Utilization of different nitrogen sources by the marine cyanobacteria Prochlorococcus and Synechococcus

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ABSTRACT: *Prochlorococcus* is the most abundant phytoplankter throughout the photic zone in stratified marine waters and experiences distinct gradients of light and nitrogen nutrition. Physiologically and genetically distinct *Prochlorococcus* ecotypes partition the water column: high-B/A (low-light adapted) ecotypes are generally restricted to the deep euphotic zone near or at the nitracline. Low-B/A (high-light adapted) ecotypes predominate in, but are not limited to, NO_3^--depleted surface waters, where they outnumber coexisting *Synechococcus* populations. The niche partitioning by different *Prochlorococcus* ecotypes begs the question of whether they also differ in their nitrogen (N) utilization physiology, especially with respect to NO_3^- utilization. To explore this possibility, we studied the capabilities of different *Prochlorococcus* and *Synechococcus* strains to grow on a variety of N sources. We found that all the isolates grew well on NH_4^+ and all were capable of urea utilization, occasionally at a lower growth rate. None of the *Prochlorococcus* isolates were able to grow with NO_3^-. Four high-B/A *Prochlorococcus* isolates grew on NO_2^-, but all others did not. Whole genome analysis of the low-B/A *Prochlorococcus* MED4 revealed that the genes required for NO uptake and reduction were absent. The genome of the high-B/A *Prochlorococcus* MIT 9313 also lacked the NO_3^- utilization genes but has homologs of genes required for NO_3^- utilization consistent with its physiology and ecology. Thus, the utilization of different N sources in the marine environment is partitioned among closely related ecotypes, each with adaptations optimized for the environment where these sources are available.