



# North Pacific Research Board *Project Synopsis*

PROJECT

203  
315  
410  
517

CONTINUED AS  
602, 701

**FUNDING SUMMARY**

**Principal Investigators**

*Phyllis Stabeno,*

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Alaska Fisheries Science Center

*Terry Whitledge,*

University of Alaska Fairbanks

**Year funded**

2002

**Research period**

September 2002–  
December 2006

**Budget**

\$736,500 (total)



**RESEARCH THEME**

Ecosystems

## Long-term observations: Sentinels for change in the Bering Sea ecosystem

### THE BERING SEA ECOSYSTEM

Located between Alaska and Russia, the Bering Sea supports vast numbers of marine birds and mammals. It generates more than forty percent of all fish and shellfish landings in the United States and is the source of more than 25 million pounds of subsistence foods used by nearly 55,000 local residents. As a high-latitude body of water, the Bering Sea is very sensitive to changes in climate. As climate changes, the ability of the Bering Sea to provide the resources on which Alaskans depend may also change.

### WHY WE DID IT

Long-term monitoring is critical to understanding and predicting changes in ecosystems. Our observations have allowed us to make comparisons among habitats and years, characterize interannual variability, quantify regime shifts and climate changes, and create ecosystem models.

### HOW WE DID IT

Each May and September since 2002, we have deployed and recovered oceanographic moorings with sensors that measured physical, chemical, and biological properties at four sites on the eastern Bering Sea continental shelf: **M2** (56.9°N, 164.1°W), **M4** (57.9°N, 168.9°W); **M5** (59.9°N, 171.7°W) and; **M8** (62.2°N 174.7°W).

At selected depths on each mooring, we measured temperature, salinity and currents throughout the water column, nitrate and fluorescence (a proxy for phytoplankton concentration, which tells us about the level of productivity in the water column). We made the same measurements along the 70 m depth contour (the approximate middle of the shelf) from the southeastern to the central eastern Bering Sea.

*(Continued)*



### The Big Picture

*Global warming trends in the early 2000s were concurrent with higher than average temperatures in the eastern Bering Sea. Results also showed how the recent warming of the Bering Sea and loss of sea ice have affected different components of the ecosystem.*

### NPRB Research Interest

*To “build a clear understanding of the North Pacific, Bering Sea, and Arctic Ocean ecosystems that enables effective management and sustainable use of marine resources,” we need to monitor the biophysical properties of the southeast Bering Sea ecosystem so that we can characterize changes in the physics and biology of this ecosystem that are important to the economy of Alaska and the nation.*

## WHAT WE DISCOVERED

Our long-term monitoring has resulted in several major findings:

- ⊙ Over the southeastern shelf, the presence of sea ice determines the timing of the spring phytoplankton bloom. An early bloom occurred if ice was present after mid-March; if there was no ice after mid-March, the bloom occurred later.
- ⊙ From 2001 through 2005, the southeastern Bering Sea shelf underwent a marked warming ( $\sim 3^{\circ}\text{C}$ ) closely associated with a decrease of sea ice.
- ⊙ Nutrient supply and summer salinity over the shelf have not significantly changed during the last three decades.
- ⊙ There has been an apparent decrease in the abundance of cold-water zooplankton species which are important prey for fish, seabirds, and marine mammals. It is evident from samples collected in 2005 along the 70 m contour that temperature dominates the structure of the water column over the southern shelf, while the northern shelf is dominated by salinity. In addition, the location of the boundary between the southern shelf and northern shelf appears to vary from one year to the next. This location depends greatly upon maximum ice extent during the spring.

These results, some of which were alarming, propelled the formation of a Bering Sea Inter-agency Working Group to coordinate research and speed dissemination of results among people and institutions working in the Bering Sea.

## WHAT'S NEXT?

We have shared data and results from these projects with scientists who are constructing new models to predict how the eastern Bering Sea ecosystem will react to future changes in climate and loss of sea ice. The funding to maintain these moorings continues at least through 2010, and scientists will continue to use these results to contribute to future studies of the Bering Sea ecosystem. These include the BSIERP-BEST<sup>1</sup> collaboration between NPRB and the National Science Foundation.

## OUTREACH

### Scientific Presentations

Data have supported more than 60 scientific presentations.

### Scientific Articles

Data have supported more than 35 scientific publications

### Public Presentations

Ten presentations at schools in Alaska and Washington.

### Website

Mooring designs, real-time and archived data, and cruise reports are available online at [www.pmel.noaa.gov/foci/](http://www.pmel.noaa.gov/foci/).

### Press

Press conferences on impact of climate change on ecosystems and research cruises contributed to articles in the *Anchorage Daily News* and the *Seattle Times*.

<sup>1</sup> BSIERP: Bering Sea Integrated Ecosystem Research Program (NPRB); BEST: Bering Ecosystem Study (NSF).

**MORE** | <http://project.nprb.org>

Download reports associated with this project and learn more about ecosystem research funded by NPRB.

## MISSION OF THE NPRB

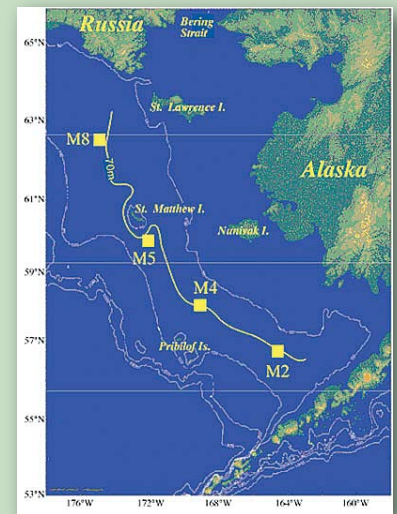
Building a clear understanding of the

North Pacific, Bering Sea and Arctic

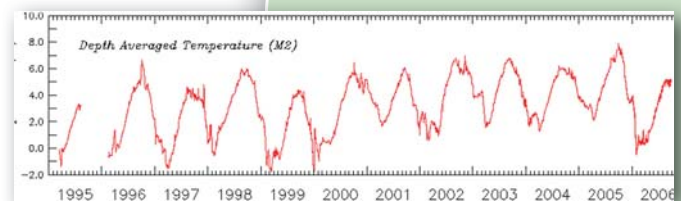
Ocean ecosystems that enables

effective management and sustainable

use of marine resources



Location of the four bio-physical moorings (M2, M4, M5 and M8) and the 70-m isobath.



Depth-averaged temperature measured at M2 during the last 11 years. Note the marked warming from 2000–2005.

## North Pacific Research Board

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