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International activities and collaborations as part of the Distributed Biological Observatory in the Pacific Arctic

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The Arctic ecosystem is undergoing change due to warming seawater temperatures and declining sea ice cover on regional to pan-Arctic scales. Changes observed in the biological system range from increasing primary productivity seasonally, but varying by region, changes in organic carbon cycling, trophic boreal species range expansion as well as Arctic species contractions, and impacts to upper trophic seabird and marine mammal populations and migration patterns. The Distributed Biological Observatory (DBO) is a successful example of a change detection array where international cooperation on a scientist-to-scientist basis is tracking the status and trends of the marine ecosystems of the Bering Strait region (Fig. 1-Left panel). Expansion of the DBO into a pan-arctic network is occurring with the developing Atlantic, Davis Strait/Baffin Bay and Siberian DBOs that will strengthen our ability to synergistically observe, track and model ecosystem impacts of a warming climate and ocean (Fig. 1-right panel). Stressors in the Pacific Arctic associated with climate warming, such as warming seawater temperatures, increasing harmful algal blooms, and ocean acidification have direct impacts on food security for coastal communities as well as potentially commercial fisheries.

Research collaboration and coordination are essential for studying the recent changes in the Arctic system (physical, biochemical, biology) with ongoing climate warming to investigate the status of the system and to develop models for projecting future ecosystem change. Time series studies are essential to track changes in the ecosystem. Knowledge gaps include regional and seasonal multi-disciplinary studies that to determine the status and trends in marine ecosystem structure that have the potential for global impacts. Topics for joint investigation include the changing seasonal sea ice cover and warming seawater and their impact on biological community composition in both the water column and benthos. The developing Pacification of the region has the potential for reorganization of the ecosystem with increased human usage for commercial shipping through the Arctic. In addition, the potential for fish extraction in the high Arctic was the basis for the June 2021 International Agreement to prevent Unregulated High Seas Fisheries in the central Arctic Ocean that directs = coordinated and joint research activities and monitoring from the outer shelf regions to the Central Arctic Ocean in a pan-Arctic fashion before fish extraction can occur.

Building a joint, collaborative research program now using Japan's new research icebreaker as an organizing field platform would be an excellent contribution to international collaboration for science activities extending into the Arctic Basin. There is a need for national as well as internationally coordinated funding support to develop a joint field program with multi-disciplinary science activities that leverage scientific strengths in the international community.



The new Japanese icebreaker could act as a “flagship” research platform for international collaboration to address important studies to understand high Arctic ecosystem function,

drivers, and stressors. While the icebreaker is being built the science community should develop a science program to solicit national and international support for joint activities to take advantage of the new platform as a first research activity. Until then, synthesis projects using available international data and forums for discussing key topics for research themes for through regional meetings are necessary to develop scientific direction that would increase our understanding of the changing Arctic system. The international Synoptic Arctic Survey (SAS, 2020-2022) that resulted in multiple ship operations into the high Arctic is another observing program planning for coordinated ship activities in 2030 (Paasche et al. 2019).

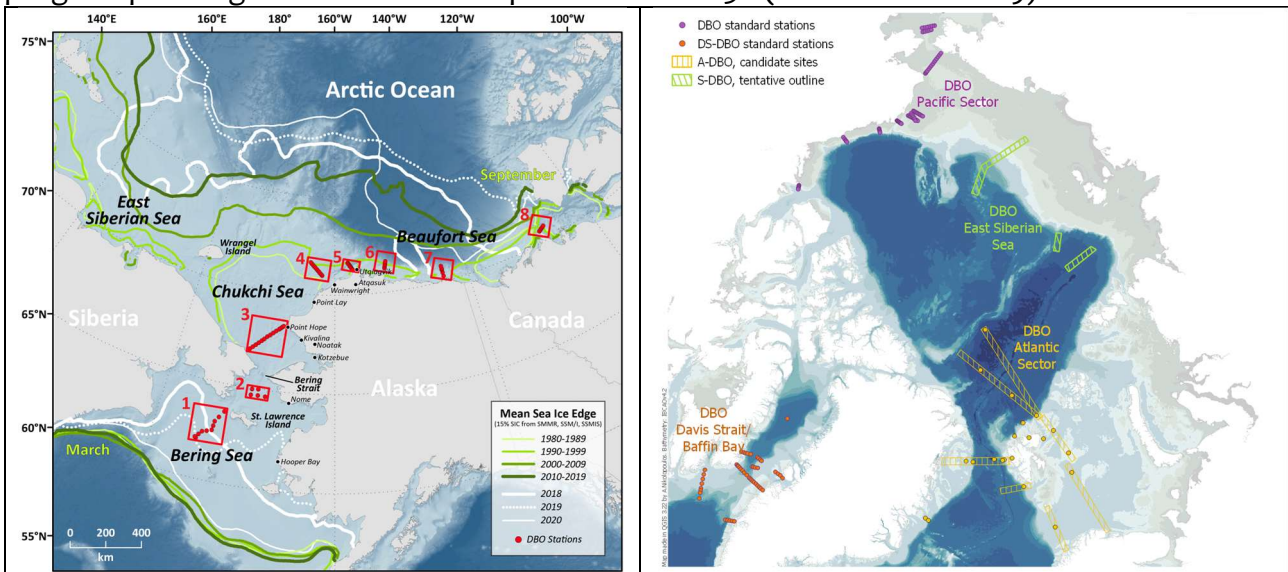


Figure 1. Left. The Distributed Biological Observatory (DBO) stations in the Pacific Arctic (Frey et al. 2023). **Right.** Expansion of the DBO to the pan-Arctic with the addition of the East Siberian Sea DBO (S-DBO), the Atlantic Sector DBO (A-DBO), and Davis Strait/Baffin Bay DBO (DS-DBO). Figure courtesy of Anna Nickolopoulos (<https://arcticpassion.eu/adbo/>).

References

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