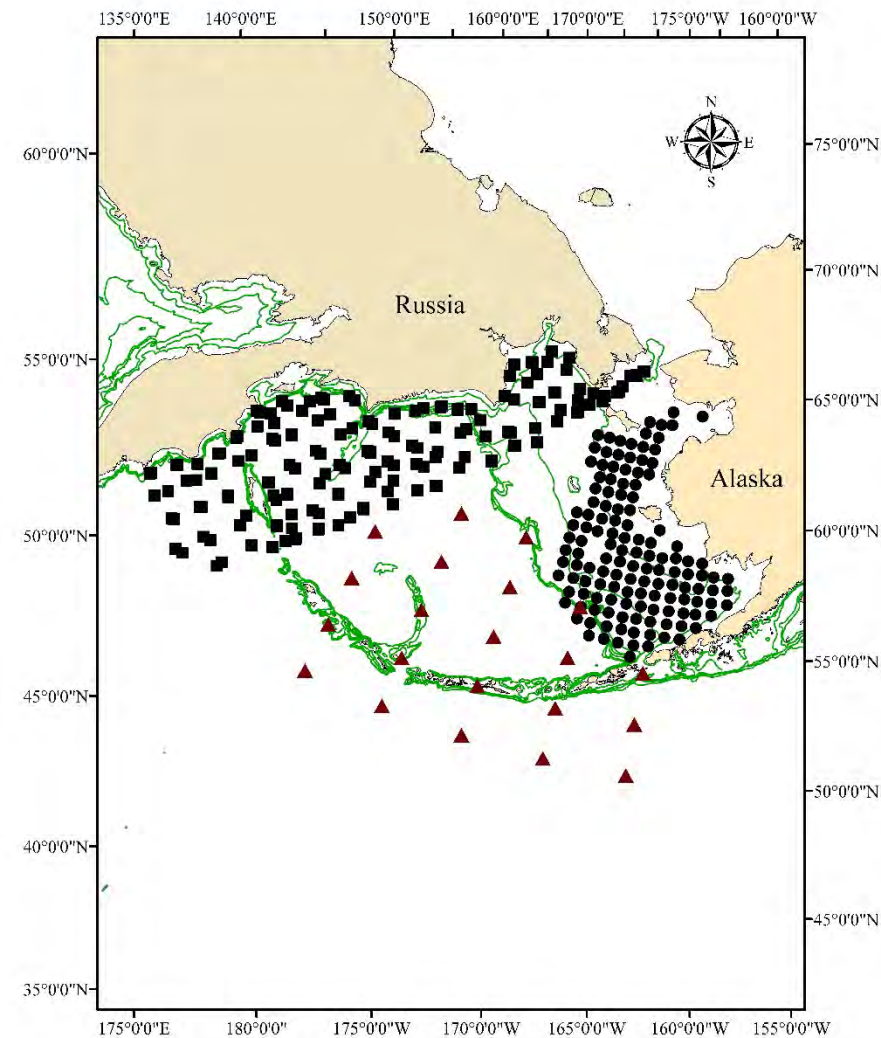
F/V Sea Storm (USA)

Black Circles



R/V Kaiyo maru (Japan)

Red Triangles



Conclusions

- The annual integrated ecosystem surveys in the NBS provide a wealth of information on ecosystem processes.
- Modeling effort will help us extend the time series of bio/physical oceanographic and fish data sets from NBS to understand processes and mechanisms that affect growth and fitness during critical periods for juvenile Chinook salmon.