

## North Pacific Research Board Semiannual Progress Reports

### Project # 607

**Title:** Modeling study on the response of lower trophic level production to climate

**Principal Investigator(s): (Include name, affiliation and email address)**

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**Contract Period and Amount of Funding:**

June 1, 2006 to May 30 2008, \$149,547

**Report Period:** June 1 to July 15, 2006

**Report Date:** July 15, 2006

**Lead Author of Report:** Meibing Jin

**Project Summary:**

The most prominent climate trends resulting from global climate warming in the southeastern Bering Sea, reduced sea ice cover and rising seawater temperature, have profound impacts on lower trophic level production and fishery production. Some explanatory hypotheses relating sea ice variability to marine ecosystems have been proposed, such as the Oscillating Control Hypothesis (OCH, Hunt et al. 2002), but have not been studied through a coupled ice-ocean ecosystem model yet. This study aims to establish a coupled ice-ocean ecosystem model including both pelagic and sea ice habitats, based on the existing pelagic ecosystem model (Jin et al. 2006b) for the Bering Sea and the ice-ocean ecosystem model (Jin et al. 2006a) for offshore Barrow. We will conduct sensitivity studies of the impact of physical and biological process variations on primary production, nutrient cycling, phytoplankton species composition, and carbon export to benthos. We will provide recommendations on how, when and which observations should be made to ensure effective improvement in understanding of the Bering Sea ecosystem. Historical observations from the NOAA mooring site M2 are being used to construct a multi-year (1958-2005) model run. The long time series of biogeochemical model results will be used to elucidate the lower trophic level productivity response to climate changes.

**Progress Summary:**

During this first month of the project we are making progress developing the models and testing some of the model components.

We are setting up the coupled ice-ocean ecosystem model including both pelagic and sea ice habitats, based on the existing pelagic ecosystem model (Jin et al. 2006b) for the Bering Sea and the ice-ocean ecosystem model (Jin et al. 2006a) for offshore Barrow.

A multi-year (1990-2005) model (pelagic model only) run forced by NCEP reanalysis data was conducted and the following observed data were processed to validate the model results: 1) temperature, salinity, fluorometer data at NOAA/PMEL mooring from 1995-2004; and 2) daily SeaWiFS chl a data (1997-2005). The initial comparison is favorable and we are optimistic on writing manuscripts with the results as time goes on. One figure showing preliminary results for the multi-year run at the M2 site in the southeastern Bering Sea is displayed in the 'Ongoing Progress' on our project web site (see the link and description below). In the figure, modeled surface phytoplankton biomass (in mg Chl a m<sup>-3</sup> unit) is compared with daily SeaWiFS Chl a concentration along with daily SSM/I sea ice concentration. Note that there appears to be some model data discrepancies at the peak of bloom in certain years (e.g. 1998 and 1999), however that may be due to gaps of missing SeaWiFS Chl a data for cloudy days which are common in the Bering Sea.

For the purpose of outreach and education, a DOE/EPSCoR (U.S. Department of Energy's Experimental Program to Stimulate Competitive Research) high school student is working with PI on data and image processing and web display of research results during summer 2006. Our project web site and the student activity web page can be accessed as below:

<http://www.frontier.iarc.uaf.edu/nprb2006/>

<http://denali.frontier.iarc.uaf.edu:8080/~mbj/student2006/>