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Note added in proof *

The field of marine N_2 fixation has moved forward at a rapid pace since we prepared the final draft of this review article nearly two years ago. It is not possible to summarize all of the data, however, we believe that mention of a few papers will provide the reader with access to new lines of research. In addition, several recent review articles that deal, in part, with marine N_2 fixation have also appeared (Capone 2001, Codispoti et al. 2001; Cullen et al. 2002).

The most important recent publication, in our view, is the discovery of unicellular N_2-fixing cyanobacteria in the subtropical North Pacific Ocean (Zehr et al. 2001). The *in situ* expression of nitrogenase in this diverse, numerically abundant population of phototrophs suggests that environmental rates of N_2 fixation, based on extrapolation of *Trichodesmium* distributions and abundances – which is not a very precise method to begin with (Chang 2000) – may have been systematically underestimated in this environment. Likewise, the discovery of small ($<10\ \mu$m) coccoid (non-heterocystous) cyanobacteria in the Baltic Sea also requires a recalculation of the impact of N_2 fixation as a source of new nitrogen in that habitat (Wasmund et al. 2001). More discoveries of novel N_2 fixing microorganisms are likely to follow in future years.

Recent studies of the oligotrophic regions of the western North Atlantic Ocean have focused on the dynamics of the dissolved P pools and the N:P stoichiometry of the ambient inorganic and organic substrate pools. Wu et al. (2000) and Cavender-Bares et al. (2001) presented evidence that the bioavailable pool of soluble reactive phosphorus in the western North Atlantic Ocean near Bermuda was <1 nM compared to values that were 1–2 orders of magnitude higher in the oligotrophic North Pacific Ocean near Hawaii. Wu et al. (2000) hypothesized that these regional differences were a result of a larger atmospheric flux of iron in the Atlantic Ocean. The iron-sufficient Atlantic would sustain enhanced N_2 fixation, resulting in the efficient and complete removal of bioavailable phosphorus (Wu et al. 2000). This model

* This note in proof refers to the article "Dinitrogen fixation in the world's oceans" by Karl et al., pp. 47–98 of this issue.

supports the suggestion that dust-derived iron may control N_2 fixation in the North Pacific Ocean, as discussed in the body of our review.

Consistent with the suggestion that the western North Atlantic Ocean may be iron-sufficient, Sañudo-Wilhelmy et al. (2001) have recently reported that the activities of field-collected *Trichodesmium* were independent of dissolved iron concentrations or the iron cell quotas of the colonies. They further concluded that the structural iron requirements for the growth of N_2-fixing microorganisms may be lower than previously calculated; a revised iron efficiency metabolic model has now been prepared (Kustka et al. 2002). Sañudo-Wilhelmy et al. (2001) also concluded that the phosphorus cell quota may control N_2-fixation rates in *Trichodesmium*, and at least one recent deterministic model for the control of marine N_2 fixation, has explicitly included both dissolved inorganic phosphorus concentrations and the nitrogen-to-phosphorus ratios in diazotrophs as key environmental controls (Fennel et al. 2002). Ongoing research at two open ocean time-series stations, BATS and HOT, will continue to focus on the rates, mechanisms, controls and ecological consequences of N_2 fixation (Orcutt et al. 2001; Church et al. 2002; Dore et al. 2002) during the next decade.

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