

Evolutionary adaptation to steady or changing environments affects competitive outcomes in marine phytoplankton

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Abstract

The interplay of phytoplankton competition and adaptation affects how phytoplankton, and ultimately marine ecosystems, respond to global warming. However, current ecosystem models do not consider both processes simultaneously. To study how the interplay of competition and adaptation affects phytoplankton responses to global warming, we developed an innovative ecosystem model for the Baltic Sea that simulates competition between three functional phytoplankton groups and allows for adaptation to changing temperatures. We found that competition and adaptation influence each other, with the outcome depending on environmental conditions. In a steady environment, competition drives adaptation to individual niches to reduce competition pressure. In a changing environment, adaptation enhances the competition pressure by allowing inferior competitors to mitigate the dominance of pre-adapted superior competitors. Our results demonstrate that by neglecting adaptation, models can overestimate warming-related changes in species dominance. Ecosystem models should include both competition and adaptation to accurately simulate phytoplankton responses to global warming.

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