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Top-down controls on the ecological niche of marine N₂ fixers

Angela Landolfi¹, A. E. Friederike Prowe², Markus Pahlow², Christopher J. Somes², Chia-Te Chien², Markus Schartau², Wolfgang Koeve², and Andreas Oschlies²

¹CNR, ISMAR, Roma, Italy (angela.landolfi@artov.ismar.cnr.it)

²GEOMAR Helmholtz Centre for Ocean Research Kiel, Kiel, Germany

The factors that control the distribution of marine diazotrophs and their ability to fix N₂ are not fully elucidated. We discuss insights that can be gained from the emerging picture of a wide geographical distribution of marine diazotrophs and provide a critical assessment of environmental (bottom-up) versus trophic (top-down) controls. Expanding a simplified theoretical framework, we find that selective mortality on non-fixing phytoplankton is identified as a critical process that can broaden the ability of diazotrophs to compete for resources in top-down controlled systems and explain an expanded ecological niche for diazotrophs. Our simplified analysis predicts a larger importance of top-down control on competition patterns as resource levels increase. As selective mortality can control the faster growing phytoplankton, coexistence of the slower growing diazotrophs can be established. However, these predictions require corroboration by experimental and field data, together with the identification of specific traits of organisms and associated trade-offs related to selective top-down control. Elucidation of these factors could greatly improve our predictive capability for patterns and rates of marine N₂ fixation.