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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,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, 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," and all were capable of urea utilization, occasionally at a lower growth rate. None of the Prochlorococcus isolates were able to grow with NO,. Four high-B/A Prochlorococcus isolates grew on NO,, 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, utilization genes but has homologs of genes required for NO," 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.

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