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TITLE: Shift from P to N limitation of phytoplankton growth across the Pearl River estuarine plume during summer

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ABSTRACT:

Anthropogenic loading of nutrients in rivers often increases disproportionally among N, P, and Si, and thus may shift the type of phytoplankton nutrient limitation in the coastal receiving waters.The effect of anthropogenic nutrient loading has rarely been addressed in the Pearl River estuary along the southern coast of China, even though it is one of the largest rivers in the world.We conducted a cruise along the Pearl River estuary and adjacent coastal waters south of Hong Kong during July 17 to 18, 1999.Samples were taken for salinity and nutrients (NO 3 , SiO 4 , PO 4 , NH 4 and urea) and nutrient addition experiments were conducted on board.Vertical profiles of salinity showed a salt-wedge estuary and the coastal plume covering the waters south of Hong Kong.Concentrations of NO 3 were very high (ca 90 µM) upstream of the Pearl River estuary, and much of the riverine NO 3 was not utilized in the estuary until depletion at the edge of the coastal plume on the east side of Hong Kong.SiO 4 was 120 µM upstream and its utilization was similar to that of NO 3 .PO 4 was low in surface waters (< 0.5 µM) and higher below the halocline in the estuary.NH 4 and urea were generally < 4 and 1.5 µM, respectively.In the estuary, N:P ratio was 200 :1, indicating potential P limitation, while N:Si was below 1:1.Beyond the coastal plume to the east of Hong Kong, N:P and N:Si ratios were < 5 :1 and 1:0.3, respectively, indicating potential N limitation.Nutrient limitation was shown in nutrient addition experiments and was consistent with the ratios of nutrients.Therefore, nutrient limitation shifted across the coastal plume from P limitation in the estuary to N limitation in the oceanic waters.Potential P limitation was observed in the estuary; P and Si co-limiting occurred at the edge of the coastal plume, and N was limiting in the oceanic side.This spatial shift in nutrient limitation has great implications for nutrient pollution control and coastal management of Hong Kong waters.

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