

Current Status of the Bering Sea Ecosystem

by Jeffrey Napp

The current cool to cold period of temperatures in the Bering Sea continued for the fourth straight year. Ice penetration into the southeastern portion was far and early. There was a brief period in March when southwesterly winds temporarily halted the southerly transport of sea ice, but this only lasted for about a week, and then the northerly winds resumed. At the time of this writing (June 2009), the cold pool of bottom water is well developed over the southeastern shelf, and the sea ice edge is at about 61°N between St. Lawrence and St. Matthews Islands. The front is composed of 4 to 6 tenths ice up to 30 cm thick. Eight to 10 tenths sea ice coverage was present between St. Lawrence Island and the Bering Strait.

The U.S. Coast Guard Cutter (Ice Breaker) *Healy* had two cruises to the eastern Bering Sea this spring. Both were part of the collaborative research by the U.S. National Science Foundation's Bering Sea Ecosystem Study (BEST) and the North Pacific Research Board's Bering Sea Integrated Research Program (BSIERP). The first cruise was from March 10–31 and focused on the northeastern portion of the Bering Sea with an emphasis on the patch dynamics of walrus in relation to their benthic food supply (www.eol.ucar.edu/projects/best/cruise_summary_info.html). Most of the stations were located to the south of St. Lawrence Island in the Middle and Coastal Domains. The second cruise was April 3–May 12 and consisted of four major east–west transects and stations along the 70-m isobath (www.eol.ucar.edu/projects/best/cruise_summary_info.html).

During the second cruise, rate process measurements for parts of the food web were made every other day. Once the ship was within the ice, short and long ice stations were occupied to sample the ice and its associated chemistry and biota. Observations for seabirds and marine mammals occurred during daylight for the duration of the cruise: 4173 kilometres of track line visual observations were obtained for seabirds and mammals. There was also a science education team aboard to help communicate the purpose of the mission and its importance. During the cruise there was a significant northerly retreat in the position of the ice edge. At most stations, the biological activity (e.g., primary production, grazing) in the water column was low, except in a large patch of water to the southwest of St. Matthews Island along the 100 m isobath where a phytoplankton bloom was occurring. Surface nitrate appeared to have been reduced from winter levels along the middle and coastal domains, but not along the outer shelf and shelf break. Complete depletion of dissolved nitrate was observed in some inner shelf areas. The initial report states that large numbers of scyphozoa continue to persist over the southeastern middle shelf.

Two other spring cruises were conducted on the NOAA Ship *Oscar Dyson* (April 23–May 4, and May 7–20) as part of the combined BEST/BSIERP program and NOAA's North Pacific Climate Regimes and Ecosystem Productivity (NPCREP) Program. The first cruise recovered and redeployed the NOAA biophysical moorings on the eastern Bering Sea shelf. Subsequent to deployment, the mooring to the east of St. Paul Island (M4) was temporarily lost as the ice shoved it about 6 nautical miles to the south. The mooring was found at its new position in June by the R/V *Knorr*. The second cruise conducted a plankton survey in the area around the Pribilof Islands and along the northern side of the Alaska Peninsula. Water temperatures were cold everywhere (<1°C), and larval fish were conspicuously absent. Walleye pollock eggs were abundant around the Pribilof Islands in the neuston, but concentrations of fish larvae of any species were low along the Peninsula. Transiting from the Pribilof Islands to the Peninsula, the ship had to navigate through a large field of sea ice over the Middle Shelf Domain (this was the ice that displaced mooring M4).

The Alaska Fisheries Science Center National Marine Mammal Laboratory conducted a dedicated marine mammal research cruise from May 13–June 11 aboard the NOAA Ship *MacArthur II* that focused on ice-associated seals in the eastern Bering Sea (<http://www.afsc.noaa.gov/nmml/polar/cruise/index.php>). Scientists are working to develop accurate population assessments of the four species of seals as well as comprehensive descriptions of their distribution and habitat use. Sixty-eight spotted and ribbon seals were sampled and measured, and 52 of them were tagged with satellite-tracking and data-logging instruments, the largest-ever tagging effort for these species in their sea ice habitat. More than 3500 positions had been received from the seals by mid-June, documenting their behavior during the seasonal period of rapid ice retreat. An unmanned aircraft system (UAS) was flown on 10 occasions for a total of 49 hours, collecting 27,000 digital photographs along more than 1000 nautical miles of track line. A small subset of the photos, examined for presence of seals, clearly demonstrated the capability to collect useful data from a small UAS platform.

The Alaska Fisheries Science Center also began its annual bottom trawl survey in late May of 2009. The Groundfish Assessment Program had accomplished approximately 100 stations by mid-June. Bottom temperatures were lower than average, and the cold pool extended into parts of Bristol Bay. Qualitatively the bottom water temperatures seemed a bit warmer than last year. There were very few 1 year old pollock in Bristol Bay and no large catches of adult pollock. Catches of 1–3 year old Pacific cod were above average catches in Bristol Bay. Plankton tows were

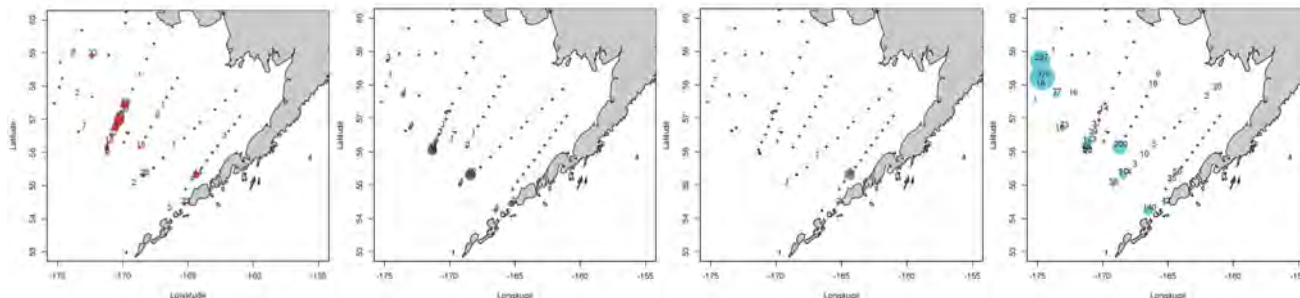


Fig. 1 Rough counts (accomplished at sea) of four taxa of larval fish removed from the drogue net of a MOCNESS sample. Panels from left to right: walleye pollock (*Theragra chalcogramma*); arrowtooth and Kamchatka flounder (*Atheresthes stomias* and *A. evermanni*); Pacific cod (*Gadus macrocephalus*), and rockfish (*Sebastes* spp.). The data represent all tows taken before July 1, 2009. Figures courtesy of E. Siddon and Dr. T. Smart.

having difficulty with high concentrations of *Phaeocystis pouchetti* and with what was estimated to be higher than usual catches of the scyphomedusa, *Chrysaora melanaster*. The survey will conclude in late July, and a map of bottom temperatures will be available late this summer.

The NOAA Ship *Oscar Dyson* began conducting an echo-integration mid-water trawl survey of the eastern Bering Sea in June (June 9–August 7). Alaska Fisheries Science Center scientists from the Marine Assessment and Conservation Engineering program will use multiple frequencies to help identify acoustic targets. In addition to assessment of walleye pollock, scientists hope to provide estimates of the distribution and abundance of forage species such as capelin and euphausiids.

The BEST/BSIERP summer cruise on the R/V *Knorr* left Dutch Harbor on June 14 and will be at sea until July 13. The goal is to conduct a follow-up cruise to the spring USCGC *Healy* cruises. For example, scientists are sampling around drifters released during the spring cruise in a patch of pollock eggs at the Pribilof Islands. Summer catches of walleye pollock along the peninsula and at the Pribilof Islands suggest that some spawning occurred in those locations after the spring cruise on *Oscar Dyson* (Fig. 1). Updates and the eventual cruise report can be viewed at www.eol.ucar.edu/projects/best/cruise_summary_info.html. Scientists are already reporting high concentrations of *Phaeocystis* and *Chrysaora* at the time of this writing.

The T/S *Oshoro maru* from Hokkaido University (recipient of the first PICES Ocean Monitoring and Service Award, POMA) will spend most of the summer in the Bering Sea and Northern Pacific Ocean: north and south of the Aleutian Island chain (June 13–19), in the deep Bering Sea basin and along the eastern continental shelf break (June

22–July 5), on the eastern Bering Sea shelf from Unimak Pass in the south to the Bering Strait in the north (July 8–17), and in the central Aleutian Island area (July 20–23).

Later this summer there will be additional cruises to observe the eastern Bering Sea ecosystem. The U.S. NOAA NPCREP program will recover and redeploy moorings aboard the NOAA Ship *Miller Freeman* (from September 19 to October 12) as part of BEST/BSIERP partnership, and will collect physical, chemical, and biological oceanographic samples across and along the shelf (70-m isobath) from the Alaskan Peninsula to St. Lawrence Island. Examination of inorganic carbon and pH will be part of that exercise. In addition, the U.S. component of the Bering–Aleutian Salmon International Survey (BASIS) from the Alaska Fisheries Science Center will conduct a broad-scale fisheries oceanography survey for pelagic fish, plankton, and biophysical oceanographic data using the NOAA Ship *Oscar Dyson* (September 2–30) and a charter vessel (from August 18 to September 7) also in support of the NPRB and NSF partnership. The *Dyson* will work primarily in the southeastern portion of the shelf and the charter vessel will work from Nunivak Island to the Bering Strait.

Seasonal coverage of the eastern Bering Sea is extensive this spring and summer thanks in a large part to the partnership between the U.S. National Science Foundation and the North Pacific Research Board. We are in the second of three field years for the BEST/BSIERP projects, and the multiple observations of the ecosystem should yield some great new insights into its structure and function.

Acknowledgements: Many thanks to the following PICESans who helped create this report: Drs. Peter Boveng, Janet Duffy-Anderson, Ed Farley, Lisa Eisner, Robert Lauth, Tracey Smart, Jim Overland, Phyllis Staben, and Troy Buckley and Elizabeth Siddon.



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 Staben) 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. He is a Principle Investigator on an NPRB-sponsored Bering Sea Integrated Ecosystem Research Plan (BSIERP) project. Jeff is also a member of the PICES Technical Committee on Monitoring.