

The Distributed Biological Observatory: A Marine Change Detection Array in the Pacific Arctic

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ABSTRACT

Marine ecosystems in the Arctic Ocean are likely undergoing significant changes due to rapid sea ice loss and seawater warming, particularly on the inflow shelves influenced by exchange with the Pacific and Atlantic oceans. Key processes that are shifting in phenology include seasonal sea ice formation and retreat over a latitudinal range, advection of nutrient-rich Pacific water across the shelves into the Arctic Basin, and pelagic-benthic coupling on the broad continental shelves that connect lower trophic organisms to upper trophic level resource use. In response to this dramatic seasonal sea ice loss and other physical changes, a Distributed Biological Observatory (DBO) is being coordinated internationally as a change detection array to measure biological responses to physical variability along a latitudinal gradient extending from the northern Bering Sea to the Beaufort Sea in the Pacific Arctic region. The most comprehensive DBO sampling has been initially focused on five regions of demonstrated high productivity, biodiversity and/or rates of change in the northern Bering and Chukchi Seas.

Since 2010, the DBO has developed by coordination through the Pacific Arctic Group, a consortium of the 6 countries operating as an independent cooperative associated with the International Arctic Science Committee. Countries participating include those sampling regularly in the region, specifically Canada, China, Korea, Japan, Russia and the United States. In addition, the DBO concept is expanding to a larger pan-Arctic network with longitudinal transect lines from west to east in the Beaufort Sea, a developing extension of the NE Chukchi Sea DBO line westward into Russian waters, and plans to include latitudinal DBO transect lines in the northern Barents Sea in the north Atlantic Arctic. Standardized sampling in all five DBO regions in the Pacific region ranges from physical to biochemical, including biological measurements across the main trophic levels to document biodiversity and biomass, to satellite observations and mooring arrays. An Arctic Marine Pulses (AMP) conceptual model includes the DBO regional locations to facilitate tracking of seasonal biophysical 'pulses' across a latitudinal gradient from the northern Bering Sea to the northern Chukchi Sea. As such, the DBO collects and evaluates key information to enable ecosystem approaches to management in pan-Arctic ecosystems. The DBO and expanding network is endorsed and facilitated by the Pacific Arctic Group that is providing a process for engaging and organizing the international scientific community in monitoring the Arctic. This presentation will highlight results and outcomes from the DBO effort to track biological responses in the context of ongoing ecosystem-based, multidisciplinary studies that are supported by a network of international stakeholders.