Hyperspectral HICO imagery reveals yellow fluorescing ciliate bloom in Long Island Sound, USA

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**Abstract**: *Mesodinium rubrum* is a widespread marine ciliate that "enslaves" chloroplasts ingested from its cryptophyte algae prey. This mixotrophic ciliate can aggregate into massive red-colored blooms in estuarine waters, but little is known about its distribution or contribution to primary production. A September 2012 hyperspectral image from the HICO sensor aboard the International Space Station revealed intense red waters in Long Island Sound populated by a massive bloom of *M. rubrum* (106 cells L-1)*.*  Genetic data confirmed the identity of the chloroplast as a cryptophyte that was actively photosynthesizing, duplicating DNA, and synthesizing proteins. Microscopy indicated extremely high abundance of its yellow fluorescing signature pigment phycoerythrin. Cell abundance was quantified in the ocean color image using an algorithm based on unique yellow fluorescence from its signature pigment phycoerythrin. Future development of hyperspectral satellites (e.g., PACE) will allow for better enumeration of these globally widespread protists known to have one of the highest marine primary production rates.