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TITLE: The Influence of Riverine Nutrients in Niche Partitioning of Phytoplankton Communities?A Contrast Between the Amazon River Plume and the Changjiang (Yangtze) River Diluted Water of the East China Sea

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ABSTRACT:

Riverine nutrients acting in concert with local hydrographic conditions create distinct ecological niches for phytoplankton communities across river-ocean continuums. Here we compare two of the world?s largest river-ocean systems, the Amazon River Plume (ARP) which outflows into the Western Tropical North Atlantic (WTNA) and the Changjiang Diluted Water (CDW) which empties into the East China Sea to show how distinctly different N: P ratios of their source waters, shape phytoplankton communities along the river-ocean continuum. Sampling in the relatively unpolluted surface waters of the ARP during peak river discharge revealed that phytoplankton communities along the river-ocean continuum were strongly controlled by Dissolved Inorganic Nitrogen (DIN, nitrate plus nitrite) concentrations which were low or beyond detectable, while Dissolved Inorganic Phosphorous (DIP, phosphate) was not limiting. Downstream of the plume, nutrient concentrations at the surface were far below the Redfield N:P ratio of 16 : 1, and in this severely nitrogen limited but silica replete mesohaline region, Diatom-Diazotroph Associations (DDA) such as Hemiaulus hauckii-Richelia proliferated, while offshore in nitrate poor oceanic waters, Trichodesmium spp. and Prochlorococcus thrived. In contrast, in the CDW, a system which has witnessed a substantial rise in anthropogenic nitrogen inputs from human pressures within the Changjiang River system, phytoplankton community structure was regulated primarily by DIP which was rapidly consumed in the inner shelf. Data from a series of summer-time cruises in the mid-shelf and offshore regions of the East China Sea, at peak discharge, established that when DIP limitation was ameliorated by on-shelf upwelling of DIP rich Kuroshio Intermediate Waters, diatoms and dinoflagellates dominated. Conversely, during years of heavy discharge, the westward flowing CDW plume was severely DIP limited, probably because water column stratification dampened upwelling of subsurface waters. The consequent phosphate limitation led to the proliferation of small phytoplankton such as Chlorophytes and Cyanobacteria. The absence of diazotrophs in the CDW, leads us to hypothesize that river-ocean continuums, whose source waters are heavily impacted by anthropogenic activities and with nutrient concentrations substantially in excess of Redfield ratios, may not support diatoms on account of DIP limitation nor DDAs and diazotrophs because of excess DIN.

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