

Unfolding Global Biodiversity Patterns of Marine Planktonic Diatom Communities across the World's Oceans

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Abstract : Analysis of microbial eukaryotic diversity is fundamental to understanding ecosystems' structure, biology, and ecology. Diatoms (Stramenopiles, Bacillariophyceae) are one of the most diverse and ecologically prominent groups of phytoplankton. This study was performed to enhance the understanding of global biodiversity patterns and structure of planktonic diatom communities across the world's oceans. We used the metabarcoding data set generated from the biological samples and associated environmental data collected during the Tara Oceans (2009-2013) global circumnavigation covering all major oceanic provinces. A total of ~18 million diatom V9-18S rDNA tags from 126 sampling stations, constituting 631 size-fractionated plankton communities were generated. Using ~250,000 unique diatom metabarcodes, the global diatom distribution and diversity across size classes, genus and ecological niches was assessed. Notably, our analysis revealed: (i) a new estimate of the total number of planktonic diatom species, (ii) a considerable unknown diversity and exceptionally high diversity in the open ocean, and (iii) complex diversity patterns across oceanic provinces. Also, co-occurrence of several ribotypes in locations separated by great geographic distances (equatorial stations) demonstrated a widespread but not ubiquitous distribution. This work provides a comprehensive perspective on diatom distribution and diversity in the world's oceans and elaborates interconnections between associated theories and underlying drivers. It shows how meta-barcoding approaches can provide a framework to investigate environmental diversity at a global scale, which is deemed as an essential step in answering various ecological research questions. Consequently, this work also provides a reference point to explore how microbial communities will respond to environmental conditions.

Keywords : diatoms, Tara Oceans, biodiversity, metabarcoding

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