Multiple scattering on coral skeletons enhances light absorption by symbiotic algae

Enríquez, Susana, Eugenio R. Méndez, Roberto Iglesias-Prieto

Limnol. Oceanogr., 50(4), 2005, 1025-1032 | DOI: 10.4319/lo.2005.50.4.1025

ABSTRACT: The success of symbiotic reef-building corals is largely determined by the efficiency with which they collect solar energy. Using thin coral laminae from the Caribbean scleractinian *Porites branneri*, we characterize the absorption spectra of intact coral surfaces. Comparisons of absorption spectra from corals with a broad range of photosynthetic pigment densities, collected during a natural bleaching event, indicate that they are capable of collecting more than 85% of solar radiation with one order of magnitude less pigment density than terrestrial leaves. Measurements of the light-absorption efficiency as a function of pigment density reveal that symbiotic algae in intact *P. branneri* absorb between two and five times more light than freshly isolated symbionts. A theoretical model shows that multiple scattering by the skeleton can enhance the local light field, thus increasing absorption. As a result of this phenomenon, corals inhabiting high light environments can maximize their absorption capacity with low pigment investment while reducing self-shading in low-light environments. Local light field enhancements may have negative effects when corals are exposed to stressful conditions. During coral bleaching, increases in local irradiance associated with reductions in pigment density could exacerbate the negative effect of elevated temperatures. Symbiotic scleractinian corals are one of the most efficient solar energy collectors in nature, and the modulation of the internal light field by the coral skeleton may be an important driving force in the evolution of this group.

Article Links

Download Full-text PDF

Return to Table of Contents

Please Note