

Oceanography Department Seminar

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Anthropogenic iron and the spring bloom in the North Pacific Transition Zone

Industrial activities in East Asia and elsewhere have increased the supply of iron to the ocean, but the biogeochemical consequences of this added source remain speculative. To provide an empirical basis for these impacts, we synthesize results from four cruises across the North Pacific Transition Zone – a seasonally oligotrophic biome located downwind of major anthropogenic iron source regions. We observe a repeated supply of isotopically-light iron from an atmospheric source during spring, which becomes heavy by autumn due to fractionation associated with biological uptake. Supply of light Fe is consistent with a significant fraction from anthropogenic sources, and coincides with springtime nitrate uptake by phytoplankton. In waters with elevated nitrate concentrations, meta-transcriptomic surveys show elevated levels of iron-stress genes, especially among diatoms. From these observations, sustained anthropogenic iron supply is expected to accelerate nitrate uptake during spring, leading to a longer oligotrophic period during summer and autumn. Preliminary investigations into regional trends in satellite chlorophyll and carbon proxies over the past 25 years are not inconsistent with this expectation: phytoplankton in nitrate-rich waters increasingly benefit at the expense of their nitrogen-limited successors. Compounding the anticipated effects of warming-driven stratification, anthropogenic iron may eventually lead to an expansion of the oligotrophic ocean.

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