Spring phytoplankton communities shaped by interannual weather variability and dispersal limitation: Mechanisms of climate change effects on key coastal primary producers

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ABSTRACT: Spring bloom composition in the Baltic Sea, a partially ice-covered brackish coastal waterbody, is shaped by winter – spring weather conditions affecting the relative dominance of diatoms and a heterogeneous assemblage of cold-water dinoflagellates, dominated by the chain-forming *Peridiniella catenata* and a complex of at least three medium-sized, single-celled species: *Biecheleria baltica*, *Gymnodinium corollarium*, and *Scrippsiella hangoei*. During the last decades, the bloom community has dramatically changed in several basins. We analyze here a 30 yr time series of quantitative phytoplankton data, as predicted by hindcast modeled ice thickness and storminess for three distinct Baltic Sea localities, to verify climate-driven mechanisms affecting the spring bloom composition. Thick (> 30 cm) and long-lasting ice cover favored diatom-dominated spring blooms, and mild winters, with storms and thin ice cover (10 to 20 cm), supported blooms of the *B. baltica* complex. Dispersal limitation plays an important role in the spatial extent of blooms of the *B. baltica* complex, caused by intricate interplay of local hydrodynamics and the dinoflagellate life cycle. Proportion peaks of key phytoplankton groups have shifted about 10 d earlier in the northwestern Baltic Sea (*P. catenata* and diatoms) and in the Gulf of Riga (*P. catenata*). The significant weather effects imply future shifts in spring bloom composition and consequent biogeochemical cycles, driven by the predicted changes in winter storminess and decrease in ice cover extent and duration in climate change models.