Coral Loss and the Long-Term Effects of No-Take Reserves on Florida's Coral Reefs

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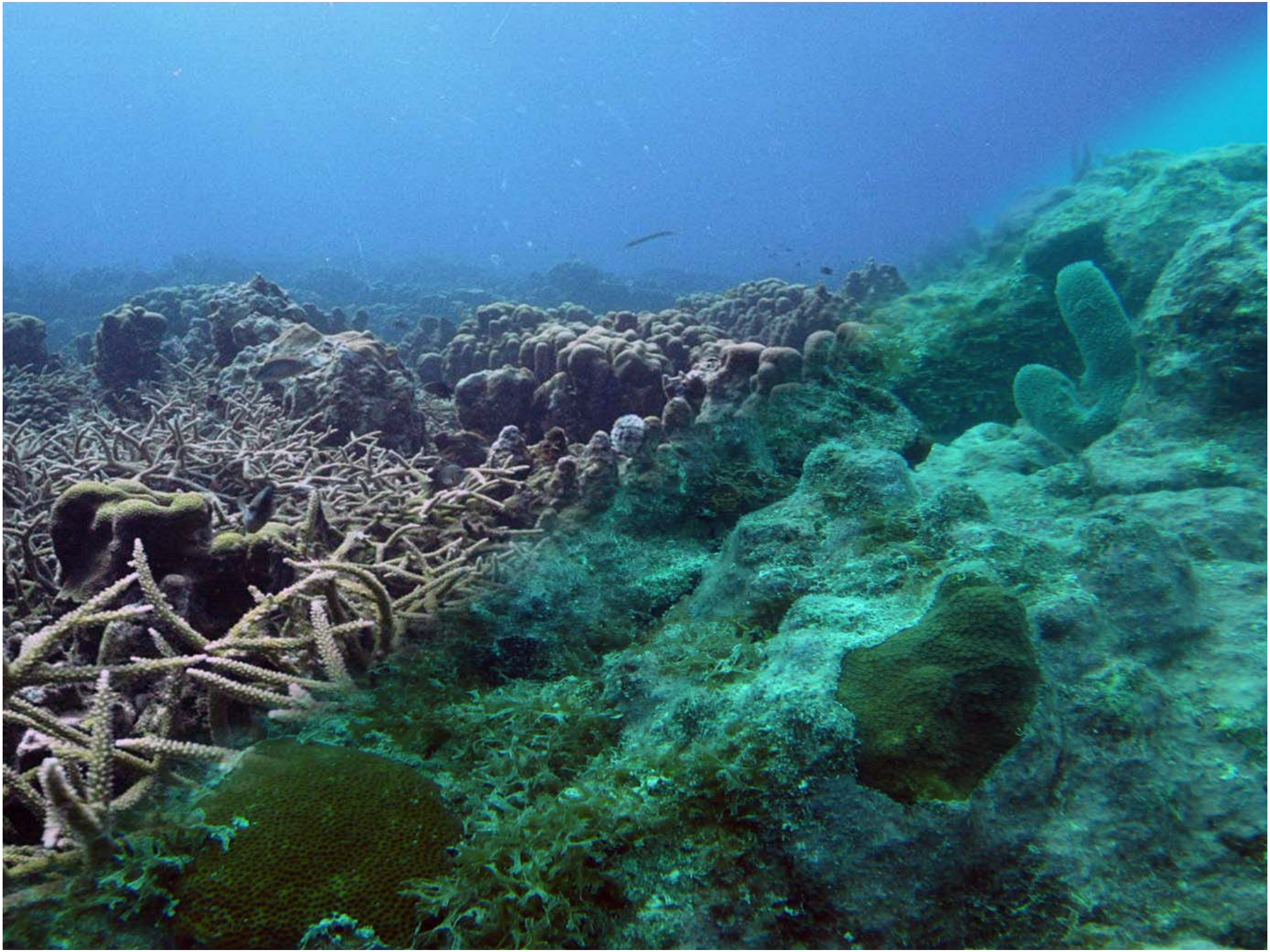
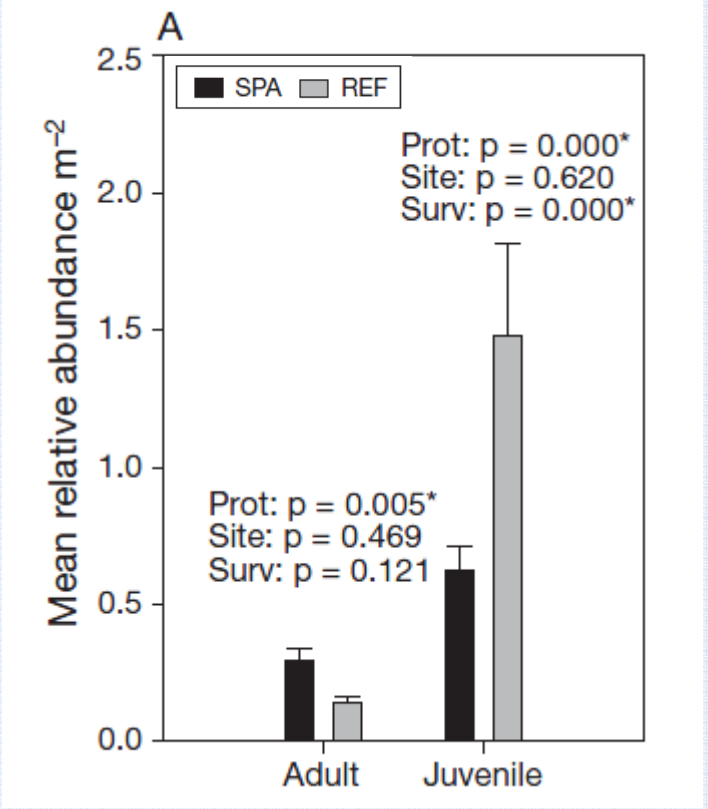


Impacts of no-take reserves

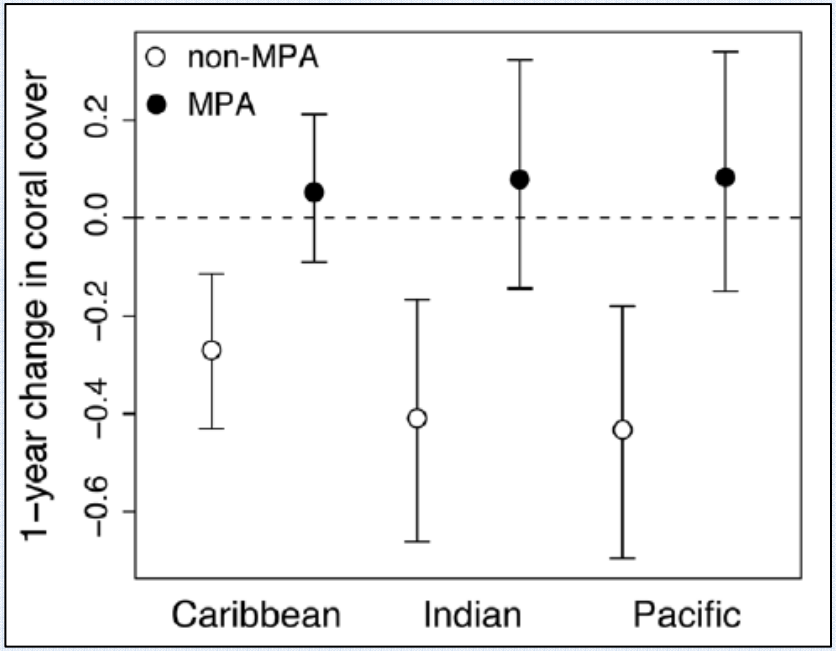
- 93% established with the goal of ecosystem management (Claudet and Pelletier 2004)
- Increased abundance of herbivores (Kramer and Heck 2007; Mumby et al. 2006)
- Less macroalgae (Mumby et al. 2007)



Kramer and Heck 2007

What about the corals?

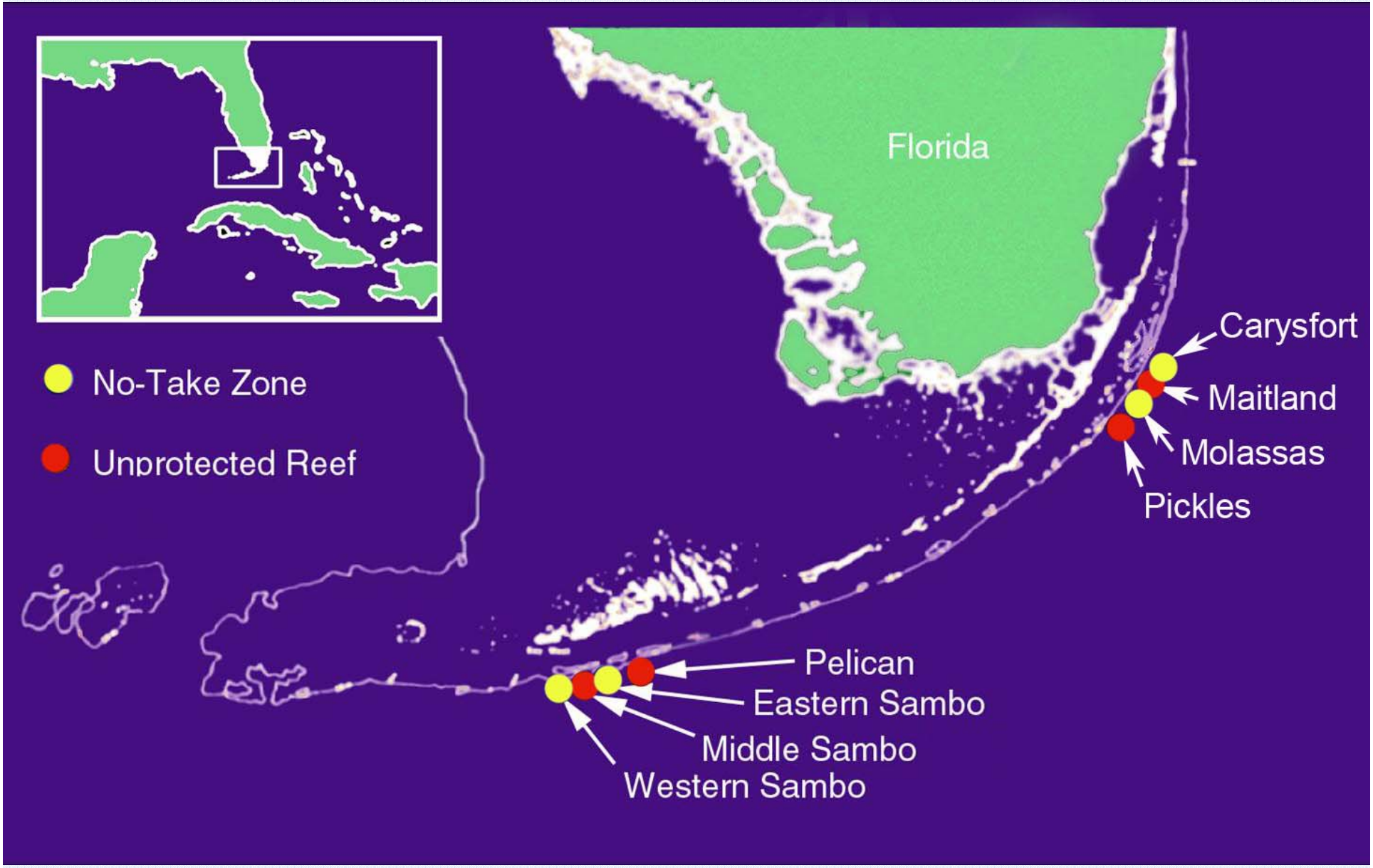
- Lower level of macroalgae promote increased coral settlement (Kuffner et al. 2006)
- Greater growth and survival of juvenile corals (Box and Mumby 2007)
- No-take areas mitigate coral decline (Selig and Bruno 2010)



Selig and Bruno 2010

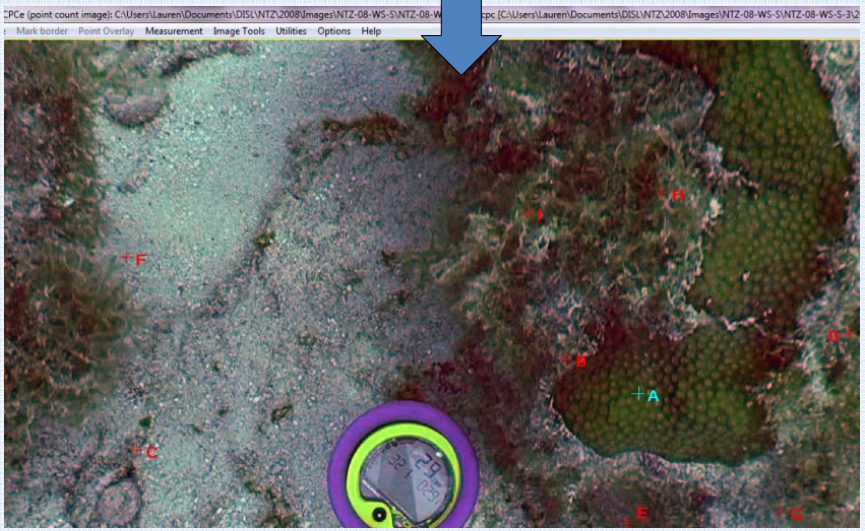
Research Questions

- How have the benthic assemblages changed over time in the FKNMS?
  - Overall community change
  - Cover of macroalgae and CTB (=crustose coralline algae, fine turf algae and bare space)
  - Hard coral cover
- Do the effects of no-take zones translate to the benthos?

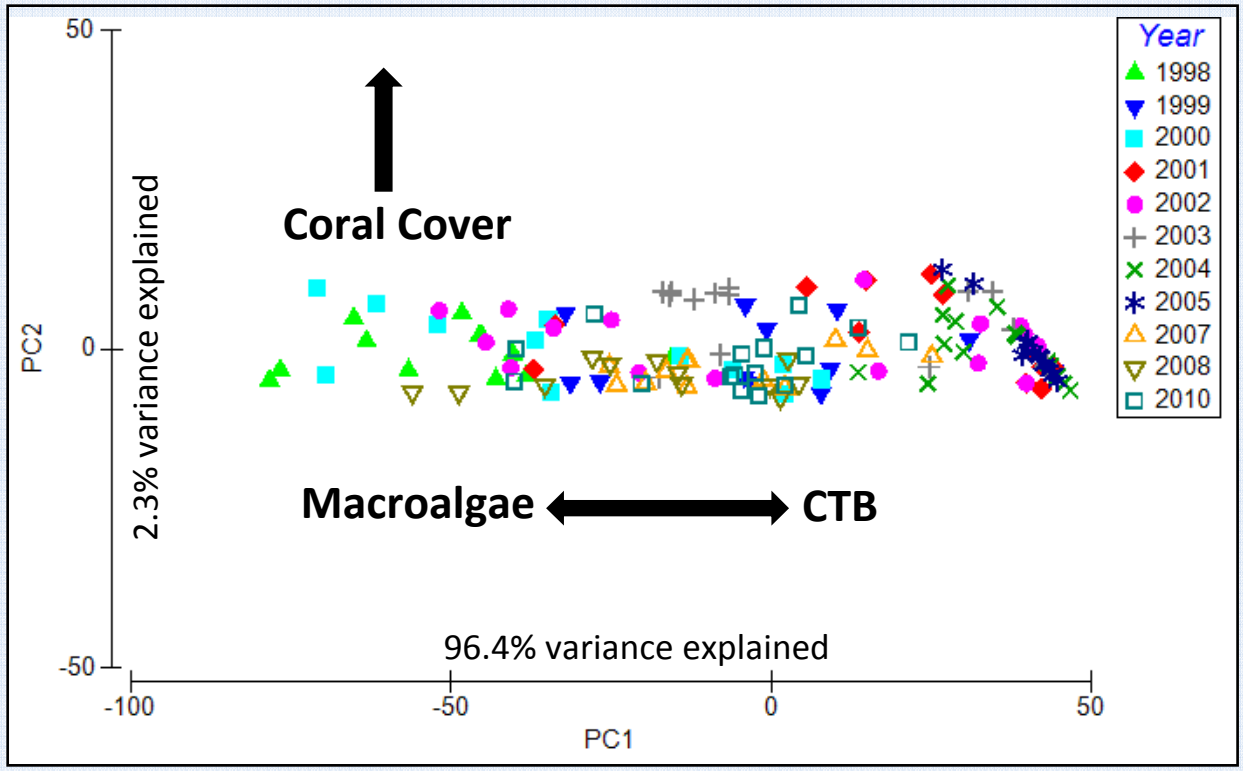

Florida
No-Take Zone
Unprotected Reef
Carysfort
Maitland
Molassas
Pickles
Pelican
Eastern Sambo
Middle Sambo
Western Sambo

Methods

- 11 years of data (1998-2010)
- Haphazard video transects at shallow (9m) and deep (15m) locations
- Assessed benthic cover from still frames using point count software



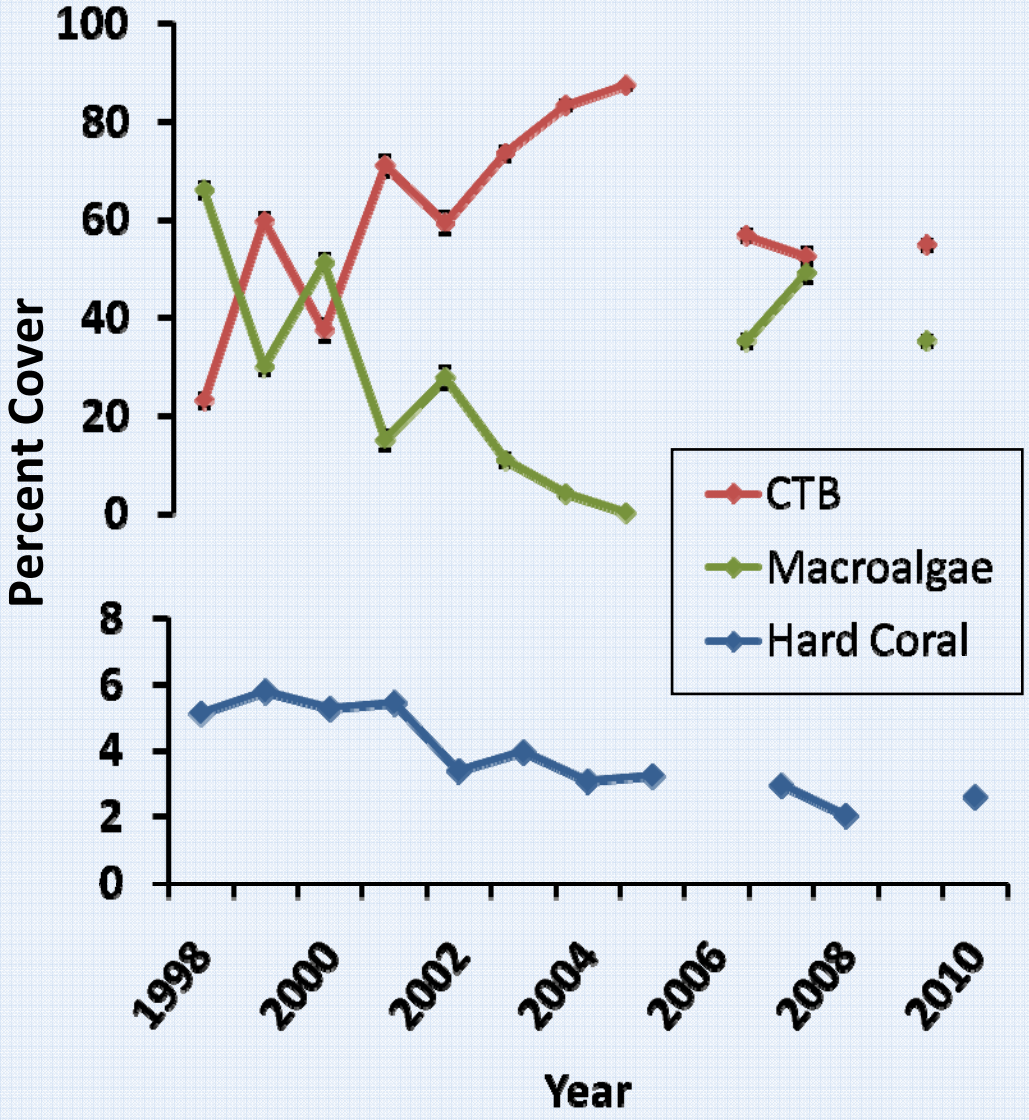
Benthic assemblages over time

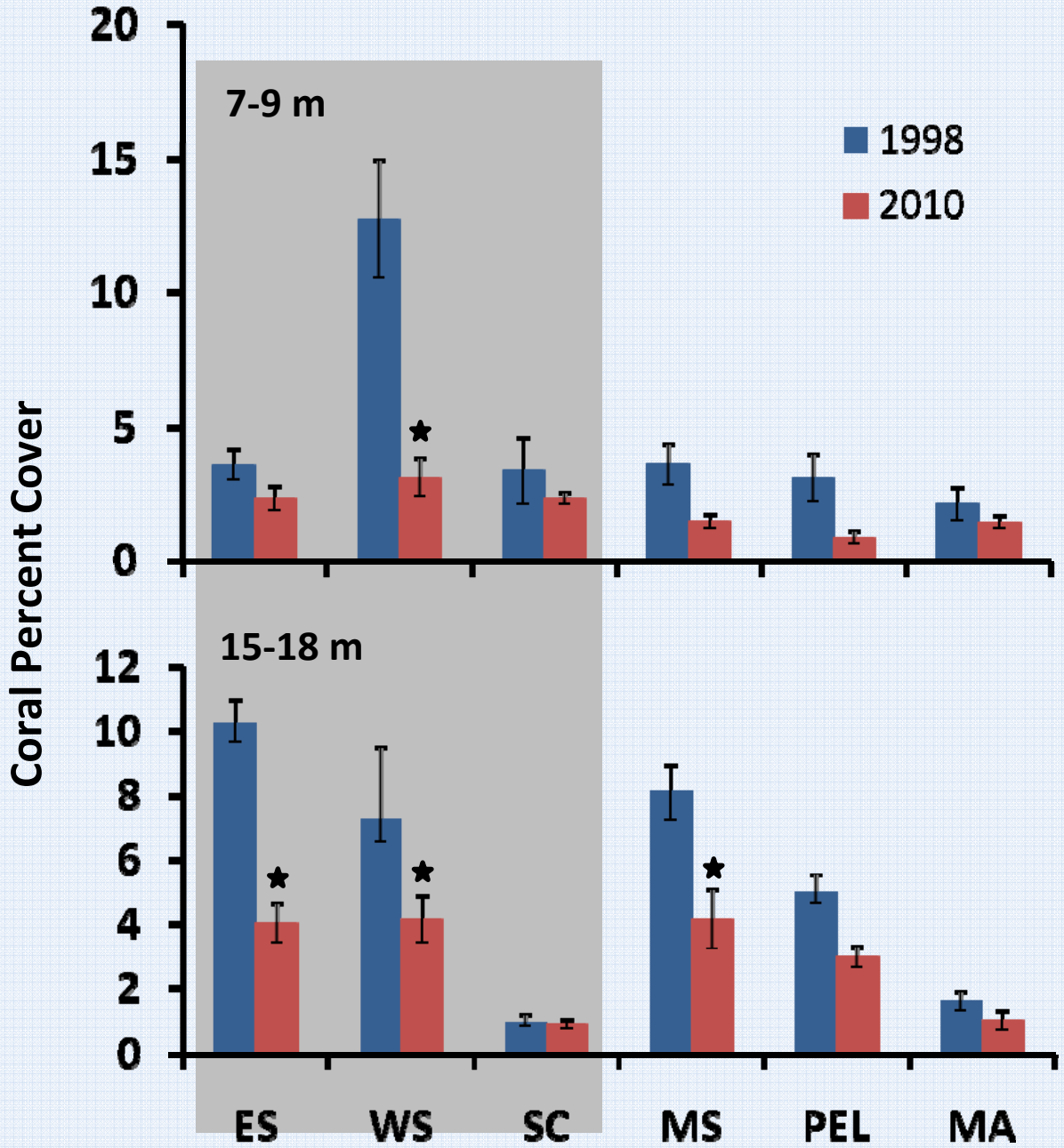


- PCA shows a change in benthic assemblages over time controlled by the balance between macroalgae and CTB
- No trend in macroalgal cover through time
- Algal cover and coral cover are decoupled

Change in benthic assemblage over time

- Macroalgae and CTB are negatively correlated through time (rho= -0.991; $p<0.001$), but macroalgal and coral cover are not (rho= -0.018; p=0.958)
- Coral loss is independent of algal dynamics
- Coral cover has declined significantly

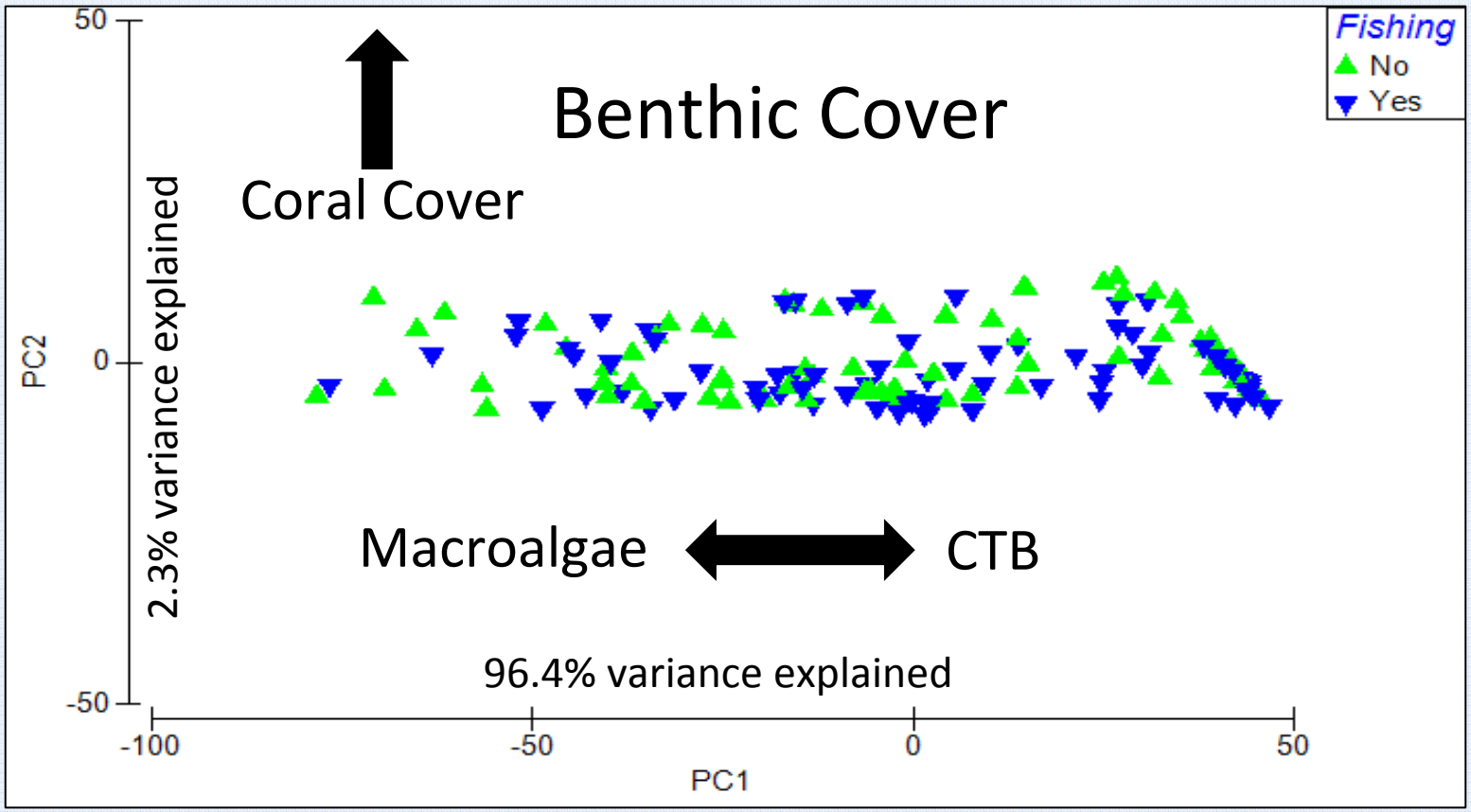



Coral Percent Cover
7-9 m
15-18 m
1998
2010
20
15
10
5
0
12
10
8
6
4
2
0
ES
WS
SC
MS
PEL
MA

Change in coral cover by site

- Significant declines in coral cover are more common in protected than non-protected sites
- Sites with higher coral cover in 1998 experienced greater coral loss
- Decline in coral cover is unrelated to protection

What is the impact of no-take status on the benthos?



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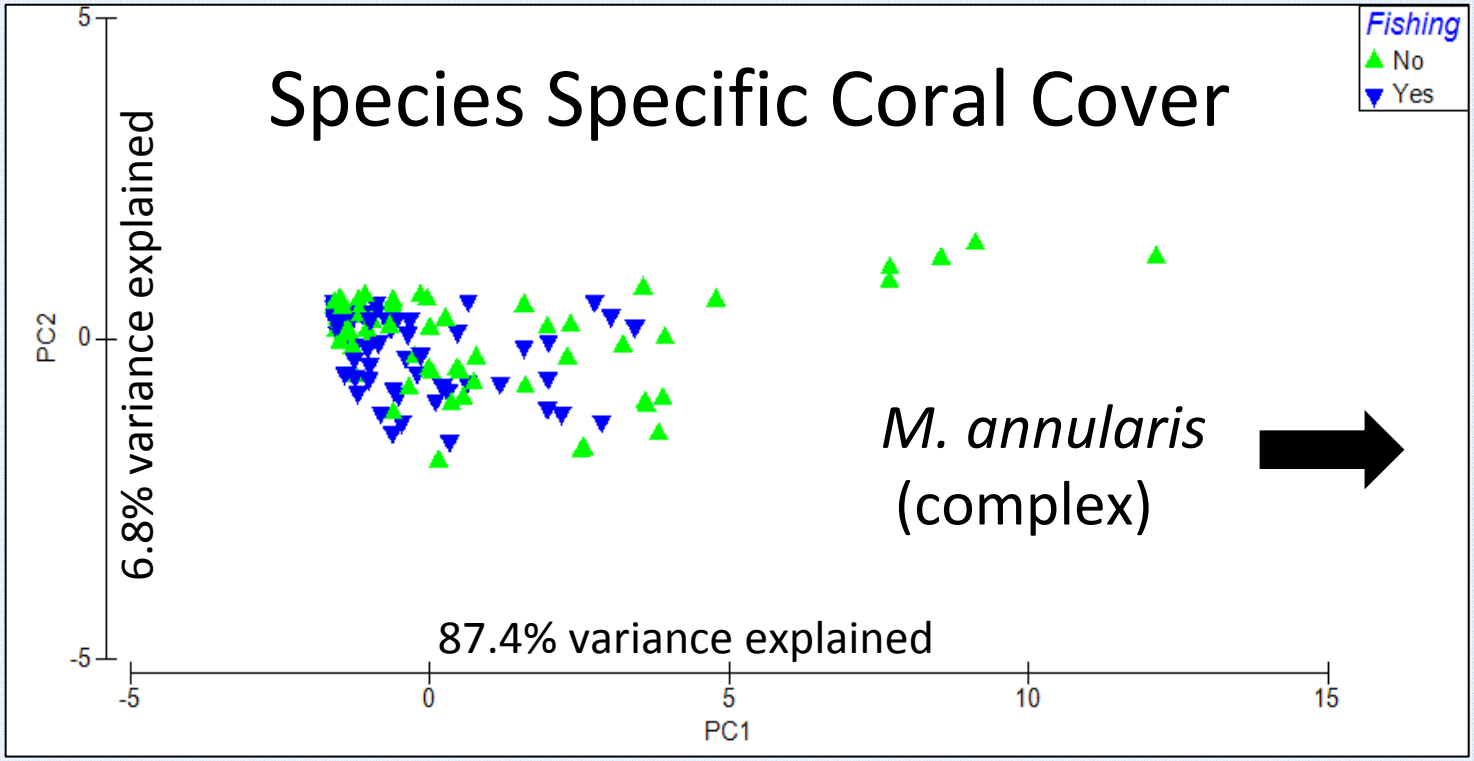
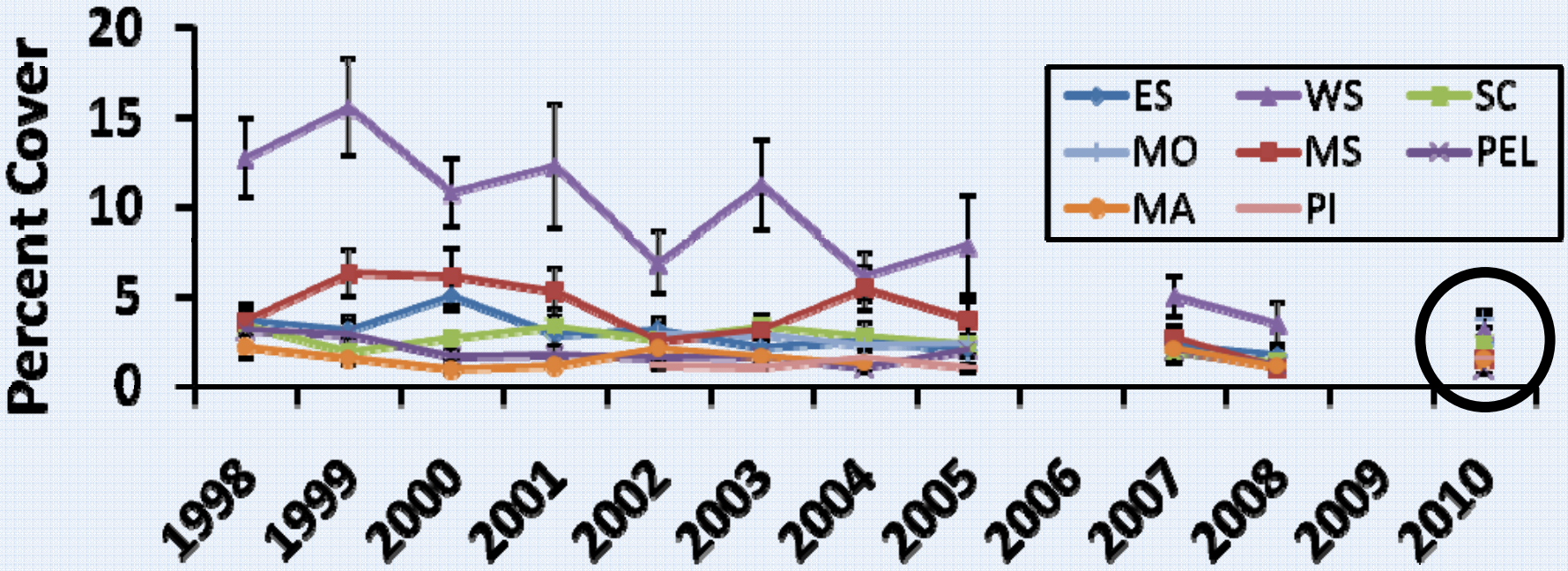


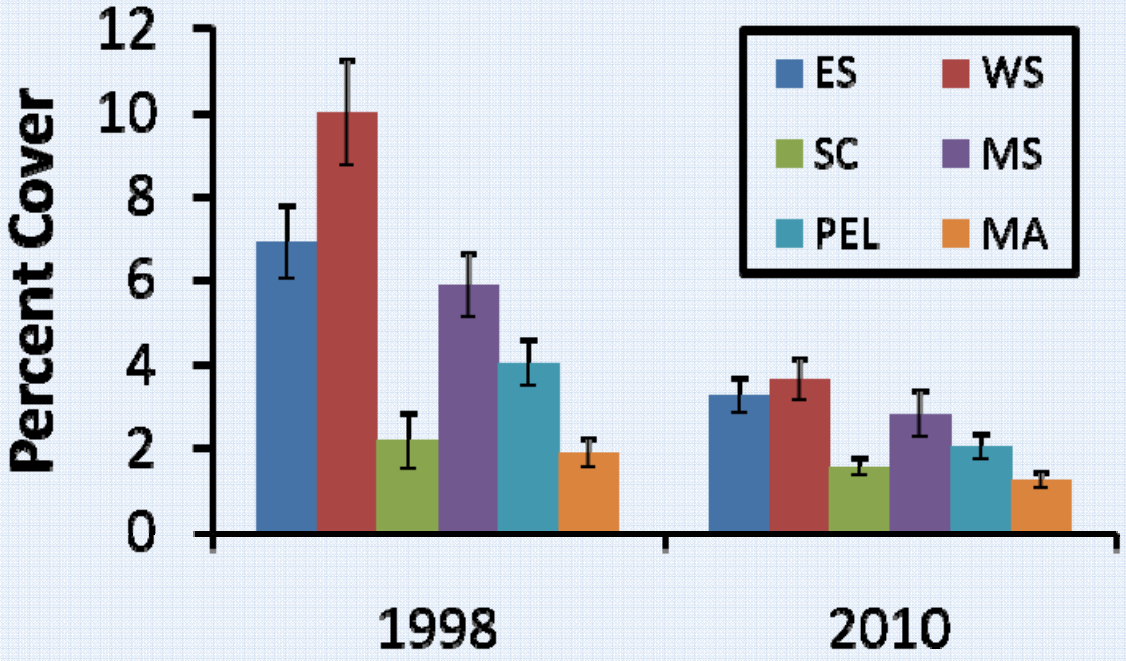
- No-take status cannot explain the variability in the benthic assemblage of FKNMS coral reefs

Homogenization of FKNMS Coral Reefs



Homogenization of FKNMS Coral Reefs

- Range of coral cover
  - 1998:27.32%
  - 2010:12.05%
- Variance in coral cover
  - 1998: 20.37
  - 2010: 3.73



Summary

- Coral decline cannot be reversed solely by establishing no-take zones in the FKNMS
  - Small scale of no-take zones (Claudet et al. 2007)
  - It may take more time for effects to be seen (Selig and Bruno 2010)
- Must simultaneously address regional and global perturbations that affect coral reefs