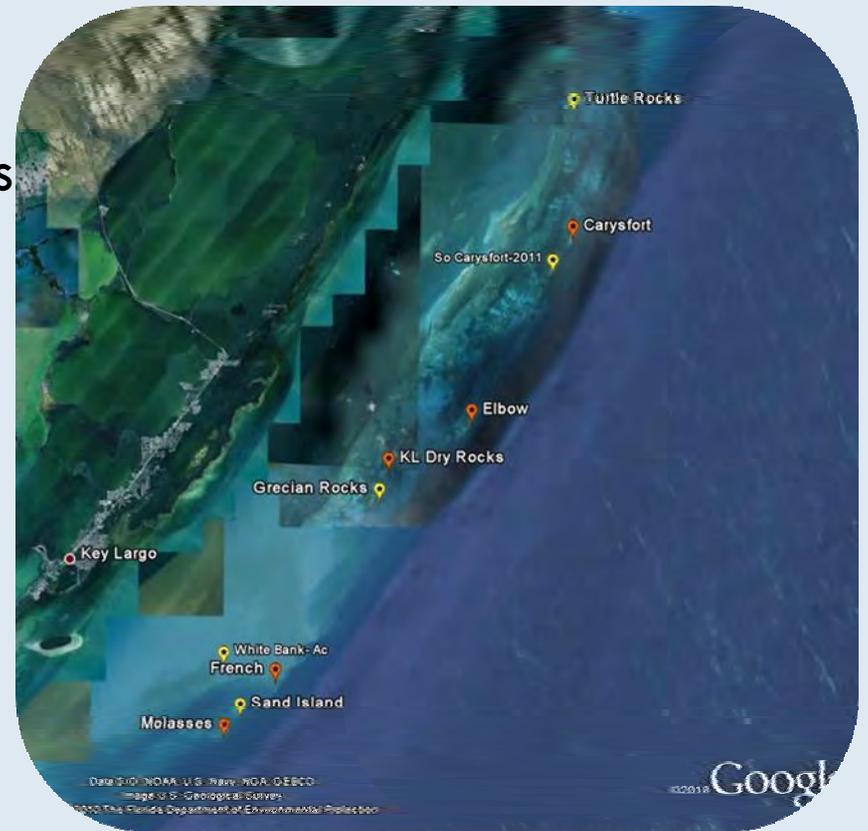


# DRIVERS OF POPULATION DECLINE IN *ACROPORA PALMATA* IN THE FLORIDA KEYS NATIONAL MARINE SANCTUARY

# Demographic monitoring

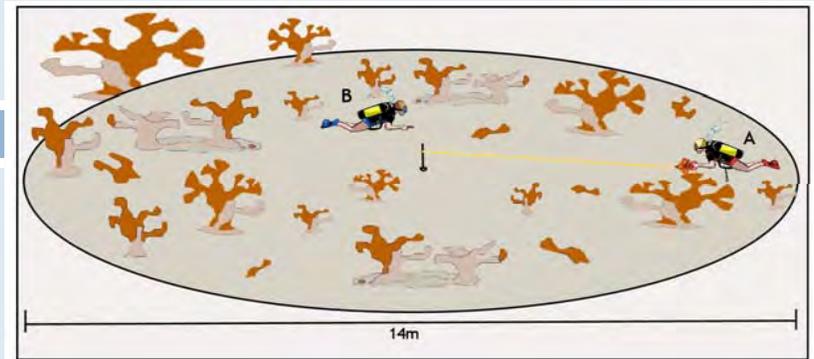
- Began in 2004
  - ▣ 15 study plots at 5 sites
  - ▣ Expanded to 27 plots at 8 sites
  - ▣ Quarterly monitoring scaled back to 3 times a year
- Objectives:
  - ▣ Quantify basic population parameters (mortality & recruitment)
  - ▣ Identify and determine the relative importance of threats (chronic vs.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



*Is there more than there was? Why not?*

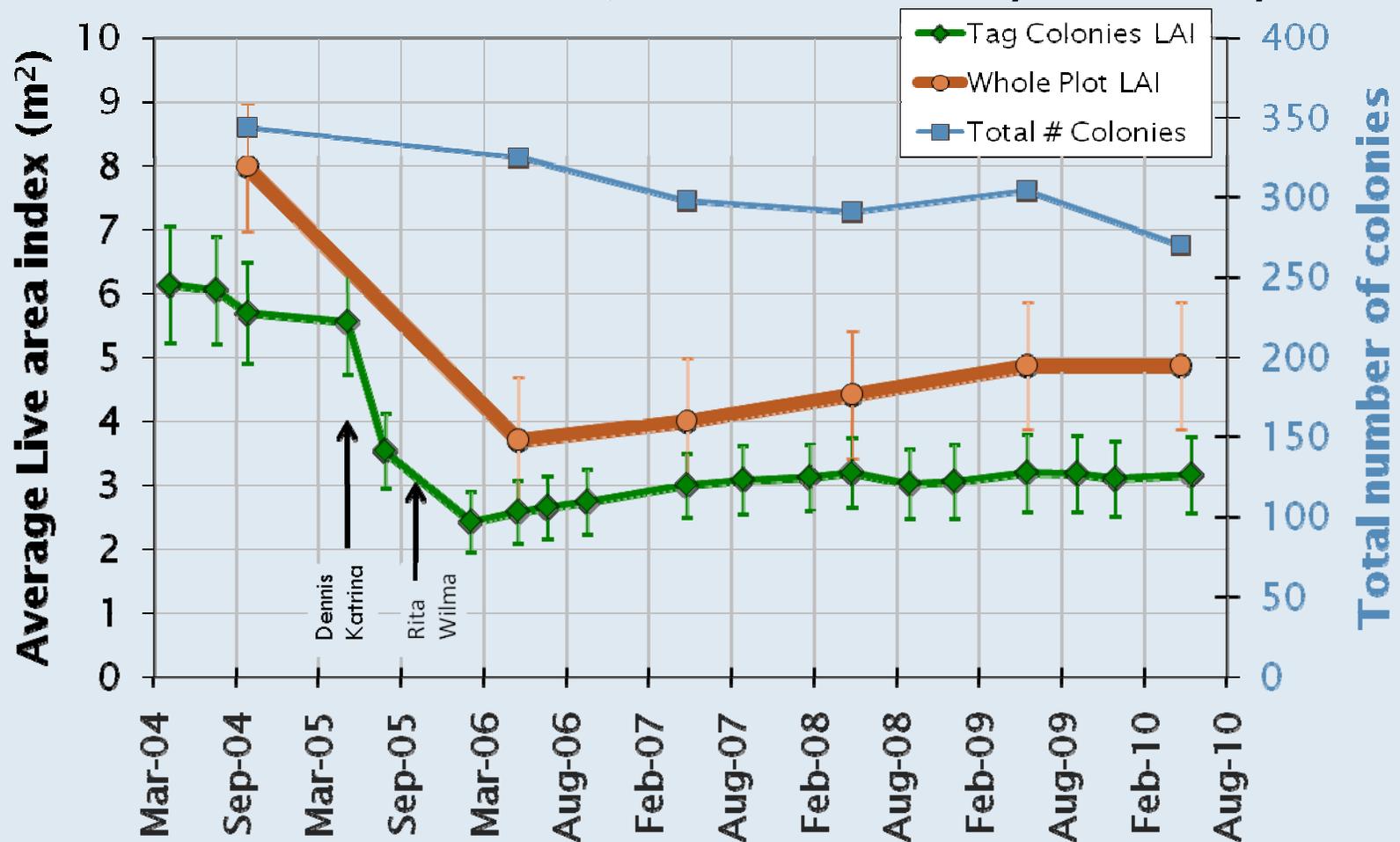
# Methods

- 150m<sup>2</sup> 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



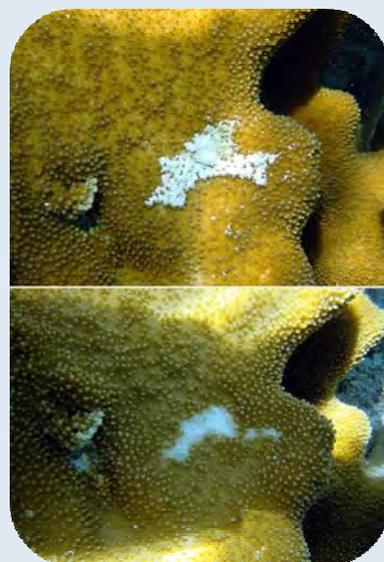
Rapid Tissue Loss



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%



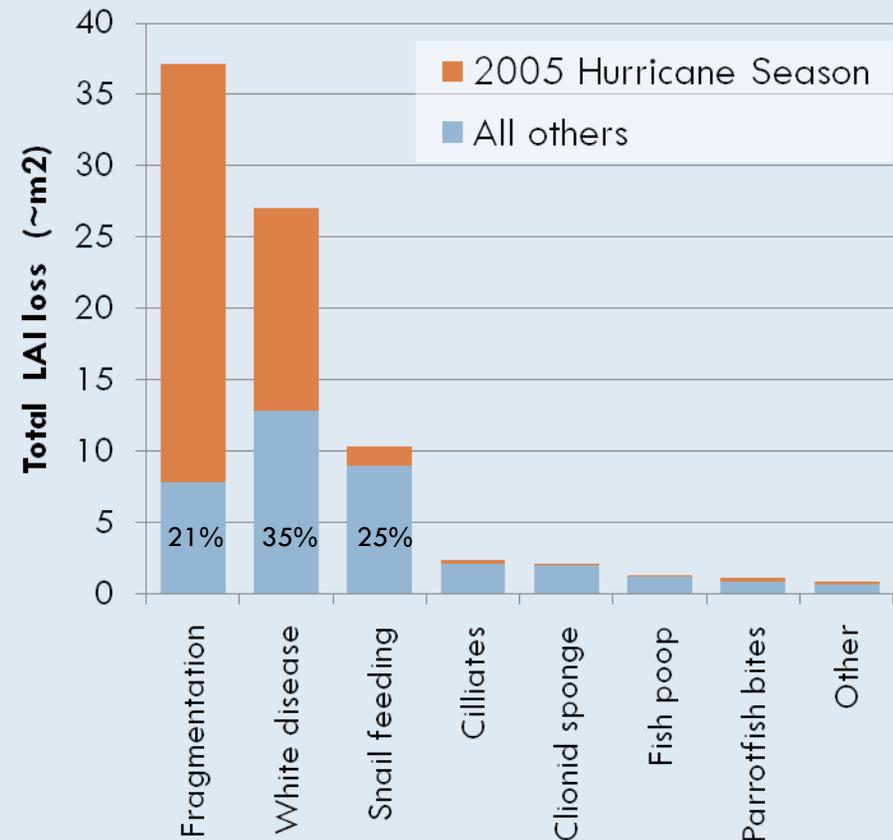
# Fragmentation area estimates

- 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...

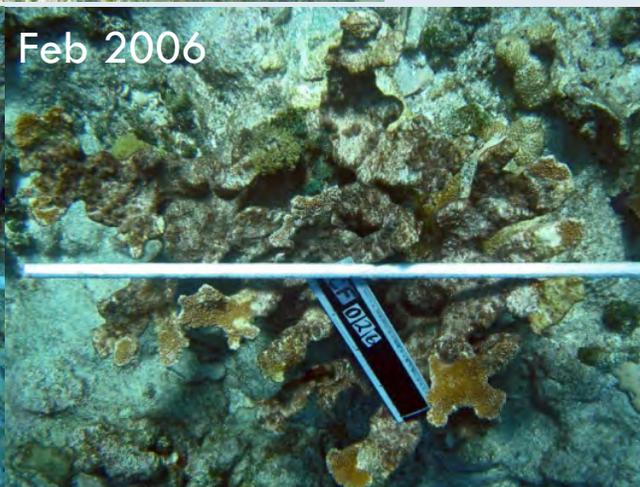
Can't remove all the snails...

...can we?

# *Coralliophila abbreviata* feeding

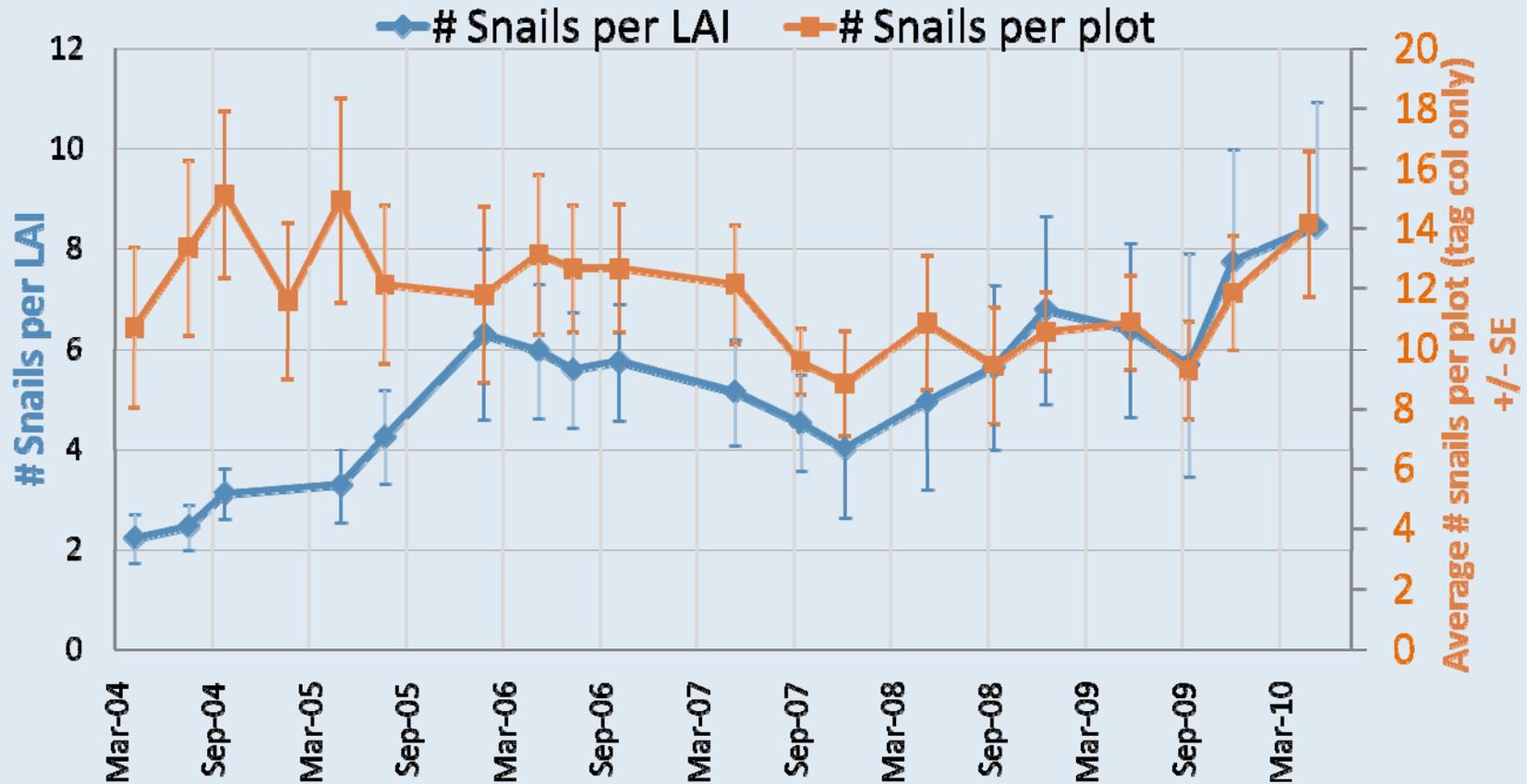
- Snails responsible for 25% of lost live area
- On average ~30% colonies are snail infested
  - ▣ Average of 4 snails per infested colony
- Snails are persistent
  - ▣ Average age 7.8yrs (Johnston & Miller 2007)
  - ▣ Snails often feed on a colony until it is dead or nearly dead





# 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!