

From sea ice to seals: A moored marine ecosystem observatory in the Arctic

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Emerging sensor technologies have opened up new opportunities to monitor and understand complex interactions across all levels of the ecosystem. The Chukchi Ecosystem Observatory uses these technologies to meet needs for continuous, high resolution, and year-round observations in the biologically productive and seasonally ice-covered Chukchi Sea off the northwest coast of Alaska. This mooring array records a broad suite of parameters that facilitate observations yielding better understanding of physical, chemical and biological couplings, phenologies, and the overall state of this Arctic shelf marine ecosystem. While cold temperatures and eight months of sea ice cover present challenging conditions for the operation of the observatory, this extreme environment also provides as a rigorous test bed for innovative ecosystem monitoring strategies. Our data provides new perspectives on the seasonal evolution of sea ice, water column structure and physical properties, annual cycles in nitrate, dissolved oxygen, inorganic carbon, phytoplankton blooms and export, zooplankton abundance and vertical migration, the occurrence of Arctic cod, and vocalizations of marine mammals such as bearded seals. We are combining these integrated ecosystem observations with ship-based observations and modeling to produce a time-series that documents biological community responses to changing seasonal sea ice and water temperatures while establishing a scientific basis for ecosystem management. In working towards an ecosystem observatory network around Alaska, we are currently developing a second ecosystem observatory for the Gulf of Alaska. If this approach can be successful in the unforgiving Arctic environment, then it is ready to be deployed globally in ecosystems where the operational challenges are typically much reduced.