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TITLE: Recent decadal trends in global phytoplankton composition

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ABSTRACT:

Abstract Identifying major trends in biogeochemical composition of the oceans is essential to improve our understanding of biological responses to climate forcing. Using the NASA Ocean Biogeochemical Model combined with ocean color remote sensing data assimilation, we assessed the trends in phytoplankton composition (diatoms, cyanobacteria, coccolithophores, and chlorophytes) at a global scale for the period 1998?2012. We related these trends in phytoplankton to physical conditions (surface temperature, surface photosynthetically available radiation (PAR), and mixed layer depth (MLD)) and nutrients (iron, silicate, and nitrate). We found a significant global decline in diatoms (?1.22% yr ?1 , p < 0.05). This trend was associated with a significant (p < 0.05) shallowing of the MLD (?0.20% yr ?1), a significant increase in PAR (0.09% yr ?1), and a significant decline in nitrate (?0.38% yr ?1). The global decline in diatoms was mostly attributed to their decline in the North Pacific (?1.00% yr ?1 , p < 0.05), where the MLD shallowed significantly and resulted in a decline in all three nutrients (p < 0.05). None of the other phytoplankton groups exhibited a significant change globally, but regionally there were considerable significant trends. A decline in nutrients in the northernmost latitudes coincided with a significant decline in diatoms (North Pacific, ?1.00% yr ?1) and chlorophytes (North Atlantic, ?9.70% yr ?1). In the northern midlatitudes (North Central Pacific and Atlantic) where nutrients were more scarce, a decline in nutrients was associated with a decline in smaller phytoplankton: cyanobacteria declined significantly in the North Central Pacific (?0.72% yr ?1) and Atlantic (?1.56% yr ?1), and coccolithophores declined significantly in the North Central Atlantic (?2.06% yr ?1). These trends represent the diversity and complexity of mechanisms that drives phytoplankton communities to adapt to variable conditions of nutrients, light, and mixed layer depth. These results provide a first insight into the existence of trends in phytoplankton composition over the maturing satellite ocean color era and illustrate how changes in the conditions of the oceans in the last ~15 years may have affected them.

SOURCE: Global biogeochemical cycles

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