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BIOLOGICAL TIME SERIES OBSERVATIONS IN THE PACIFIC ARCTIC

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The Pacific sector of the Arctic Ocean is experiencing major reductions in seasonal sea ice extent and increases in ocean temperatures. Emerging observations indicate that these changes are driving shifts in marine species composition that likely signal large-scale ecosystem reorganization. One of the key uncertainties in the region is how the marine biological system will respond to seasonal shifts in the timing of spring sea ice retreat and/or delays in fall sea ice formation. It is also uncertain what impact these changes will have on the functioning of the marine ecosystem in this highly productive region. Variations in upper ocean water hydrography, phytoplankton production, pelagic-benthic coupling and sediment carbon cycling are all influenced by sea ice and temperature changes in the region. Potential biological impacts to climate forcing include shifts in species composition and abundance, northward range expansions, and changes in lower trophic level productivity that directly cascade and affect the life cycles of higher trophic level organisms. Several programs undertaken before and during the International Polar Year (IPY), including the BEST/BSIERP (Bering Sea Research Program), Canada's Three Oceans (C3O), Russian US Long-term Census of the Arctic Ocean (RUSALCA), and SBI (Western Arctic Shelf-Basin Interactions) are providing insights into the key processes influencing ecosystem function in this region.

Over the last two decades certain sites have been occupied and re-occupied during both national and international studies, forming a growing time-series for the northern Bering Sea to Barrow Canyon. These studies indicate spatial changes in carbon supply to the underlying sediments by proxies such as changes in infaunal community composition and biomass, and shifts in sediment grain size on a S-to-N latitudinal gradient, with implications to system-level ecosystem structure. Other evidence indicates a spatial shift northward in fish distributions and marine mammal migrations, with direct impacts on habitat for ice dependent species, such as walrus. In order to track the biological response to sea ice retreat and environmental change we are working to develop a "Distributed Biological Observatory" (DBO) program that

includes select biological measurements of lower trophic level species that are tied to sentinel higher trophic level species as well as undertaking coordinated hydrographic measurements (Grebmeier et al. 2010, Eos Trans. AGU, 91:161-162). Although at an early state, a coordinated program of appropriately integrated observatory measurements will allow for evaluation of the producer-consumer response to hydrographic shifts with climate warming. The DBO currently focuses on four regional "hotspot" locations along a latitudinal gradient in regions that exhibit high productivity, biodiversity, and overall rates of change. The DBO will serve as a change detection array for the identification and consistent monitoring of biophysical responses. A network of spatially explicit DBOs would be organized through a collaborative international network under the international Pacific Arctic Group (PAG) to facilitate tracking the ongoing shifts in ecosystem structure in the next decades. This presentation will evaluate the status and developing trends of the marine biological system as it responds to the rapid environmental forcing occurring in the Pacific Arctic sector.