DRIVERS OF POPULATION DECLINE IN ACROPORA PALMATA IN THE FLORIDA KEYS NATIONAL MARINE SANCTUARY

Dana E. Williams and Margaret W. Miller
Demographic monitoring

- Began in 2004
  - 15 study plots at 5 sites
  - Expanded to 27 plots at 8 sites
  - Quarterly monitoring scaled back to 3 times a year
- Objectives:
  - Quantify basic population parameters (mortality & recruitment)
  - Identify and determine the relative importance of threats (chronic vs. acute)

Is there more than there was? Why not?
Methods

- 150m² fixed circular plot
- All colonies are mapped annually
- Randomly chosen subset of tagged colonies assessed 3x a year
  - Colony size (L W H)
  - Condition (% live)
  - Presence of threats (predators, disease etc)
- Live Area Index to track changes in live tissue cover
  - Average dimension squared (area)
  - % live adjust for partial tissue cover
Population Trends

- >50% decline in 2005, <15% recovery after 5 years
What caused the decline?

... and what is slowing recovery?
Causes of Recent Mortality

- White Band Disease
- White Pox
- Rapid Tissue Loss
- Snail Feeding
- Ciliate ‘Band’
- Fish Poop
- Parrotfish Bites
- Cliona (sponge)
Recent Mortality area estimates

- RM severity rank (0-5)
- Causes of RM are recorded for each colony
  - Multiple sources are ordered as primary, secondary etc. based on the relative amount of recent mortality they are causing
- Area for each threat is totaled for comparison

Rank 1 = 1-5%
Rank 3 = 25-45%
Rank 5 = 80-100%
Fragmentation area estimates

- Not categorized as ‘recent mortality’ because recently dead skeleton is not present
  - Can’t measure what is not there during field surveys
- Can look at change in size to estimate live tissue area lost to fragmentation
  - Assume missing area had same % cover of live tissue as remainder of the colony prior to break
- Caveat: not all fragmentation decreases the colony dimensions
Drivers: Chronic & Acute

- Total LAI Loss observed as recent mortality or fragmentation since 2004
- Fragmentation resulted in more lost area than other causes
  - However, 80% of that loss occurred in a 4 month period
- White disease and snail feeding are more substantial chronic threats than fragmentation
  - Snails account for 25% of lost area in absence of substantial physical disturbance
Fragmentation

- 63 new colonies at the Spring 2006 survey 😊
- 89 colonies gone since spring 2005 😞
- Net loss of colonies
  - Large colonies replaced by fragments
- Should not be overlooked as a threat
What can we do about it?

Can’t stop fragmentation from storms…
Disease? Manageable in the future with research…
Can’t remove all the snails…

...can we?
**Coralliophila abbreviata feeding**

- Snails responsible for 25% of lost live area
- On average ~30% colonies are snail infested
  - Average of 4 snails per infested colony
- Snails are persistent
  - Average age 7.8yrs (Johnston & Miller 2007)
  - Snails often feed on a colony until it is dead or nearly dead
Accelerating impact?

As colonies decrease in number the snails pile on the remaining colonies.
Should we remove snails?

- Although not primary source of mortality it is a manageable one.
- Known disease vectors so removal could have positive impact beyond feeding.
- Prey on other coral hosts.
  - More abundant but smaller and slower growing on Montastraean and other head corals.
  - Removing them from Acropora will not remove them from the ecosystem.
- Acropora snails may have escaped natural predation.
  - E.g. lobster decreased in number and size so can not handle the larger sized snails found on Acropora.
- If they tasted good we would not be asking this question…
Acropora is circling the drain!

- There is less than there was which is less than there was before
- Recovery too slow to keep pace with disturbance frequency
- Three main threats
  - Disease- No known way of directly stopping it. Firewall approach? Removal of vectors…
  - Fragmentation- can’t be stopped but impact mitigated through ‘rescue’ fragments
  - Snail Predation- Stopped by removing snails. The most immediately accessible tool we have at our disposal
- Feasibility needs to be evaluated
  - Can only be done with support of managers!!
Support

- Funding 2004-2006 through Nat’l Undersea Research Center (UNCW)
- 2006 to present through NOAA’s Coral Reef Conservation Program
- Project permitted by FKNMS
  - FKNMS-2010-053
  - FKNMS-2008-080
  - FKNMS-2006-012
  - FKNMS-2005-066
  - FKNMS-2004-012
Thank you!