Producing *Acropora palmata* in offshore coral nurseries for reef restoration

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Introduction:

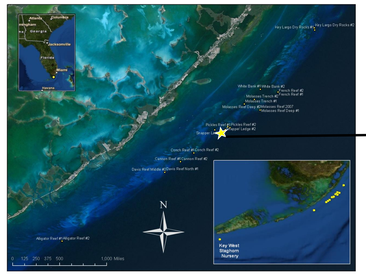
Elkhorn coral, *Acropora palmata*, is one of the most important reef building corals in the Florida Keys and tropical Western Atlantic. Over the last 30 years it has undergone a dramatic decline in frequency, distribution, and health to the point where it has recently been listed as "Threatened" under the US Endangered Species Act. A recovery plan for the species is being developed by NOAA Fisheries, includes an offshore nursery program that will likely be an important component of the plan. In 2009 the Coral Restoration Foundation established a coral nursery on Snapper Ledge for the purpose of developing the best nursery techniques for propagating *Acropora palmata*.

Yesterday's Typical Elkhorn Reef

Today's Typical Elkhorn Reef

Acropora palmata nursery goals:

1) to develop effective, low cost nursery techniques that can be easily replicated in different parts of the Keys
2) to produce multiple generations of clones that can be used for restoration projects and scientific research



CRF Nursery & Restoration Sites

CRF Elkhorn Nursery

Acknowledgements

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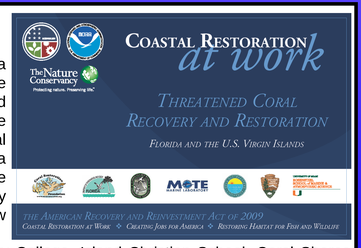


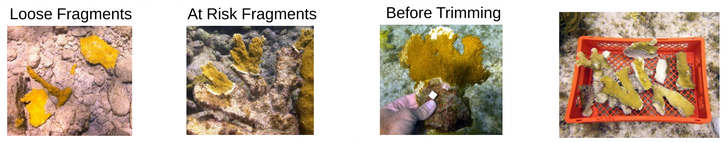
Objective 1:

Develop effective methods for asexually propagating *Acropora palmata* in an offshore nursery setting

Methods:

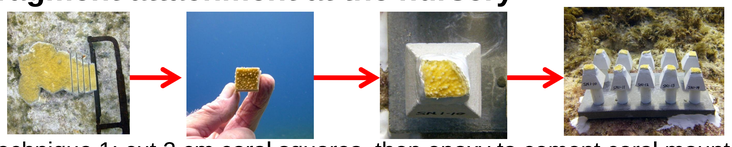
Coral collection

Loose Fragments | At Risk Fragments | Before Trimming

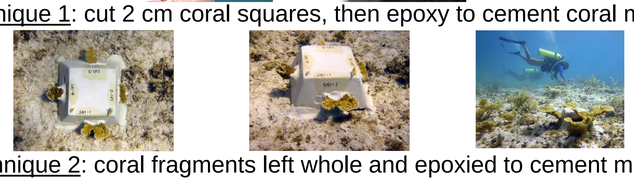


Fragments and "at risk corals" collected from eight Upper Keys reefs

Fragment attachment at the nursery

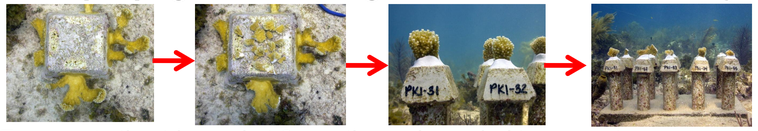


Technique 1: cut 2 cm coral squares, then epoxy to cement coral mounts



Technique 2: coral fragments left whole and epoxied to cement mounts

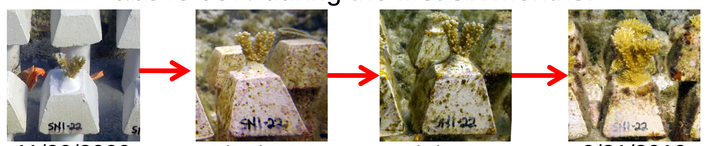
Coral propagation of 2nd generation at the nursery



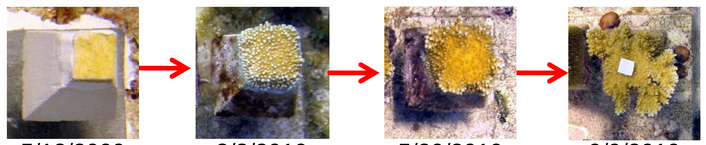
Fragments tips trimmed at 9 months and epoxied to cement coral mounts

Results:

All methods yielded outstanding results with survival rates above 95% during the first six months.



11/20/2009 | 1/14/2010 | 3/9/2010 | 9/21/2010



5/12/2009 | 3/8/2010 | 5/20/2010 | 9/9/2010

Conclusions:

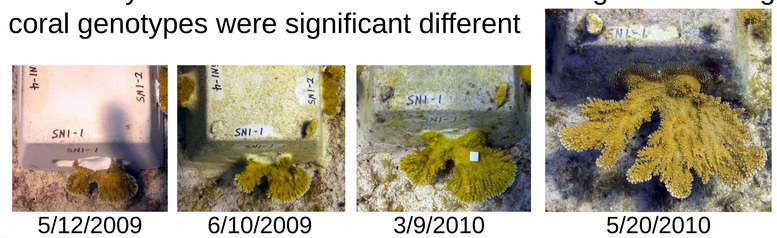
- Collected corals were successfully trimmed at 9 months (no losses)
- Small fragments (100 cm^2) pruned to 4 cm^2 can start new colonies
- *Acropora palmata* 2nd generation fragments cut to 4 cm^2 grow into branching colonies with up to 80 cm^2 surface area within 15 months

Objective 2:

Determine if growth rates vary significantly among eight *Acropora palmata* genotypes from the Upper Keys

Methods:

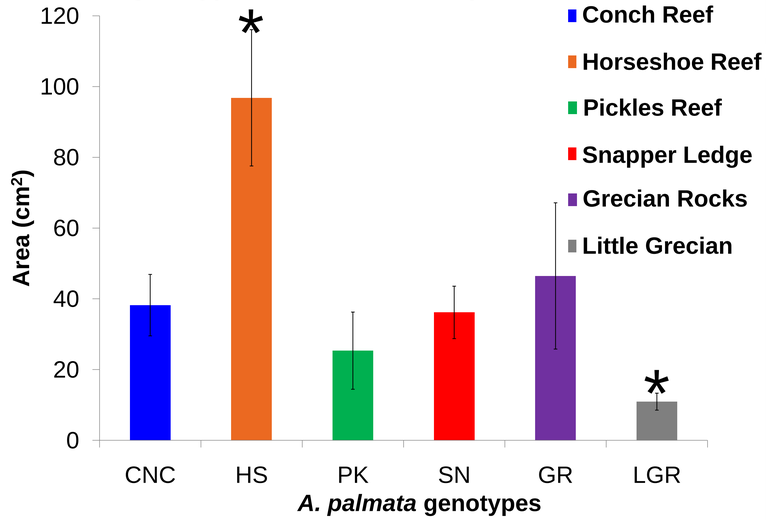
- Coral fragments collected were epoxied on concrete platforms for each eight genotypes at nursery site
- Photos inventories were completed quarterly and growth was measured from coral area using coral point count.
- One-way anova used to determine if mean growth among coral genotypes were significant different



5/12/2009 | 6/10/2009 | 3/9/2010 | 5/20/2010

Results:

Mean change in growth (± standard error) among *A. palmata* genotypes from March to September 2010



*Growth significantly different ($p > 0.001$) in ANOVA test

Conclusions:

- Although fragment size is important, clearly some genotypes grow faster than others under the same growing conditions
- Horseshoe Reef, perhaps the last remaining healthy thicket of *A. palmata* in Florida, grew at twice than the next fastest genotype
- Snapper Ledge corals in the nursery are healthy and growing, while the wild colonies on the same reef remain the same size

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