Environmental drivers of recent biodiversity patterns in the Eastern Bering Sea

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The Eastern Bering Sea (EBS) is a highly productive shelf region that accounts for 40% of the total US fish landings. This area is also exposed to drastic climatic changes marked by extreme fluctuations in temperature, sea ice concentration, and timing. Here, we examined the spatial structures of species richness (SR) and phylogenetic diversity (PD) using occurrence and abundance data from NOAA bottom trawl surveys in the EBS from 1990-2018. Our biodiversity analyses focused on 159 marine vertebrate and invertebrate taxa consistently identified for at least 20 years within the study duration. The study period was defined by stanzas of low (1990-1999) and high (2000-2019) magnitudes of climatic variability. SR and PD during the latter period were generally higher than the former. Moreover, under the period of a high degree of climatic variability, diversity averaged over cold winters was higher than in warm winters. Modeling the effects of abiotic factors to SR and PD further revealed that sea ice minimum from mid-winter to summer, winter sea ice concentration and summer surface and bottom temperatures were the most influential factors to biodiversity in the EBS. In particular, higher sea ice minimum corresponds to an increase in SR, however, lower winter sea ice concentration results in an increase in PD. Warmer summer (June-September) temperatures, however, tend to support higher marine diversity. These findings showed that the interplay of abiotic factors elicited complex diversity responses in the EBS community. The ongoing and abrupt variations in sea ice and thermal conditions in the region impact and will continue to drive substantial changes in the biodiversity dynamics, underpinning ramifications on the prevailing ecosystem structure and function.

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