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Title: *Modeling Habitat Use by Bowhead Whales in Response to past and future Arctic Climate Change*

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The effects of climate change are projected to be disproportionately pronounced in polar regions, where changes in the density and extent of sea ice will have pronounced effects on the spatio-temporal dynamics of the marine planktonic ecosystem. The endangered bowhead whale (*Balaena mysticetus*) is one of the largest animals in the Arctic, yet they feed on some of the smallest Arctic animals, zooplankton. Changes the abundance and distribution of zooplankton due to changes in sea ice would have direct effects on bowhead whales. In addition, loss of Arctic sea ice also has the potential to increase negative anthropogenic interactions, as areas become more accessible to vessels and oil exploration.

The objective of our research is to improve understanding of how the Arctic planktonic ecosystem and sea ice affects the regional distribution of bowhead whales in the Beaufort and Chukchi Seas, and to develop hindcasts and long-term forecasts of their distribution under different Arctic climate change scenarios. Our approach combines a multi-decadal bowhead whale survey dataset with modeled environmental data from the pan-Arctic Biology/Ice/Ocean Modeling and Assimilation System (BIOMAS). BIOMAS is a fully coupled 3D biology/sea ice/ocean model with an 11-component lower-trophic model adapted to the Arctic Ocean. Importantly, BIOMAS generates estimates of three zooplankton groups (microzooplankton, mesozooplankton/copepods, and predatory zooplankton), representing bowhead whale prey. We used BIOMAS output to train species distribution models for bowhead whales in the Chukchi and Beaufort Seas. Satellite derived sea surface temperature, sea ice and chlorophyll data were also used as predictors in the models.

Results from hindcasting experiments show that species distribution models can reproduce the general migratory patterns of the bowhead whale migration, given inter-annual environmental variability. In the next phase of our research we will explore changes in bowhead whale habitat suitability under different climate change scenarios by running BIOMAS forward in time. Those predictions will be used to drive species distribution models. This type of scenario study will help us understand the potential changes in bowhead whale habitat and help evaluate strategies for minimizing human-whale interactions as sea-ice extent and whale

populations change in the coming decades.