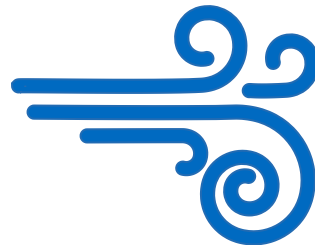
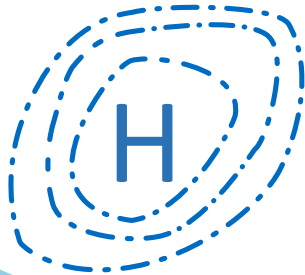


2018 Eastern Bering Sea Ecosystem Status Report: *In Brief*



Current Conditions

The eastern Bering Sea was characterized by anomalously warm conditions in 2018. Over the northern shelf, an unprecedented near-complete lack of sea ice occurred; the southeastern shelf had no sea ice and no cold pool (footprint of winter sea ice persisting as cold bottom water the following summer, less than $<2^{\circ}\text{C}$).

Unusual and unexpected weather events during the winter of 2017/2018 resulted in the lowest ice year on record for the eastern Bering Sea. First, residual heat in the ocean delayed freeze-up. Then, a large and persistent high-pressure system centered over the Aleutian Islands and shifted the position of the Aleutian Low Pressure System to the northwest. Lastly, highly unusual winds from the southwest brought warm air over the Bering Sea and prevented sea ice from forming until March.



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How did the system respond?

Northern Bering Sea

Consequences of no sea ice: Without sea ice melt (freshwater), there was no salinity component to the stratification of the water column. The water column was well-mixed from top to bottom and resulted in a weak and delayed spring bloom (~1 month later than typical). A weak bloom cannot fuel the next link in the food chain, the zooplankton. Their abundances and lipid quality were low (lower nutritional value). Anecdotally, large **copepods** were predominantly *Eucalanus bungii*, not a lipid-rich species.

Bottom trawl, surface trawl, and acoustic surveys again documented the presence of pollock and Pacific cod in the northern Bering Sea. Pollock biomass (total weight of all fish in the population) declined slightly from 2017 to 2018. However, more than 50% of **Pacific cod** biomass in the eastern Bering Sea was found over the northern portion of the shelf. **Juvenile forage fish** (e.g., pollock, capelin, herring), an important prey resource for birds and mammals, all showed downward trends in abundance over the northern portion of the shelf in 2018.

Scientists expect that the juvenile Chinook salmon index will be below average for the 2nd consecutive year. This could lead to reduced bycatch caps three to four years in the future.

Ice seal distributions were dramatically impacted by the lack of sea ice and retraction of the ice edge to the northeast. **Ribbon seals** were unusually scarce. Spotted seal pups weighed less and had less blubber than in recent years. NOAA received reports from communities in the region of exceptionally high numbers (~50) of dead seals (primarily young bearded seals) on beaches along the north side of St. Lawrence Island in early June. Additionally, 48 beached ice seals (bearded, ringed, and sub-adult spotted seals) were reported near Wales. The seals appeared to have poor body condition and empty stomachs.

A seabird die-off event, unprecedented in terms of spatial and temporal scale, occurred. Large numbers of seabirds (mainly **murres**) washed ashore from Bering Strait southward through Norton Sound and along the shores of St. Lawrence Island over several months. Starvation is the only identified cause of death to date. Based on historical diet information, it appears that large, lipid-rich zooplankton were in low supply in 2018. Community members, subsistence eggers, and scientists also observed reproductive failures and poor reproductive success (mainly by murres and kittiwakes).

Community members provided invaluable observations of ecosystem response to the lack of sea ice over last winter. For example, large Pacific cod were caught in crab pots in Nome, indicating that these adult fish may have remained over the northern shelf last winter. King salmon were caught on rods from the beach in Nome and halibut fishing off Savoonga was “really great” (Gay Sheffield, UAF MAP, Nome). Subsistence hunters for auklet fledglings struggled to find live birds and murres, shearwaters, and crested auklets were found dead and emaciated in Nome and on St. Lawrence Island.

Southeastern Bering Sea

The timing of the spring bloom was a bit late, but otherwise the conditions were typical of a low-ice year with above-average water temperatures and lack of cold pool (similar conditions to early 2000s). By late spring, small copepod abundances were at one of the highest levels recorded while krill abundances were low. A summer acoustic survey indicated low densities of **krill**, continuing a trend of low abundance of this important prey resource since 2012. Reduced energy transfer from the prey base to the top-level predators likely contributed to poor body condition and observed mortality events (i.e., mammals and seabirds).

Larval pollock production was high and their distribution shifted eastward and onto the shelf (typical of other warm years). However, poor condition and survival is predicted for these fish due to the diminished prey base available. The bottom trawl survey indicated that Pacific cod and pollock abundances were below average. Pacific cod abundance was lower, but biomass was higher (fewer, larger fish). There was no evidence of pollock recruitment, with low age-1 numbers since 2014 and abundance dominated by the 2012 year class.

Wind and ocean patterns were favorable for winter-spawning flatfish (e.g., **arrowtooth flounder**, Northern rock sole) in 2018 indicating that larval fish were carried to nursery areas with optimal conditions for their survival; only 2015 and 2018 had larval drift trajectories consistent with above-average survival. There has been a negative trend in Pacific cod condition (i.e., skinnier fish at a given length) since a peak in 2003. The condition of adult pollock was the second lowest on record and continued a decreasing trend since 2010. An index of overall biomass of demersal (living closer to the seafloor) and benthic (living on the bottom of the seafloor) fish and invertebrates (largely driven by biomass of pollock) dropped sharply between 2017 and 2018. Estimates of age-1 predation mortality remain above average for pollock while Pacific cod and arrowtooth flounder mortality were at and below the mean, respectively.

The story was mixed for motile epifauna including crabs, urchins, and sand dollars. The biomass of some species groups (e.g., **urchins**, sand dollars) continued an increasing trend in 2018 while many commercial crab stocks declined. Pribilof Island **blue king crab** abundance remains below average, but most stocks (St. Matthew Island blue king crab, Tanner crab, and Bristol Bay red king crab) show declining trends. On the bright side, female **snow crab** abundance is above average and expected to continue to increase in coming years.

Northern fur seal pup production at St. Paul Island has been declining by ~4% per year since 1998 while while St. George Island pup production increased by about 5% since 2016. Also at the Pribilof Islands, seabird reproduction was poor, as expected for a warm year with little sea ice. On St. George Island, murres experienced the latest mean hatch date ever recorded.

What do the Indicators Tell Us This Year?





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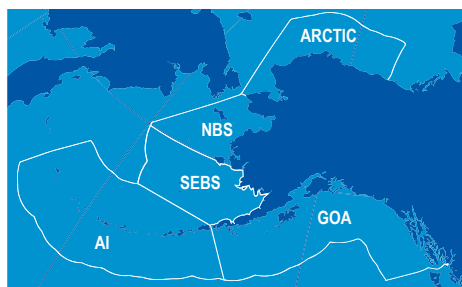
Future Projections



The Chukchi Sea has been freezing up, on average, one day later each year since 1980. NOAA Fisheries' Alaska Fisheries Science Center and NOAA Research's Pacific Marine Environmental Laboratory produce a 9-month forecast of ocean conditions in the eastern Bering Sea using the Bering10K ocean and plankton model. The prediction for summer 2019 is for continued warmth similar to 2014–2018 and reduced cold pool extent.

Management Uses

Resource managers used ecosystem information collected in this report to help determine management measures for pollock in 2019. They took into account unfavorable environmental conditions that limit pollock survival including warm water and limited prey, which could affect future stock size. Despite the stock being well above average, they made a precautionary adjustment to lower the **overall** biological catch limits for pollock. Pollock are managed as part of the groundfish group, which have a combined annual fishing cap of 2 m mt for the Bering Sea. Due to biological constraints in other groundfish fisheries, the final catch limits for pollock, well below the biological limits, were increased slightly from 2018 (by <2%).



Links to full reports from Large Marine Ecosystems are available here: <https://access.afsc.noaa.gov/reem/ecoweb/Index.php>

Reference: Siddon, E., and Zador, S., 2018. Ecosystem Status Report 2018: Eastern Bering Sea, Stock Assessment and Fishery Evaluation Report, North Pacific Fishery Management Council, 605 W 4th Ave, Suite 306, Anchorage, AK 99501

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Hot Topics

Pollock in Bristol Bay



Community members, and subsistence and commercial fishers from Bristol Bay reported unusual behavior of adult pollock in the summer 2018. Sightings of pollock swimming “with their heads out of the water” and “half swimming, half floating” were observed. Pollock washed ashore in high numbers along the beaches and were caught in subsistence set nets both near Pilot Point on the Ugashik River and from the Nushagak District. “Traditionally, it is unusual to see pollock in the salmon season in Bristol Bay” (Catie Bursch, fisher). Fishermen reported dead fish ashore in May and observations of “odd behaviors” continued through July 2018.

Samples of adult pollock that had washed ashore were sent to NOAA/Alaska Fisheries Science Center in Juneau for processing. Fish were “definitely skinny” (Bob Lauth, NOAA/AFSC), but stomach contents were “pretty typical” (Kerim Aydin, NOAA/AFSC). Stomach and intestine samples were processed for PSP toxins (i.e., saxitoxin); all samples contained low but detectable levels of PSP, therefore toxins could have played a role in the unusual behaviors and mortality events (Kathi Lefebvre, NOAA/NWFSC). It is important to note that the levels were well below seafood safety regulatory limits for human consumption.

Interestingly, NOAA's bottom trawl survey found record-high concentrations of adult pollock at stations within Bristol Bay during summer 2018. Additionally, the inshore run of **sockeye salmon** into Bristol Bay was the largest on record and nearly double the average run size since 1963.

A Rat on St. Paul

The Pribilof Islands support a globally significant concentration of breeding seabirds; the Ecosystem Conservation Office of the Aleut Community of St. Paul Island maintains a rat prevention program to provide an early detection system to safeguard against the potentially catastrophic impacts rats could have on breeding seabirds. However, a rat was detected at the St. Paul fish processing plant during August 2018. The office, in consultation with U.S. Fish and Wildlife Service, deployed a “strike team” of rat eradication experts in September, but efforts to trap the rat have been unsuccessful.

