

The Bering Sea: Current status and recent events

by Jeffrey M. Napp

Current status of the Bering Sea ecosystem

The winter of 2006/07 in the eastern Bering Sea was colder with more ice farther south than in the previous 6 years. Winter temperatures at NOAA's Mooring Site M2 reached freezing, and the maximum summer integrated water temperatures were cool (~ 4°C; **Fig. 1**). In contrast, ice cover in the Arctic Ocean was 40% less than the long-term average, and half of this loss occurred in the last year. Speakers at the 2007 Science Board Symposium on "The changing North Pacific: Previous patterns, future projections and ecosystem impacts" (PICES XVI, Victoria, Canada) noted that the loss of arctic sea ice may be occurring at a rate faster than predicted by IPCC models.

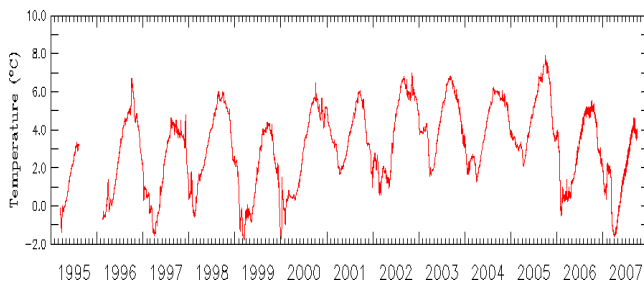


Fig. 1 Average water column temperature in the southeastern Bering Sea (1995–2007), measured at NOAA's Mooring Site M2. Source: P.J. Staben, NOAA – PMEL.

During the summer of 2007, the cold pool (bottom water with temperature <2°C on the eastern Bering Sea shelf remaining from the southern ice extent) was clearly evident in bottom trawl surveys conducted by NOAA–Fisheries Alaska Fisheries Science Center (**Fig. 2**). The cold pool extended south to the Alaskan Peninsula.

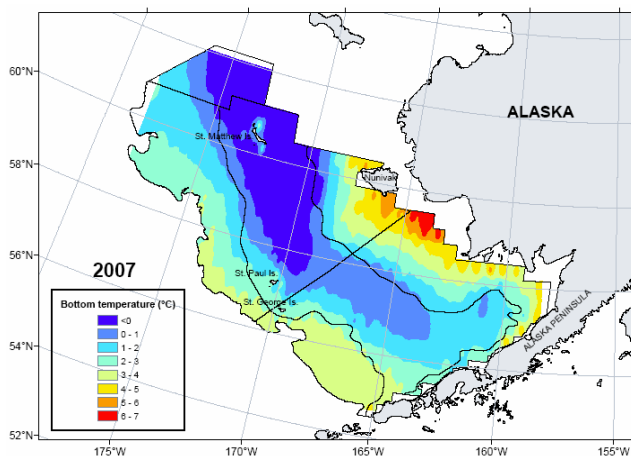


Fig. 2 Bottom water temperatures measured from the head rope of a trawl during the annual NOAA–Fisheries Alaska Fisheries Science Center summer bottom trawl survey. Figure courtesy of R. Lauth, NOAA, AFSC, RACE Division.

A late summer/early fall bloom of coccolithophores was observed from ~57°N to 60°N and ~169° to 172°W (south of St. Lawrence Island and east of the Pribilof Islands) by the U.S. component of the Bering Aleutian Island Salmon International Survey (BASIS, **Fig. 3**). Hokkaido University's Satellite Remote Sensing Group detected the bloom as late as October using MODIS/Aqua.



Fig. 3 Aquamarine waters in the eastern Bering Sea during BASIS. Source: L. Eisner, NOAA – AFSC.

Climate models predict that the effects of global warming on ice cover will be largest in the fall. Unlike previous years, the ice growth in the Arctic and the Chukchi Sea was slow in the fall of 2007. In mid-December 2007, open water persisted in the Chukchi Sea with up to +10°C anomalies in air temperature over most of the western Arctic and Chukchi Sea. BASIS researchers also noted in their surveys of the northern Bering and Chukchi Seas that the Chukchi Sea was warmer than the Bering Sea. At the time of this writing (December 2007), Chukchi Sea ice growth appears to be delayed by about 2 months, potentially diminishing the atmosphere's ability to generate conditions (cold northerly winds) that favor production of large amounts of ice in the eastern Bering Sea.

However, November 2007 sea surface temperatures (SSTs) from the Bering Sea are among the coldest since 1982, and are similar to the most recent cold year, 1999 (**Fig. 4, top**). The dominant pattern of SST covariation (55%) in November features a region of positive loadings throughout most of the Bering Sea centered over the deep basin, which is contrasted with a region of lesser negative loadings in Norton Sound in the northeastern Bering Sea (**Fig 4, bottom**). Positive loadings are associated with warmer SSTs.

The eastern Bering Sea did not experience much heating during the previous summer, so present water temperatures are cool (see above), requiring less heat flux to form ice. Scientists are divided in their opinions of whether or not 2007/08 will be a cold winter and spring for the eastern Bering Sea. Some point to the absence of Arctic sea ice that conditions the northerly winds responsible for Bering

Sea ice formation, and say that we can expect less ice this year; others point to the already cold water temperatures (and the moderate to strong La Niña on the equator) and say that we could have extensive sea ice coverage.

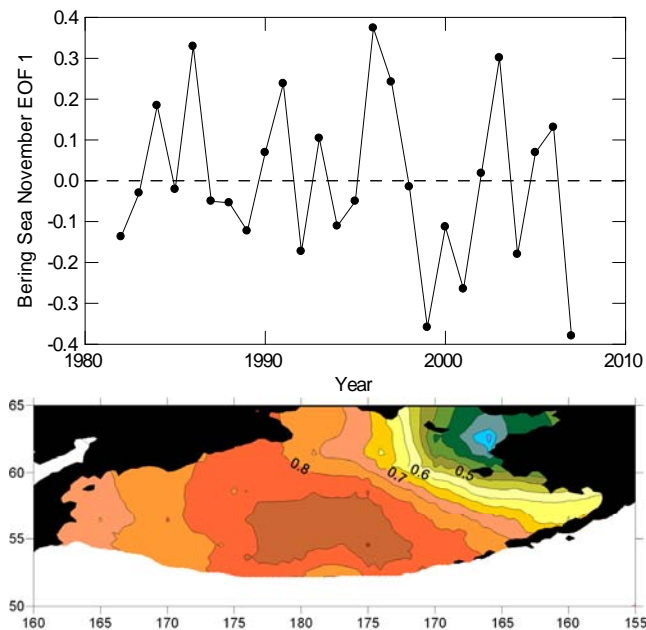


Fig. 4 (Top) Time series (1982–2007) of EOF 1 from Bering Sea November sea surface temperature (SST) data. (Bottom) Spatial pattern of EOF1 loadings from November SST data. Figures courtesy of S. McKinnell, PICES Secretariat.

The disappearance of sea ice can be expected to affect the management of ice-dependent wildlife such as polar bears, ice seals, and walrus. At last year's Alaska Marine Science Symposium there were several reports of impacts on polar bears, specifically on their increased mortality. The higher mortality rates were the result of starvation. Instances of cannibalism and decreased food availability due to loss of sea ice were reported. Recently, there have been reports from Russia of increased mortality of walrus due to reduced availability of sea ice as habitat. Densities of animals within walrus colonies were much greater last summer due to the lower availability of ice. Disturbances of the animals by bears, humans, etc., result in stampedes

of walrus off the ice, and during these stampedes many animals are mortally injured or killed (http://seattlepi.nwsource.com/national/1501ap_sea_ice_walrus.html).

Recent data on fish populations in the eastern Bering Sea show continued decline in the biomass of both Pacific cod and walleye pollock, and increases in the biomass of flatfishes, including arrowtooth flounder. Pollock biomass is only 87% of the long-term mean, though the 2006 year class appears to be well above average at this time (<http://www.fakr.noaa.gov/npfmc/newsletters/NEWS1207.pdf>).

2007/08 activities in the eastern Bering and Chukchi Seas

2008 will be an active year for research in the Bering and Chukchi Seas. Scheduled programs include: 1) the Japan–U.S. IPY cruise, (<http://www.nipr.ac.jp/~ipy/sympo/procfiles/34-Saitoh.pdf>); 2) a partnership between the U.S. National Science Foundation's Bering Sea Ecosystem Study (BEST), and the North Pacific Research Board's Bering Sea Integrated Ecosystem Research Program (BSIERP, <http://bsierp.nprb.org>); and 3) the joint Russian–American Long-Term Census of the Arctic (RUSALCA). These investigations are in addition to annual cruises and surveys planned by the U.S. NOAA–Fisheries and the State of Alaska.

For example, last year, Hokkaido University's T/S *Oshoro-maru* extended their "usual" area of operations in the southeastern Bering Sea to include stations south of St. Lawrence Island, Norton Sound, and the eastern Chukchi Sea (Fig. 5). They will occupy nearly the same stations in 2008, and one of the objectives will be to compare the distribution of Arctic cod (*Boreogadus saida*) in the last two years with trawls taken in the early 1990s. Similarly, BEST will conduct a series of cruises aboard the USCG Icebreaker *Healy* beginning in approximately mid-March through mid-July in the eastern Bering Sea from the Aleutian Islands to St. Lawrence Island.

The Understanding Ecosystem Processes of the Bering Sea website sponsored by BEST and BSIERP (see above) has a page dedicated to information about research cruises (note

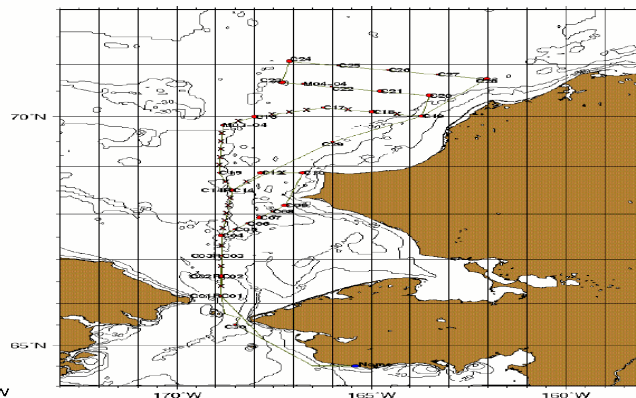
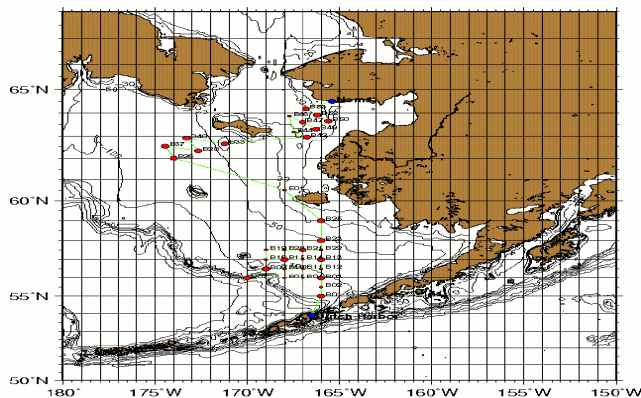


Fig. 5 T/S *Oshoro-maru* stations and cruise tracks from Legs 2 and 3, summer 2007. Figure courtesy of S. Saitoh (<http://odyssey.fish.hokudai.ac.jp/IPY/>).

that there is also an IPY arctic ship coordination website at <http://www.asci-ipy.de/>). The author would like to encourage all who are working in these geographic regions to submit descriptions of their field programs (including land-based studies on birds, seals, and humans) to the website. Metadata can also be submitted to the North Pacific MetaDatabase that is maintained by PICES (<http://www.pices.int/projects/npem/default.aspx>). A little effort to make your programs known to others working in these areas will foster increased collaboration and interdisciplinary research in these regions.

Last, but not least, there will be a full day workshop at the PICES Seventeenth Annual Meeting (PICES XVII) in Dalian, China (October 23–November 2, 2008), for the presentation and discussion of results from IPY field projects. We hope to see you there!

Acknowledgements: Many thanks to the following PICEanS who helped create this report: Drs. Lisa Eisner, George Hunt, Skip McKinnell, James Overland, Sei-ichi Saitoh, and Phyllis Stabeno.



Dr. Jeffrey (Jeff) Napp (jeff.napp@noaa.gov) is a Biological/Fisheries Oceanographer at the Alaska Fisheries Science Center of NOAA–Fisheries. He is Head of the Recruitment Processes Program at the Center and co-leader (with Dr. Phyllis Stabeno) of NOAA’s Ecosystems and Fisheries Oceanography Coordinated Investigations (EcoFOCI). His research is focused on physical and biological processes at lower trophic levels that affect recruitment variability in fish populations. Jeff was active as a Principal Investigator in past Bering Sea research programs (NOAA’s Bering Sea FOCI, Southeast Bering Sea Carrying Capacity) and is currently a Principal Investigator on an NPRB-sponsored Bering Sea Integrated Ecosystem Research Plan (BSIERP) project. He formerly served on the BEST (Bering Ecosystem Study) Science and Implementation Plan Steering Committee. Jeff is also a member of the PICES MONITOR Technical Committee.

PICES Interns



PICES offers sincere thanks to **Mr. Xuewu Guo** (Yellow Sea Fisheries Research Institute of the Chinese Academy of Fishery Sciences, Qingdao, China), the 2007 PICES intern, who will complete his term at the Secretariat at the end of January, and return to China. Many of you had an opportunity to meet him at the ICES/PICES Conference for Early Career Scientists on “*New frontiers in marine science*” in Baltimore (U.S.A.), at the PICES Sixteenth Annual Meeting in Victoria (Canada), or at the PICES Secretariat office. It was very enjoyable working with him, and we appreciate his dedicated efforts and excellent performance during this past year. We wish him great success in his career.

We are pleased to announce that **Mr. Key-Seok Choi** from the Korean Ocean Research and Development Institute (Ansan, Korea) will join the Secretariat in early February as the 2008 PICES Intern. He has a unique combination of a Bachelor’s Degree in Oceanography and a Master’s Degree in Library Science, and we look forward to his involvement in PICES activities.