

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

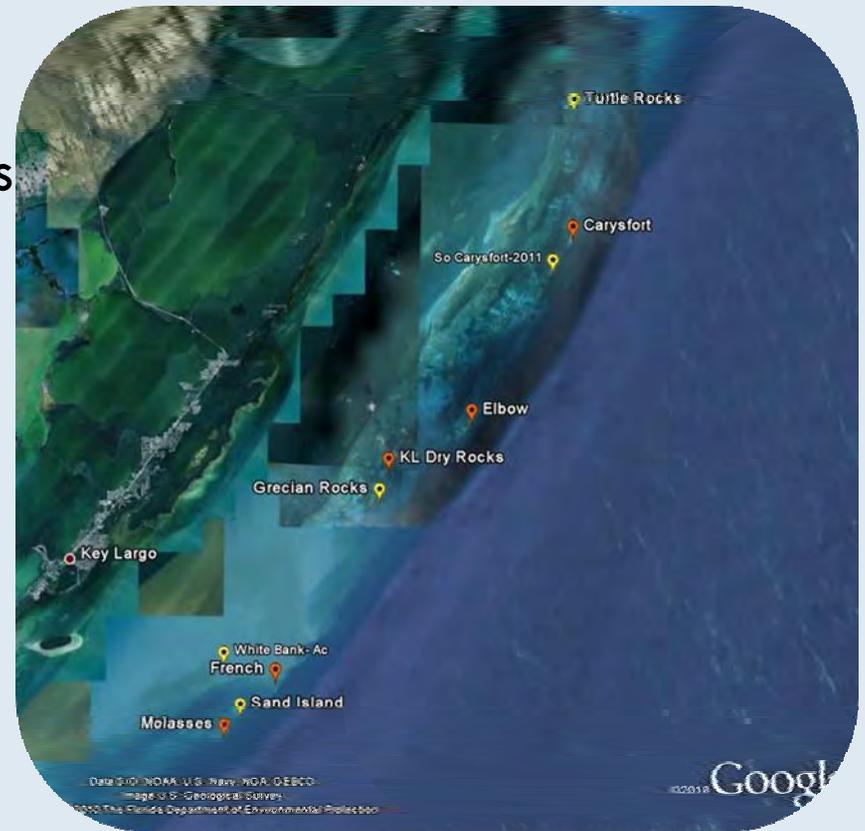


NOAA
CORAL REEF
CONSERVATION PROGRAM

Dana E. Williams and Margaret W. Miller

Demographic monitoring

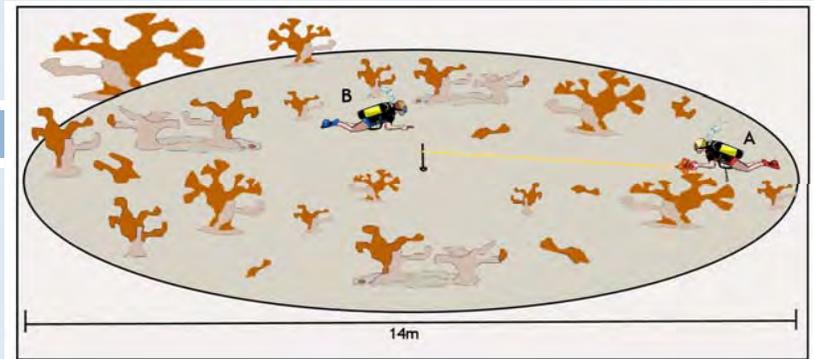
- Began in 2004
 - ▣ 15 study plots at 5 sites
 - ▣ Expanded to 27 plots at 8 sites
 - ▣ Quarterly monitoring scaled back to 3 times a year
- Objectives:
 - ▣ Quantify basic population parameters (mortality & recruitment)
 - ▣ Identify and determine the relative importance of threats (chronic vs. acute)



Is there more than there was? Why not?

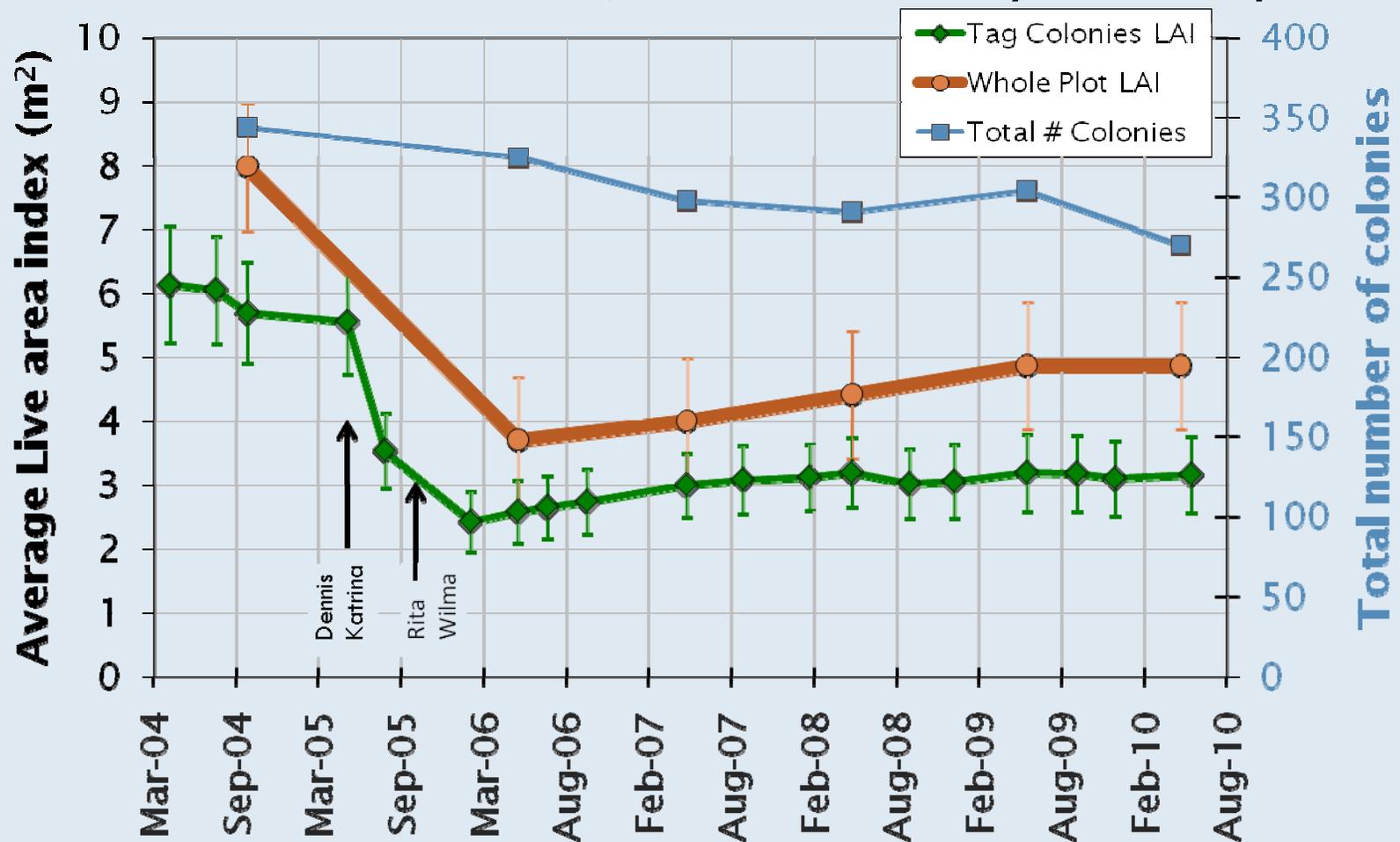
Methods

- 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



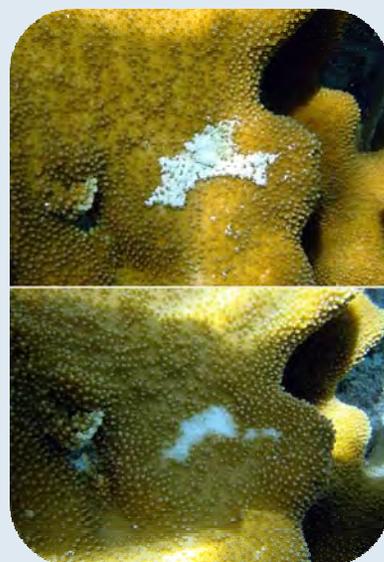
Rapid Tissue Loss



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%



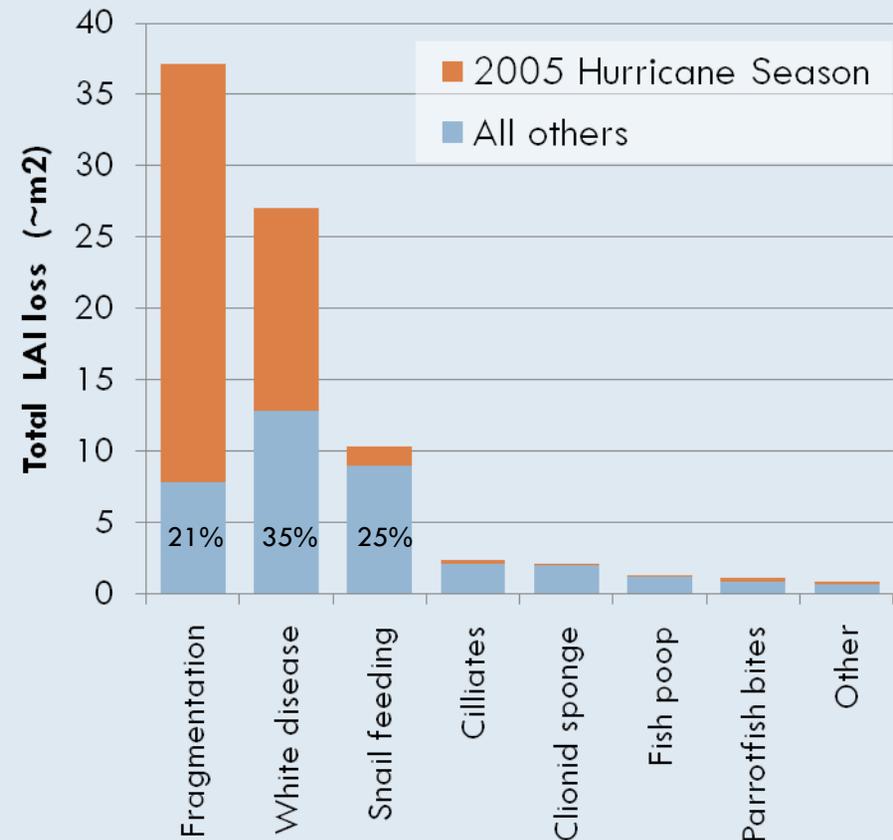
Fragmentation area estimates

- 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...

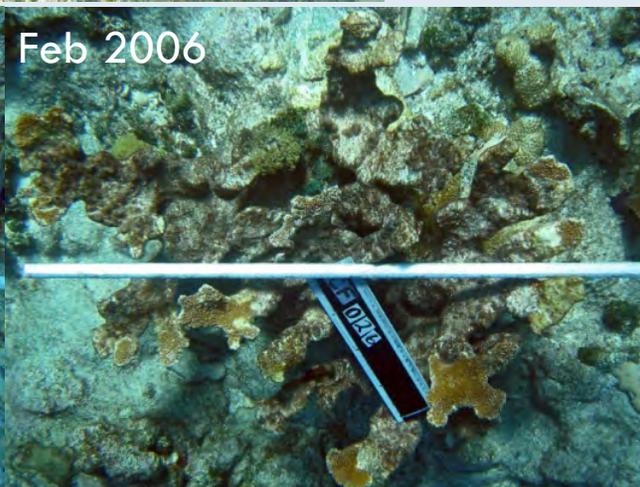
Can't remove all the snails...

...can we?

Coralliophila abbreviata feeding

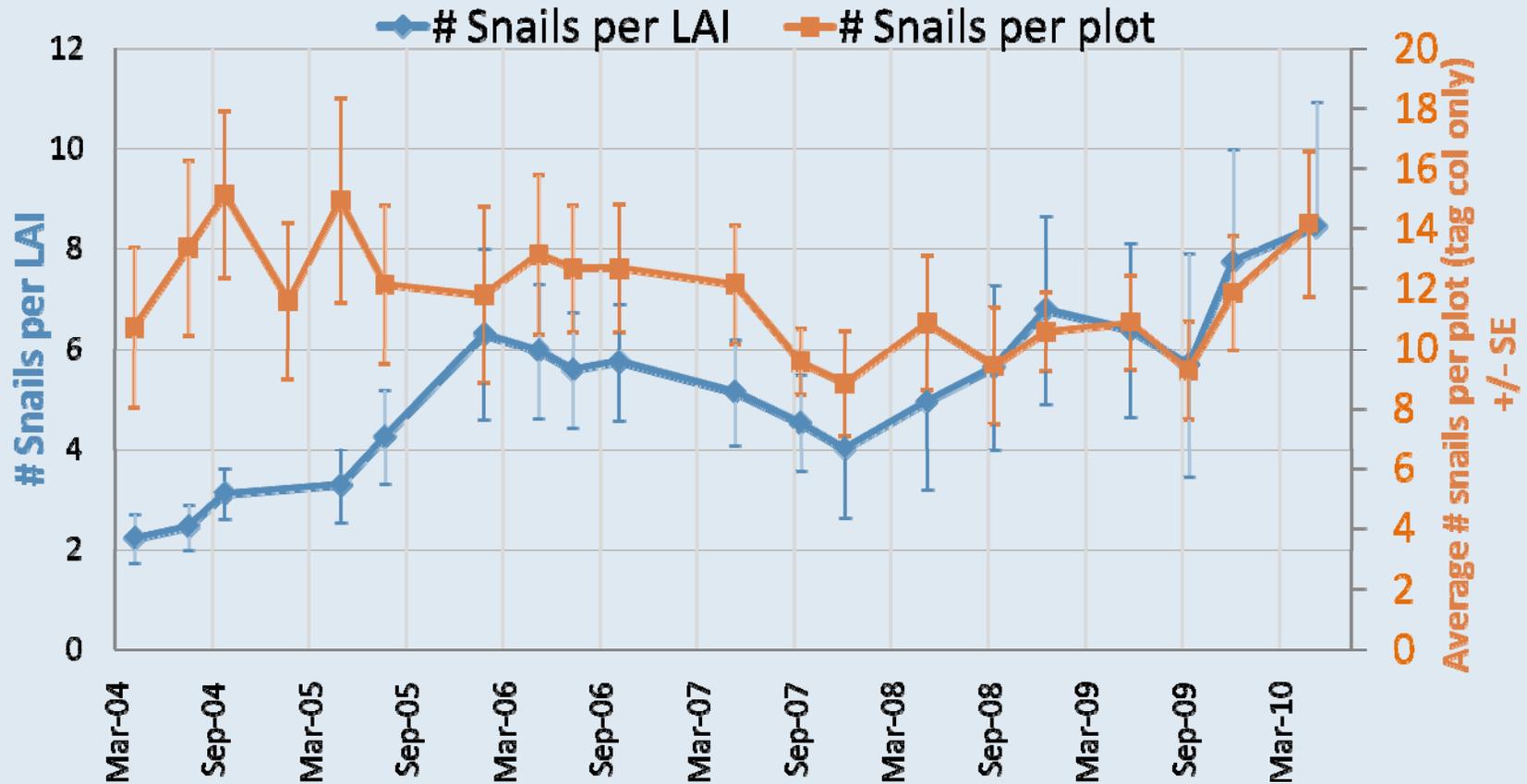
- Snails responsible for 25% of lost live area
- On average ~30% colonies are snail infested
 - ▣ Average of 4 snails per infested colony
- Snails are persistent
 - ▣ Average age 7.8yrs (Johnston & Miller 2007)
 - ▣ Snails often feed on a colony until it is dead or nearly dead





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 *Montastraea* 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!