BEST-BSIERP
Bering Sea PROJECT
UNDERSTANDING ECOSYSTEM PROCESSES IN THE BERING SEA 2007–2013

Biophysical Moorings

TAKING MOTHER OCEAN'S PULSE FROM AFAR

The Bering Sea shelf is a big place. It is bigger than the state of California, with weather that challenges even the saltiest seafarers. Ships provide the best platform for scientists to make most ocean measurements, but both funding and seasonal ice cover limit ship-based research in the Bering Sea. Scientists with the joint research program Ecosystems & Fisheries-Oceanography Coordinated Investigations (EcoFOCI), have used moored oceanographic instruments ("moorings"), like a stethoscope anchored to the seafloor, to track the health of the Bering Sea year-round since 1995. These moorings provide decades-long records of important ecosystem variables.

During the Bering Sea Project we discovered that water is less sharply stratified in the north than the south because tides are weaker. This creates a stable layer above the bottom mixed layer and below the surface mixed layer, which receives sufficient light to support a sub-surface phytoplankton bloom in the north during summer. Summer primary production can affect the productivity of the entire food web. We discovered how the spring phytoplankton bloom is affected by ice retreat, and that blooms occur deeper below the surface in the

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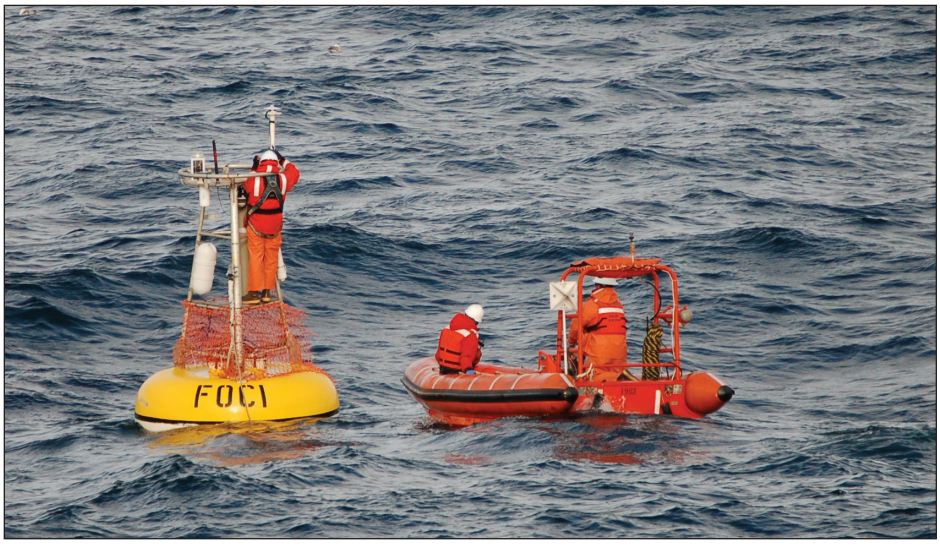
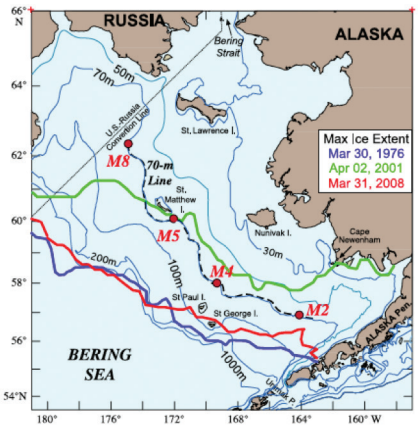


Edward Cokelet

EcoFOCI scientist Scott McKeever removes sensitive equipment on the surface buoy of the M2 Mooring before bringing it onboard the ship.

Fig. 1



EcoFOCI maintains an array of four moorings on the southeastern Bering Sea Shelf (M2, M4, M5, M8). M2 began the 19th year of observation in 2013.

The Big Picture

Long-term biophysical moorings provide year-round measurements of the state of the Bering Sea, filling the gaps in knowledge between ship-based observations. These measurements provide a foundation for understanding the mechanisms that drive this productive region. The Bering Sea Project provided the opportunity to look at targeted ecosystem questions about the physical, chemical, and biological changes in climate and ocean conditions in the context of this long-term data set. During the Bering Sea Project, we used data from these moorings to help answer questions about the differences between the northern and southern Bering Sea, and if animals will be able to shift their ranges northward with climate warming; the difference between warm and cold years on the Bering Sea shelf and how the animals that live here are affected; and how the timing of the spring bloom will affect everything from the smallest plankton to the largest whales.

A component of the BEST-BSIERP Bering Sea Project, funded by the National Science Foundation and the North Pacific Research Board with in-kind support from participants.

north. We learned that the magnitudes of the spring and fall blooms are related, and that the interval between blooms can vary by up to two months. This length of time between spring and fall blooms may affect the amount of production (i.e., food) that reaches higher trophic levels, including fish, seabirds, and whales.

How We Did It

EcoFOCI maintains an array of four long-term biophysical moorings in the Bering Sea (Figure 1). Each mooring hosts instruments that make hourly measurements of temperature, salinity, nitrate, chlorophyll (fluorescence), currents, and sea ice, year-round (Figure 2). The instruments are programmed to take measurements at least every hour and then store the data. The M2 mooring also hosts acoustic instruments that record zooplankton size and abundance and marine mammal vocalizations. Moorings are recovered and re-deployed using ships in spring and fall, weather and ice permitting.

Why We Did It

The Bering Sea supports abundant and diverse wildlife, coastal communities, and some of the world's most commercially valuable fisheries. This cold, shallow sea is also extremely variable, so predicting changes in ocean conditions has great value from economic, ecological, and public safety perspectives. We continue to measure the vital signs of the Bering Sea to better understand how this ecosystem responds to change. The Bering Sea oscillates between periods of relative warm and cold conditions (Figure 3). Observing how the ecosystem responds to warm periods (i.e., 2000-2005) vs. cold periods (i.e., 2006-2010) can help us predict how this ecosystem responds to climate warming. This information will help us adapt to a changing climate and ensure that the living marine resources of the Bering Sea continue to be managed in a sustainable way.

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The Bering Sea Project is a partnership between the North Pacific Research Board's Bering Sea Integrated Ecosystem Research Project and the National Science Foundation's Bering Ecosystem Study. **www.nprb.org/beringseaproject**

Fig. 2

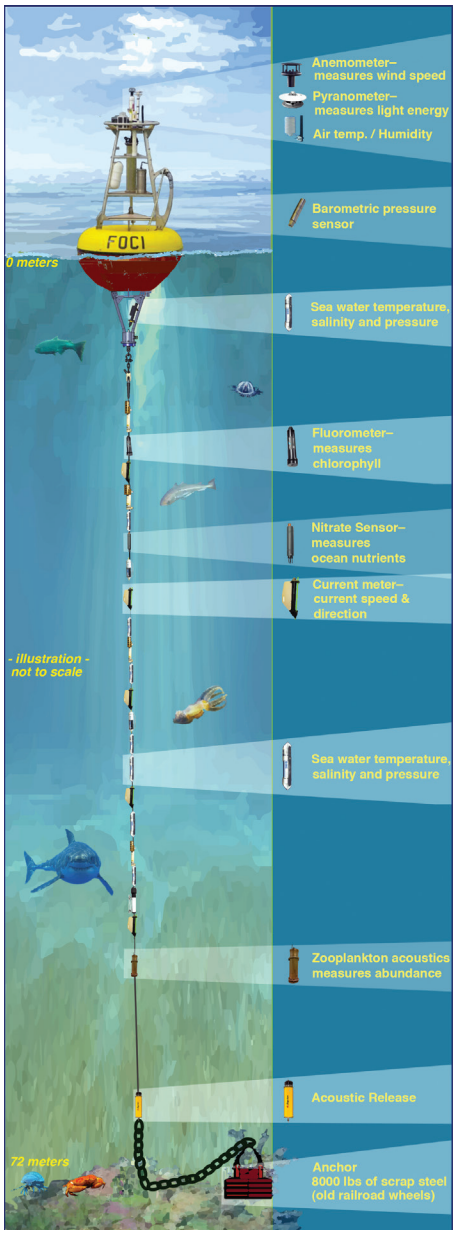
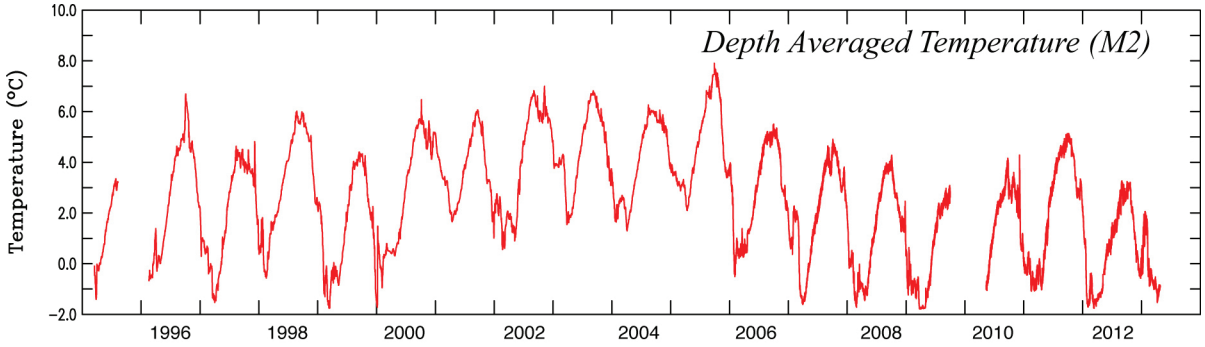


Diagram of a biophysical mooring including surface buoy (ice-free seasons), illustrating how instruments are arranged along the length of the mooring.

Fig. 3



Temperature averaged across all depths measured by the M2 mooring during 1995-2011.

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