The Bering Sea: Current status and recent events

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Current status of the Bering Sea ecosystem

Water temperatures in the southeastern Bering Sea continue to be warm, and the southernmost penetration of sea ice is significantly less far than in the 1970s, 1980s, and 1990s. Both the winter minimum and summer maximum temperatures have increased over the southeastern middle shelf (Fig. 1). A higher winter heat content for the water column means that northerly winds must be colder and blow longer to result in significant penetration of ice into the southeast Bering Sea. Furthermore, as the Arctic Ocean loses ice, northerly autumn and winter winds are less likely to be as cold as in previous decades. Since these winds are responsible for the formation of ice in the northern Bering and advection of ice into the southeast, this will result in later ice formation in the Bering Sea (Overland and Stabeno, Eos, 2004, Vol. 85, No. 33, p. 309-316).

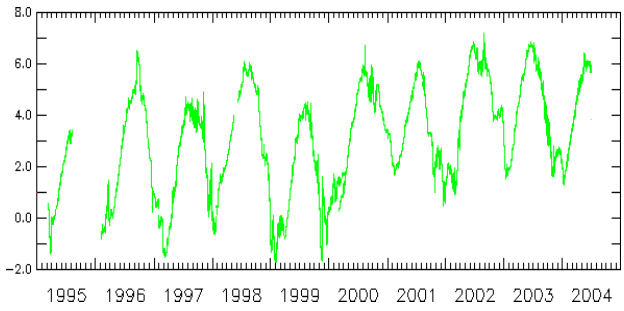

Fig. 1 Average water column temperature in the southeastern Bering Sea from 1995 – 2004 as measured at the Mooring 2 site. Source: P.J. Stabeno, NOAA – PMEL.

In recent years, there appears to have been a shift in the currents around the Pribilof Islands. This was particularly noticeable in 2004, when the northward flow along the west side of the Pribilof Islands was absent until July. This flow pattern was evident in both current meters and satellite-tracked drifters (http://www.pmel.noaa.gov/foci/lobec/gl_drifters.shtml). The typical pattern of a relatively strong (~20 cm s^{-1}) eastward flow along the south side of St. George Island, which turns northward following the 100 m isobath, has been hypothesized as an important source of nutrients to waters in and around the Pribilof Islands.

At the recent ESSAS symposium (see below), there were oral reports of other anomalous observations for the eastern Bering Sea. For example, summer mesozooplankton wet weight over the shelf may be decreasing, and the zooplankton community assemblage may differ from what was observed in this region during the 1980s and 1990s. In the summer of 2004, nesting planktivorous birds at the Pribilof Islands showed increased levels of stress hormones indicating difficulty in finding food. This shift was coincident with a shift in water movements. Other seabird species experienced unexpectedly poor reproductive success there. How the patterns in observed seabird recruitment are tied to recent changes in circulation around the Pribilof Islands is an area of active investigation. Scientists presenting these and other results at the ESSAS symposium are completing their research and preparing results for publication in a peer-reviewed symposium volume.

Ecosystems Studies of Sub-Arctic Seas (ESSAS)

A GLOBEC Symposium on "Climate variability and subarctic marine ecosystems" was held May 16-20, 2005, in Victoria, Canada. PICES co-sponsored the meeting and served as a local organizer for this event. Co-convenors Drs. George Hunt, Jr. (U.S.A.) and Kenneth Drinkwater (Norway) enthusiastically welcomed 224 scientists from 15 countries to the symposium. A symposium on climate effects is timely because recent changes in ecosystem

function appear to correlate with fluctuations in the physical environment, and because of growing concern about anthropogenically-induced climate change. Participants heard from a diverse group of scientists about recent changes in the Barents, Norwegian, Bering and Okhotsk Seas, and the Arctic, Antarctic, and North Pacific Oceans. Papers addressed changes within the physical, chemical and biological realms, including changes to fisheries and top trophic levels. Many of the presentations discussed localized warming in particular regions, however, it was interesting to note that several areas (*e.g.*, NW Atlantic, two sectors in the Antarctic) have exhibited cooling in recent years. Three days of oral presentations and two poster sessions demonstrated the rich variety of research conducted in the subarctic seas. Most sessions were plenary, although the sessions on the afternoon of May 18 were run concurrently. The purpose of the symposium was, in part, to launch a new GLOBEC program called ESSAS (**E**cosystems **S**tudies of the **S**ub-**A**rctic **S**eas; see details on the GLOBEC website at http://www.pml.ac.uk/globec/structure/regional/essas/essas.htm). The symposium was followed on May 20 by a workshop to review and discuss a draft Implementation Plan for ESSAS. Implementation of ESSAS will encourage and support undertakings by scientists to conduct comparative and synthesis efforts in the earth's subarctic ecosystems. Such an approach is necessary to understand, on a global scale, the climate teleconnections that exist among ecosystems.

Bering Sea Ecosystem Study (BEST)

The ESSAS Symposium was preceded by a one-day workshop to discuss a draft implementation plan for BEST (see details on the ARCUS website at http://www.arcus.org/Bering/oiw/best_workshop_05.html). Over 130 scientists attended the workshop, which was intended to provide an opportunity for the scientific community to critique the draft Implementation Plan written by the BEST Science Steering Committee chaired by Dr. G. Hunt, Jr. The U.S National Science Foundation, the funding agency promoting BEST, will support an initial phase of 3 to 5 years. It is hoped that a successful first phase will lead to a more ambitious second phase. The first phase will focus on physical, chemical and biological processes affected by the reduction of ice in the eastern Bering Sea. Work is expected to be conducted at the leading ice edge as well as to the north, in ice-filled waters, and to the south in open, ice-free waters during spring. If resources are available for a second phase, then other seasons, and geographic areas can be added.

The BEST Science Plan aims to follow processes through the food web from physics to fisheries, marine birds and mammals, and humans. Development of a human dimension component to BEST (HBEST) is ongoing and is being led by Dr. Benjamin Fitzhugh (Univ. of Washington, U.S.A.). A draft outline of HBEST is available at http://www.arcus.org/Bering/hbest/index.html.

Bering Climate Page

NOAA's Pacific Marine Environmental Laboratory (PMEL) hosts a unique and valuable resource for scientists working in the Bering Sea. The Bering Climate Page (http://www.beringclimate.noaa.gov) provides data and a variety of tools to investigate climate-ecosystem coupling in the Bering Sea (Fig. 2). Created by Drs. James Overland and Sergey Rodionov (U.S.A.), the page contains: a brief overview on current status of the Bering Sea, a quick look at over 25 indices of climate and ecosystem status, links to web accessible scientific reports, essays by topic experts, and perhaps the most valuable feature for researchers, a data page that provides access to climate, atmospheric, oceanic, biological, and fisheries data time series. Each time series is described and its relevance as an index or metric is explained. Users can examine recent trends in each individual index (look at the new regime shift calculator) as well as calculate correlations between indices. The web page is easy to use and a great way to generate hypotheses after looking at data.

Fig. 2 Bering Climate Page. Web page of check boxes and buttons that allow users to examine recent trends in climate, atmospheric, oceanographic, biological, and fisheries data.

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