The Effects of Increased Sea Temperature on Phytoplankton Community Composition by Cell Size

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To better understand the manner of phytoplankton decline due to climate change, this study explored changes in phytoplankton community composition during the spring phytoplankton bloom in the Northeast Atlantic Ocean from 2003 to 2021. As they are the foundation of marine ecosystems, it is critical to understand how phytoplankton are affected by changing climate conditions to better inform policy. The distribution and abundance of picophytoplankton (<2 um diameter), nanophytoplankton (2–20 µm diameter), and microphytoplankton (20–200 um diameter) were compared. The external variables investigated included surface temperature, mixed layer depth, and the concentration of the nutrients nitrate, silicate, phosphate, and of dissolved oxygen. Results showed that the spring bloom is primarily composed of microphytoplankton, which decreased significantly after 2011, affecting bloom size. This does not correlate with changes in nano- or picophytoplankton abundance, suggesting that other species and categories of phytoplankton did not move to fill the niche left by the decrease of microphytoplankton. A reduction in nutrients due to increased sea temperatures and reduced ocean mixing was noted, possibly accounting for phytoplankton decline. As predicted range shifts and changes in make up of community composition were not found, it is suggested that phytoplankton communities are not adapting to new climate conditions so will continue to decline. This is expected to cause cascading effects across trophic levels, reducing marine biomass and biodiversity. The ocean's ability to sequester carbon will also be lessened, exacerbating climate change, and possibly leading to a devastating positive feedback loop.

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