

# Comparison of size-dependent carbon, nitrate, and silicic acid uptake rates in high- and low-iron waters

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Limnol. Oceanogr., 50(3), 2005, 825-838 | DOI: 10.4319/lo.2005.50.3.0825

ABSTRACT: We compare the relative contribution of large phytoplankton (>5 and >10 µm) to uptake rates of carbon (C), nitrate ($NO_3^-$), and dissolved silicon (Si) and uptake ratios of Si :NO and Si :C in Monterey Bay, California (a high-iron region) with three low-iron regions in the eastern tropical Pacific: the Costa Rica upwelling dome, Humboldt current, and Peru upwelling. We also demonstrate the effect of iron enrichment on the above parameters in the latter three regions. In Monterey Bay waters, the >5-µm size fraction accounted on average for the majority of particulate organic C and was responsible for 92% of total C uptake, 81% of total $NO_3^-$ uptake, and 98% of total 23 Si uptake. In contrast, in low-iron eastern tropical Pacific waters, the >5-µm size fraction accounted for less than half of the particulate organic C and was responsible for a substantially smaller proportion of total C and $NO_3^-$ uptake: 27-43% for C and 34-59% for $NO_3^-$. Iron enrichment experiments in the eastern tropical Pacific resulted in much higher $NO_3^-$, C, and Si uptake rates, although increases were restricted to cells in the >5-µm size fraction. Si:NO and Si:C uptake ratios decreased after iron addition at most locations, and decreases were a direct result of lower Si:$NO_3^-$ and Si:C uptake ratios in the >5-µm size fraction. Our results suggest that iron availability is a major factor regulating primary production, new production, Si uptake, and Si:$NO_3^-$ and Si :C uptake ratios in the larger phytoplankton size classes in high-nitrate, low-chlorophyll (HNLC) regions in the eastern tropical Pacific.