



Habitat suitability and ecological niches of different plankton functional types in the global ocean

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Marine plankton play a central role in the biogeochemical cycling of important elements such as carbon, nitrogen, and sulphur. While our knowledge about marine ecosystem structure and functioning is still scarce and episodic, several recent observational studies confirm that marine ecosystems have been changing due to recent climate change, overfishing, and coastal eutrophication. In order to better understand marine ecosystem dynamics, the MAREDAT initiative has recently collected abundance and biomass data for 5 autotrophic (diatoms, Phaeocystis, coccolithophores, nitrogen fixers, picophytoplankton), and 6 heterotrophic plankton functional types (PFTs; bacteria, micro-, meso- and macrozooplankton, foraminifera and pteropods). Species distribution models (SDMs) are statistical tools that can be used to derive information about species habitats in space and time. They have been used extensively for a wide range of ecological applications in terrestrial ecosystems, but here we present the first global application in the marine realm, which was made possible by the MAREDAT data synthesis effort. We use a maximum entropy SDM to simulate global habitat suitability, habitat extent and ecological niches for different PFTs in the modern ocean. Present habitat suitability is derived from presence-only MAREDAT data and the observed annual and monthly mean levels of physiologically relevant variables such as SST, nutrient concentration or photosynthetic active radiation received in the mixed layer. This information can then be used to derive ecological niches for different species or taxa within each PFT, and to compare the ecological niches of different PFTs. While these results still need verification because data was not available for all ocean regions for all PFTs, they can give a first indication what present and future plankton habitats may look like, and what consequences we may have to expect for future marine ecosystem functioning and service provision in a warmer world.