ABSTRACT

Investigating Electrolytic Mineral Accretion for Coral Reef Restoration

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The objective of this study was to develop a scientific method for testing the effect of low direct current on the growth of corals. It has been hypothesized that weak direct current increases the aragonite form of calcium carbonate deposition in some corals, resulting in increased growth. The validity of this claim remains unsubstantiated because of weaknesses in the experimental design of previous studies.

In phase 1 of this study, the experimental design was developed and tested in small pilot experiments; whereas phases 2 and 3 were larger field experiments in the island of Tobago. Electrically conductive racks, called Buoyancy Test Racks (BTRs), small enough to carry individual coral fragments, served as the cathode while a titanium coated iron mesh was used as the anode. Forty coral nubbins were attached to electrically charged BRTs and the exact number of nubbins attached to BTRs with no electricity acted as controls. The BTRs allowed the measurement of growth in weight and volume of individual nubbins via buoyant weighing and water displacement.

Phase 2, using *Porites porites* and *Acropora cervicornis*, had unacceptable mortality in the control, which resulted in the premature termination of the experiment. Results for phase 3 using *Millepora sp.* showed that some individuals displayed normal branching morphology, whereas a few (about 9%) accreted in boulder-type morphology. X-ray diffraction of the normal branching morphology indicated that control and charged accretion had similar ratios of aragonite to brucite (about 90% aragonite), whereas the boulder-type morphology had a higher proportion of brucite (about 60 to 80%). Further analyses on growth showed significant differences in mean weights of controls versus charged. During the 48-week time period of the experiment the controls showed a significant decrease in weight of about 50% (ANOVA F=2.46 and P=0.0012). During the same time period the charged treatment showed a significant increase in weight by about 400% (ANOVA F=11.54 and P=0.0000). Overall results indicate that the enhanced growth for one species (*Millepora sp.*) supports the hypothesis that weak direct current increases the aragonite form of calcium carbonate deposition in some corals, resulting in increased growth. With some methodological adjustments this technology has the potential to restore reefs that are adversely affected by environmental change.

Key words: electrolytic mineral accretion, Biorock®, *Millepora alcicornis*, brucite, aragonite, buoyant weighing, direct current (DC)