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Latitudinal gradients in marine diatom and coccolithophore diversity

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Latitudinal gradients in biodiversity have long been recognised in terrestrial ecosystems, with the highest diversity of many groups occurring in the tropics and declining towards the poles. For marine phytoplankton, a latitudinal gradient has been observed in dinoflagellates, and there seems to be some consensus that coccolithophore diversity also follows the typical pattern of highest diversity at low latitudes. Mixed results have so far been reported for marine diatoms.

We use the new MAREDAT (Marine Ecosystem DATa) diatom and coccolithophore datasets to investigate global patterns in species diversity. This database contains global biomass and abundance observations for 10 plankton functional groups, including 91 704 samples of diatom abundance and biomass and 11 703 for coccolithophores. We find evidence for a poleward decline in species richness and diversity for both groups, with total observed species richness per 5 degree latitudinal band declining by approximately 75% between the equator and 60°.

Mean station diversity is measured using both species richness and the Shannon diversity index. For the diatoms, species richness per station declines from a mean of 25 between 20°S and 20°N to values less than 10 for stations above 60°S and N. For the coccolithophores, the trend is less clear: mean station richness reaches a maximum of 22 between 10 and 15°N and shows a clear northward decline, with only one species per station reported north of 60°N. Mean coccolithophore richness per station is, however, relatively low at the equator, with highest richness per station in the Southern Hemisphere observed between 20 and 40°S.

Highest richness and diversity of both groups is associated with low group-specific biomass and low total chlorophyll, with higher productivity regions typically dominated by one or few species.