PHOTOSYNTHETIC PIGMENTATION AND DIVERSITY OF SYMBIOTIC DINOFLAGELLATES IN LOBATE *PORITES* SP. CORALS

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ABSTRACT

Coral bleaching refers to an observable color change in a normally pigmented coral caused by a loss of symbiotic algal (= zooxanthellae) pigmentation and/or a loss of the zooxanthellae. Measurement of coral pigmentation is undoubtedly important to monitoring and understanding these changes, yet pigment ranges of normally colored corals are largely unknown. This study developed robust methods to determine photosynthetic pigment concentrations and examined quantitative responses to sources of variability including depth, coral species, zooxanthellae strain, and laboratory treatments of high light, shade, and high temperature for the common corals *Porites lobata* and *Porites evermanni* from Kaneohe Bay. Methods of sampling and extraction were designed to rapidly preserve the sample and prevent sample loss prior to analysis by HPLC.

The photosynthetic pigment concentrations measured using these refined methods were 2-4 fold greater than previous reports. The mean (SD) concentrations for *P. lobata* and *P. evermanni* combined (n = 80) in decreasing abundance (pg cell^{-1}) were: chlorophyll *a*, 8.65 ± 3.34, peridinin, 4.40 ± 1.79, DD + DT, 2.02 ± 0.764, diadinoxanthin (DD), 1.63 ± 0.660, diatoxanthin (DT), 0.391 ± 0.262, chlorophyll c_2, 0.789 ± 0.306, β-carotene, 0.346 ± 0.155, and dinoxanthin, 0.287 ± 0.106. In some cases the laboratory treatments extended minima and maxima of the concentration ranges.

The greatest source of variance seen here was due to depth. The trend of depth variation depended on the method of normalization with pigment concentrations increasing with depth per zooxantheller and decreasing with depth per coral surface area. The shallow congenerics *P. lobata* and *P. evermanni* display variability in their modes of photoacclimation as evidenced by chlorophyll *a* concentrations, *Symbiodinium* spp. subpopulations, and cycling between the xanthophylls DD and DT. These differences were not confirmed to originate from genetically different zooxantheller populations and may be a result of the host light environment.

Cloning the nr5.8s ITS2 region of the zooxanthellae revealed diversity within single *P. lobata* and *P. evermanni* colonies that was not previously reported for Hawaiian colonies. The zooxanthellae from both *P. lobata* and *P. evermanni* colonies appear to represent a new grouping of subclade taxa that is most similar to the C15 grouping. The cloning approach revealed an array of DNA including multiple zooxanthellae ITS2 types and in some cases coral ITS2 types within each sample. There are essential paths of future research regarding the utility of commonly used diversity assessment methods that need to be addressed before relationships between zooxanthellae strain and pigments can be assessed.