Hyperspectral analysis of chlorophyll content and photosynthetic capacity of coral reef substrates

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ABSTRACT: Few studies have assessed the biophysical properties controlling reflection and absorption of light in coral reef environments and their relationships with quantitative measures of reef health and productivity. The present article examines the relationship between spectral reflectance, photosynthetic capacity, and chlorophyll a from common coral reef substrates. Reflectance readings of several targets (massive corals *Montipora* sp., n = 49, and *Porites* sp., n = 80; macroalgae *Chlorodesmis* sp., n = 24; and sediment interspersed with benthic microalgae, n = 35) were obtained in situ on Heron Reef, southern Great Barrier Reef (23° 27'S, 151° 55'E). Measurements of photosynthetic capacity and chlorophyll content were acquired simultaneously. Linear correlations were examined between spectral reflectance at all wavelengths and both photosynthetic capacity and pigment content (Chl *a*). Reflectance plots for all targets exhibited an absorption feature centered at 675 nm, and spectral reflectance at this wavelength decreased with increasing Chl *a* levels. The strength of this correlation varied between features, being highest for *Porites* sp. and lowest for sediment, highlighting the complexities of coral reef environments and the difficulties associated with relating spectral reflectance to biophysical properties. Photosynthetic capacity did not exhibit statistically significant correlations to spectral reflectance or absorption at any wavelength. Our results demonstrate the capabilities and difficulties associated with field scale hyperspectral data for measuring select biophysical properties of coral reefs and the need for assessment of the capabilities of airborne and satellite imaging sensors for similar purposes.