Project#: B60

Title: Wintertime cod, pollock and arrowtooth flounder distribution

Principal Investigator(s) and Recipient Organization(s):
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Report Period: 1 April 2008 through 30 September 2008

Report Date: 30 September 2008

Lead Author of Report: Lorenzo Ciannelli

Proposed timeline and milestones within report period:

- Postdoc (Nate Bacheler) began work on this project in September
- Postdoc currently being trained on data sources and statistical analysis
- Postdoc obtained pollock, cod, and arrowtooth flounder larval data from AFSC
- Analysis of larval data has begun at the end of September

Project summary: We have just begun combining retrospective analysis of ichthyoplankton distributions with historical wintertime fisheries data to examine the relationship of spawning time and location to fixed and labile landscape and environmental features. These analyses will be used to create species spawning distribution models (SSDMs) using nonlinear regressions analysis (i.e., GAMs). Field data collections incorporating spatially and temporally referenced maturity data collected by observers, roe quality data collected from the commercial fisheries records, and temperature-at-depth collected by commercial fishing vessel net sensors will be assimilated in the models. We will use the results of the project to evaluate the alternative hypotheses that there is environmental flexibility in gadid spawning locations versus fixed sites, or whether there are species or stock-related differences in this spawning strategy.

A portion of our study also extends to adult stage distribution during winter months. Walleye pollock spawns during the late winter months. It is thought that recruitment of Alaska pollock may be highly dependent on the success of the young pollock in settling in suitable nursery areas, which may be dependent on where they were initially spawned. An important question that needs to be answered in order to better understand the potential effects of climate change on pollock populations therefore, is whether adult pollock select winter habitat based on location or on oceanographic conditions or both. The only extensive data set on pollock distribution and biology available for this time of year is fisheries dependent data collected by National Marine

Fisheries Service (NMFS) observers. This study employs GAMM analysis of fisheries dependent data in conjunction with satellite derived oceanographic data to assess differences in pollock biology and distribution between years with contrasting environmental conditions.

Collectively our project specifically addresses BSIERP hypotheses 2a, 2b, and 2d.

Progress Summary: We have developed a preliminary map of Pacific cod larval densities in the SE Bering Sea from larval surveys occurring in 1976, 1991-2003, and 2005-2006. The map (Figure 1, below) shows highest densities of larval Pacific cod near Unimak Island, in the SE portion of the Bering Sea. Lower densities of Pacific cod larvae occurred near the Pribilof Islands. These surveys primarily employed bongo nets, but Mocness nets, Methot trawls, and Tucker trawls were also used to collect larvae. A preliminary generalized additive model explained 37.5% of the deviance in Pacific cod abundance, and suggested that Julian day, latitude, and longitude were important predictors variables. The fact that Julian day is an important component indicates that there is a precise phenology of cod spawning in the Bering Sea.

Figure 2. Effect of Julian day as predicted from GAM model on first feeding larval abundance.

The oceanographic conditions in 2003 and 2006 differ considerably (Fig. 3) and provide and excellent opportunity for a case on adult pollock distribution during winter months. Preliminary findings show that pollock tend to concentrate in the same areas but there is some spread of mid-size ranged fish in the years with warmer conditions. This is an on-going study and only preliminary findings are available to date.

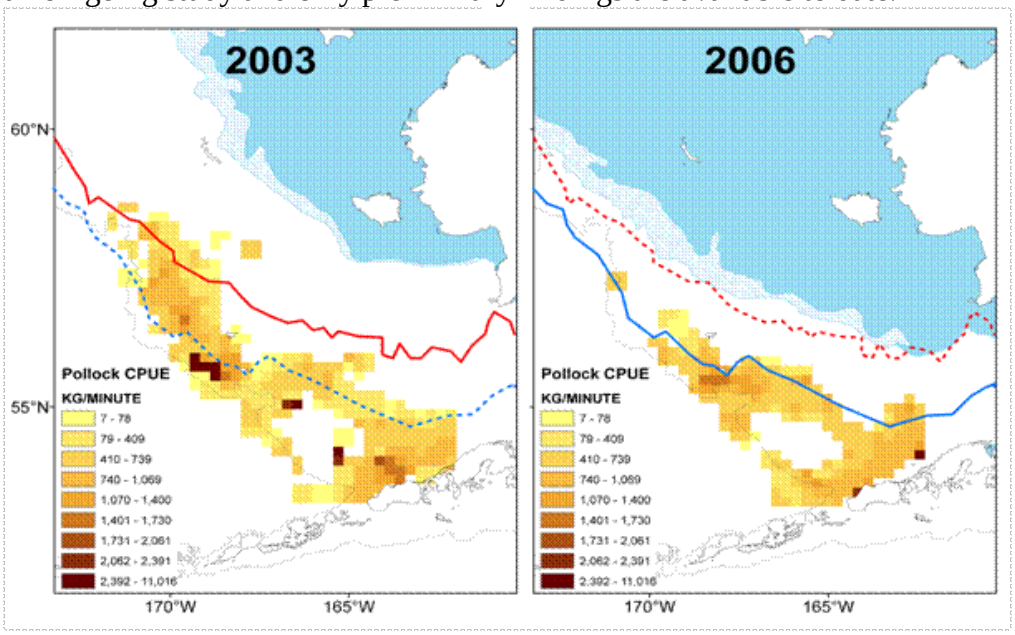

Figure 3: Mean Alaska pollock catch per unit effort (CPUE) by kilograms per minute on a 20km grid showing ice extent (light blue) on 20 January and the extent of the

pollock fishery in January through March for the two years. Colored lines indicate maximum extent of the ice from January through March for 2003 (red) and 2006 (blue) on both figures.

Lessons learned and project adjustments: Having practically just started the retrospective analysis we do not have many lessons and adjustments to report. Funding for the project did not arrive at OSU until May 2008, and advertising and hiring the postdoc took several additional months. He began work on Sept 1, 2008.

Integration activity: We have participated to the January (2008) PI meeting in Anchorage, and nearly all scheduled phone-conference PI meetings since then. We continue to work in close collaboration with Janet Duffy-Anderson, who is leading a similar study but mostly based on newly collected data on cod, pollock and arrowtooth flounder fish early life stages (O2.7)

Education and Outreach: We have recently hired Nate Bacheler, a post-doc fully devoted to this project. Nate started to work on Sept 1st, 2008.

Next year's Workplan:

What	*Who*	*Start (2009)*	*Other key dates*
Continue training post-doc on data sources and statistical analysis	**Ciannelli, Bailey**	January	
Plan visit to Seattle for co-PI meeting	**Ciannelli**	January	
Obtain pollock and cod winter catch data	**Ciannelli, post-doc, Hollowed**	Jan-March	
Gather cod maturity data	**Ciannelli, post-doc**	March-May	
Obtain physical and biological oceanography data from satellite remote sensing	**Ciannelli, post-doc**	Jan-May	
Continue retrospective analysis of ichthyoplankton and winter catches	**Ciannelli, post-doc, Hollowed, Bailey**	Jan-July	