Coral Reef Restoration:
Returning the caretakers to the reef

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the translocated *Diadema* urchins on the two experimental reefs in the short space of one year were remarkable. Some of the most significant of the data developed from this project are summarized here and the entire study is posted on the Florida Keys National Marine Sanctuary web site. This data reports the major changes in benthic ecology between 08/31/01 and 09/18/02 as documented by the NURC assessments. The below comparisons are between the combined results from both experimental reefs compared to the combined results of both control reefs before and after the translocation of the *Diadema* urchins.

Percent total stony coral cover

Perhaps the most important statistic is the percent stony coral cover. This measures the actual extent of coral tissue recovery and also includes the amount of new coral tissue cover that may have developed from new settlement of juvenile corals.

On the experimental reefs with the urchins, stony coral cover went from 9.75% to 15.25%, an increase of 59% in one year. On the control reefs without the urchins, stony coral cover went from 9.25% to 6.75%, a decrease of 24.5%.

A decrease in coral cover may be due to loss of coral tissue due to disease or bleaching, or loss of coral tissue at the point of interaction with macro algae. These data show that coral cover increased significantly on the experimental reefs and decreased significantly on the control reefs. This was the first time since the decline of the reefs began 20 years ago, that human manipulation of the ecology of a Keys coral reef reversed the decline of coral cover and decreased the growth of macro algae that shroud the reefs. Whatever the dynamics of corals, algae, and urchins, this demonstrates that the presence of the urchins results in recovery of coral cover. And this is the bottom line for recovery of the coral reefs of the Keys.

Juvenile coral density

The presence and density of juvenile corals is a measure of the success of settlement and survival of larval and juvenile corals on a reef area. The total mean density (#/m^2, number per square meter) of juvenile stony corals on the experimental reefs went from 6.17 to 15.3/m^2, an increase of 151% in one year. On the control reefs, the total mean density of juvenile corals went from 6.57 to 9.94/m^2, an increase of 54.5%.

Although juvenile corals increased on both experimental and control reefs, the experimental reefs, with the translocated urchin populations, had a much greater increase. This indicates that the presence of the urchins changed the ecology of the experimental reefs to favor the settlement and/or survival of juvenile hard corals.

Percent crustose coralline algae

The presence of crustose coralline algae is very good for the reefs. Unlike foliose algae, crustose coralline algae coats the rock surfaces and presents a smooth, hard substrate free of foliose algae, sediment and algae turf. This is a substrate that attracts settlement and survival of juvenile stony corals. In fact, it has been shown that lettuce coral, *A. agaricites*, is stimulated to settle by the chemical secretions of coralline algae.

On the experimental reefs with the urchins, crustose coralline algae cover went from 7.5% to 19.0%, an increase of 159.5% in one year. On the control reefs without the urchins, stony coral cover went from 7.75% to 8.25%, an increase of only 0.5%.

Obviously the presence of the urchins greatly stimulated growth of coralline algae on the experimental reefs as these algae increased three fold.

Brown foliose algae'

This is the type of algae that competes directly with corals for space and light. It grows much faster than coral and diminishes coral cover where it occurs on the reefs. These brown algae are typically in the genera *Tubinaria, Lobophora, Dictyota* and *Padina*. The pattern of change in brown foliose algae was more complex. On the experimental

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