

Project #: B52

Title: Biophysical Moorings

Principal Investigator(s) and Recipient Organization(s):

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Contract Period and Amount of Funding: 2008-2010 \$732,259

Report Period: 31 March 2009 - 1 October 2008 –

Report Date: 1 October 2009

Lead Author of Report: Dr. Phyllis J. Stabeno

Proposed timeline and milestones within report period:

2009 Tasks and Timeline

<i>What</i>	<i>Who/Ship</i>	<i>Dates</i>	<i>Other information</i>
Spring: Recovered/deployed moorings M2, M4	SNWM, NOAA Ship <i>Dyson</i> and fishing vessel	Apr 24 – May 7, 2009	Will also conduct CTD/bongos along southern hydrography line through M2
Processed and disseminated data,	SNWM	May 15-Sep 30	
Sent plankton samples to Poland to be counted	Napp	July 30, 2009	The actual time for processing varies
Deployed moorings at M5 and M8	Stabeno, Whitledge, R/V <i>Knorr</i>	Jun- Jul 2009	
Fall cruise on NOAA ship <i>Freeman</i> . Recover/Deploy moorings M2, M4, M5	Stabeno, Napp, Whitledge, Mordy (SNWM)	Now Sept 23 – Oct. 11	CTD/bongos along the 5 primary hydro. lines (70m isobath, & 4 cross shelf transects: (Fig. 1). M8 should be recovered on Oct. 2

Project Summary: This project is a continuation of a long-term partnership between NOAA and NPRB. Moorings have been maintained on the southeastern Bering Sea shelf at four sites: M2 (56.9°N, 164.1°W) since 1995, M4 (57.9°N, 168.9°W) since 1996, M5 (59.9°N, 171.7°W) and M8 (62.2°N 174.7°W) since 2004. This project together with research by the NOAA program North Pacific Climate Research and Ecosystem Productivity (NPCREP) will continue these measurements for one more year (2010). These moorings, together with observations along the 70-m isobath, are core to the long-term observations on

the Bering Sea shelf. All four moorings are deployed on the 70-m isobath. Key findings (the Oscillating Control Hypothesis (OCH), timing of spring bloom, and stability in the nutrient supply) have all been a result of the data collected on and around these moorings. Data from M2 has quantified the warming that occurred over the southern shelf during 2001-2005 and the marked cooling in 2007-2008. This project continues the time series of temperature, salinity, fluorescence, currents, zooplankton abundance (TAPS-8 at M2), nitrate, and oxygen at four mooring sites on the Bering Sea shelf. In addition during the late spring and summer, a surface mooring (two if ice permits) will be deployed that will measure meteorological variables (air temperature, humidity, barometric pressure, wind velocity and solar radiation – PAR). The surface moorings permit real time reporting of selected data. Data from these moorings are also critical to model verification. Products include mixed layer depth, heat content, temperature, position of the transition between southern pelagic-dominated shelf and northern benthic-dominated shelf, advection, nutrient supply and timing of the spring phytoplankton bloom.

This project supports all five BSIERP hypotheses (see <http://bsierp.nprb.org/focal/index.html>).

Progress Summary:

a) Report-period Progress: All milestones were met, in full or in part. In May 2009, moorings were recovered and redeployed at M2 and M4. Both sites contained surface moorings. Unfortunately, sea ice dragged M4 approximately 10 km to the west in mid-May. In August the mooring broke loose. The NOAA ship *Oscar Dyson* was in the vicinity conducting research on whales. The researchers on board agreed to break off early and the crew of the *Dyson* successfully recovered the mooring. Ice prevented us from reaching M5 and M8 during the May cruise, but additional moorings to measure the upper water column were deployed from R/V *Knorr* during the BEST summer cruise. Presently, we are recovering and redeploying moorings at all 4 sites during our fall mooring cruise (NOAA Ship *Miller Freeman*). All moorings at M2, M4 and M5 have been successfully recovered and winter moorings deployed. The instruments from the spring recovery have been downloaded and data processed. Samples from the previous spring were shipped in July and the data returned in December. The next step is to QC the data and upload them into the database. The spring zooplankton samples were received by Poland on 1 September 2009 and are in the queue for processing and data entry. We expect the data to be returned to the AFSC by this spring.

b) Preliminary Results. The winter of 2009 was extremely cold with extensive ice over the shelf. Figure 2 shows the temperature at M2 during the last 5 years. The bottom temperature at M2 in October 2008 did not warm above 2°C. This is unusual as can be seen in the previous years. Typically in October when with the deepening of the mixed layer the bottom temperatures warm to well above 2°C. The failure to warm in fall 2008 was a largely because surface temperatures at M2 in 2008 were below average (they did not exceed 9°C).

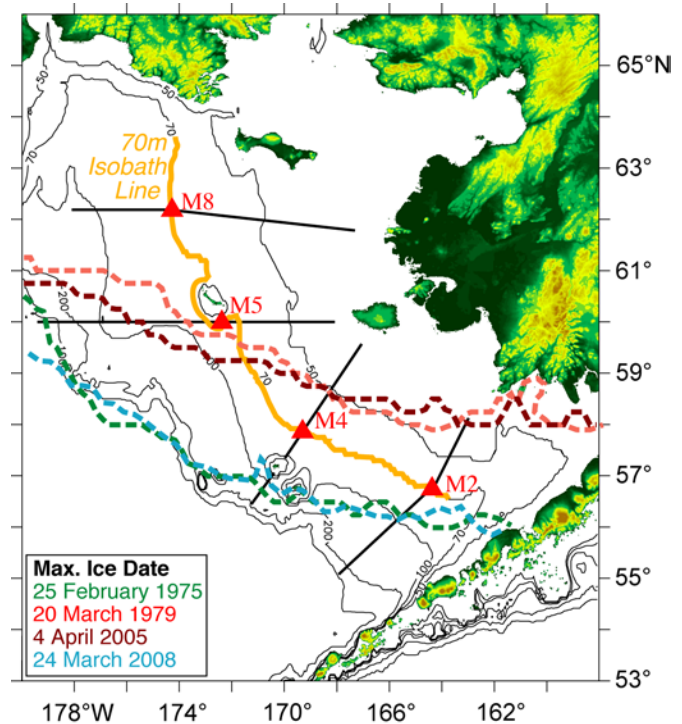


Figure 1. Bathymetry of the eastern Bering Sea. The location of the four biophysical moorings (M2, M4, M5 and M8), the 70-m isobath and the four cross shelf lines that have been adopted as standard lines. Examples of low ice extents (1979, 2005) and high extents (1975, 2008) are shown.

Bering Sea Integrated Ecosystem Research Project B52: Semiannual Progress Report

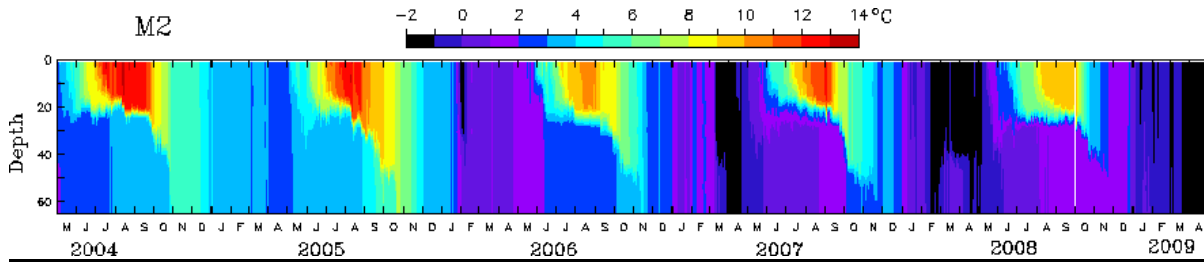


Fig. 2 Temperature at M2 during the last 5 years.

c) Concerns about this projects progress The continued late ice retreat has made it difficult to turn around the moorings on the spring cruise. While have been able to deploy an additional mooring at each site in June or July, we are unable to observe the beginning evolution of mixed layer in May. Fishing pressure remains a problem in disturbing the moorings, but we successfully tested a pop-up tag to help us locate any moorings that have been moved by fishing (or ice). These tags will automatically release several days after the planned recovery, providing us with a good estimate on the location of the mooring. The dragging of M4 by ice and its failure in August resulted in a break in the time series at M4 of approximately one month.

Education and Outreach:

Attended public presentation after the spring BEST cruise and discussed with the public goals and findings of the research.

Collaborated with Aleut Community of St. Paul Island in maintaining their temperature and salinity measurements in their harbor and on St. George Island.

Next year’s Work plan (:

BSIERP B52, Biophysical Moorings, Dr. Phyllis J. Stabeno, phyllis.stabeno@noaa.gov, 206-526-6453

2010 Tasks, Assignments, Timeline

<i>What</i>	<i>Who</i>	<i>Start (2010)</i>	<i>Other key dates/information</i>
Data delivery to data manager	Stabeno, Napp, Whitlege, Mordy (SNWM)	Dec. 2010: phys/chem Sep 2010: zoop	
Send plankton samples to Poland to be counted	Napp	November 2009 & July 2010	The actual time for processing varies.
Process and disseminate data/ Data delivery to data manager	SNWM	Oct – Dec, 2010 Mar 2010: phys/chem	
Recover/deploy moorings M2 and M4 (ice permitting) Data delivery to data manager	SNWM, <i>Oscar Dyson</i> or <i>Miller Freeman</i> ,	May 2010 Dec 2010: phys/chem	Will also conduct hydrographic stations around moorings
Deploy moorings at M5 and M8	Stabeno, Whitlege, June cruise on ship of opportunity	Jun/Jul 2010	

Bering Sea Integrated Ecosystem Research Project B52: Semiannual Progress Report

Final recovery of all moorings M2, M4, M5 and M8	SNWM, <i>Oscar Dyson</i> or <i>Miller Freeman</i>	Sep 2010	Conduct hydrographic/bongo stations; at this time there is no plan to deploy any moorings
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Related Manuscripts

Holliday, D.V., P.L. Donaghey, C.F. Greenlaw, J.M. Napp, and J.M. Sullivan (2009). High-frequency acoustics and bio-optics in ecosystems research. *ICES J. Mar Sci.* 66: 974-980.

Nystuen, J. S. Moore, P. Stabeno. A sound budget for the southeastern Bering Sea: measuring wind, rainfall, shipping and other sources of underwater sound, submitted to *J. of the Acoustical Society of America*.

Stabeno, P.J., J.M. Napp, C. Mordy and T.E. Whitley, The influence of seasonal sea ice on the eastern Bering Sea shelf ecosystem: 2005. *Progress in Oceanography*, in revision.

Stabeno, P.J., and J.E. Overland (2008): Sea ice extent: A decoupling between summer ice extent in the Arctic Ocean and winter ice extent in the Bering Sea. *Geophys. Res. Lett.* In revision

Stafford, K, S. Moore, P. Stabeno, D.V Holliday, D. Mellinger and J. Napp. Biophysical Ocean Observation in the Southeastern Bering Sea. Submitted to *JGR*.

Presentations

Stabeno, P. J., N. Kachel, C. Mordy, D. Moore and J. Napp. Bering Sea Observing Network: Physics to Whales. Poster presented at OceanObs09, Venice, Italy, September 2009.