



## Iron and macronutrients in California coastal upwelling regimes: Implications for diatom blooms

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**ABSTRACT:** The supply of iron, relative to that of the macronutrients nitrate, phosphate, and silicic acid, plays a critical role in allowing extensive diatom blooms to develop in coastal upwelling regimes. The presence or absence of a broad continental shelf influences the supply of iron. The iron input to central California upwelling waters varies spatially and can be characterized by two end-member regimes. One end member, which includes Monterey Bay and extending north to Pt. Reyes, is an iron-replete regime where upwelling occurs over a relatively broad continental shelf that results in waters with high concentrations of dissolved and particulate iron ( $>10 \text{ nM}$ ) entrained together with high concentrations of nitrate and silicic acid. In these iron-replete regions, extensive blooms of large diatoms deplete macronutrient concentrations, which results in correspondingly high chlorophyll a concentrations. The other end member, located to the south of Monterey Bay off the Big Sur coast, is an iron-deplete regime where upwelling is focused offshore of a narrow continental shelf. Upwelled waters in the Big Sur region are characterized by low dissolved and particulate iron concentrations ( $<1 \text{ nM}$ ), together with high concentrations of nitrate and silicic acid. Extremely low iron concentrations, unused nitrate and silicic acid, and a low abundance of large diatoms characterize surface waters in these iron-deplete regions, and thus represent coastal upwelling, high-nutrient, low-chlorophyll systems limited by the micronutrient iron.

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