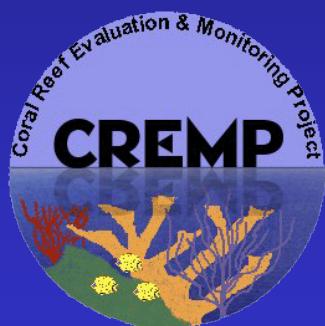


# Coral Reef Evaluation and Monitoring Project

## FKNMS Advisory Council Meeting

### June 16th, 2015

**Rob Ruzicka**  
[Rob.Ruzicka@myfwc.com](mailto:Rob.Ruzicka@myfwc.com)



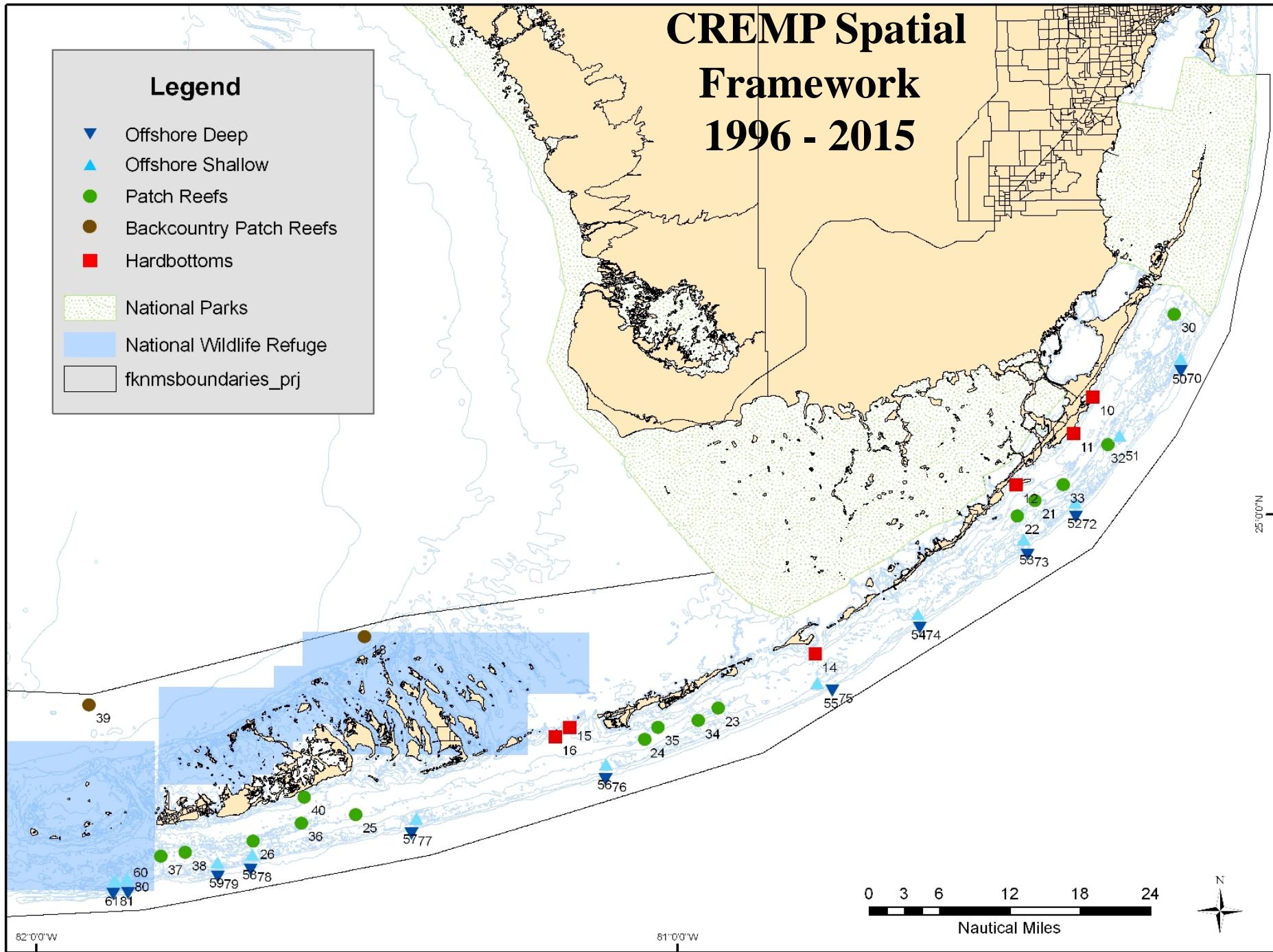
**CREMP is funded by US EPA Water Quality Protection Program  
Federal Award No. X7-95447709**

**A presentation of the Florida Fish and Wildlife Conservation Commission/  
Fish & Wildlife Research Institute**

# CREMP Spatial Framework 1996 - 2015

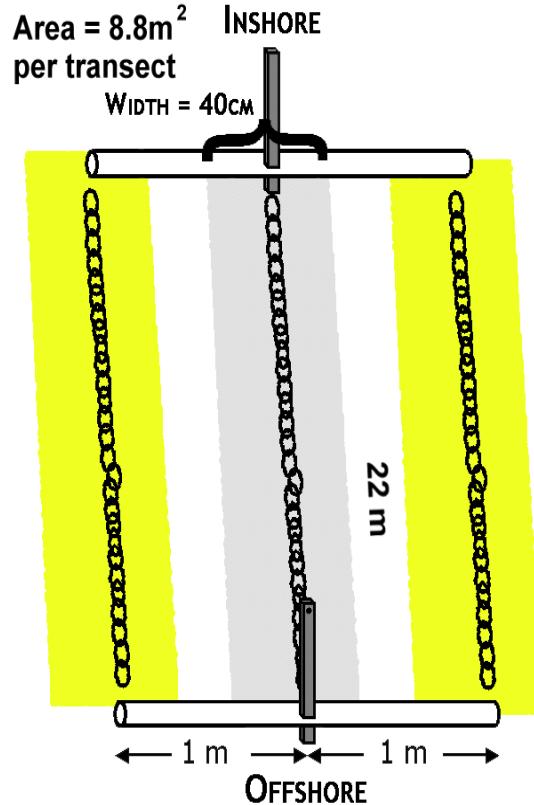
## Legend

- ▼ Offshore Deep
  - ▲ Offshore Shallow
  - Patch Reefs
  - Backcountry Patch Reefs
  - Hardbottoms
- National Parks  
National Wildlife Refuge  
fknmsboundaries\_prj

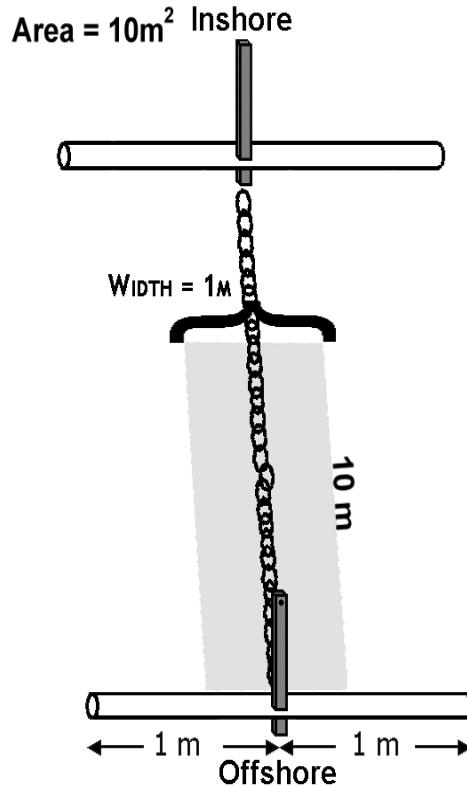


# Methods - Present

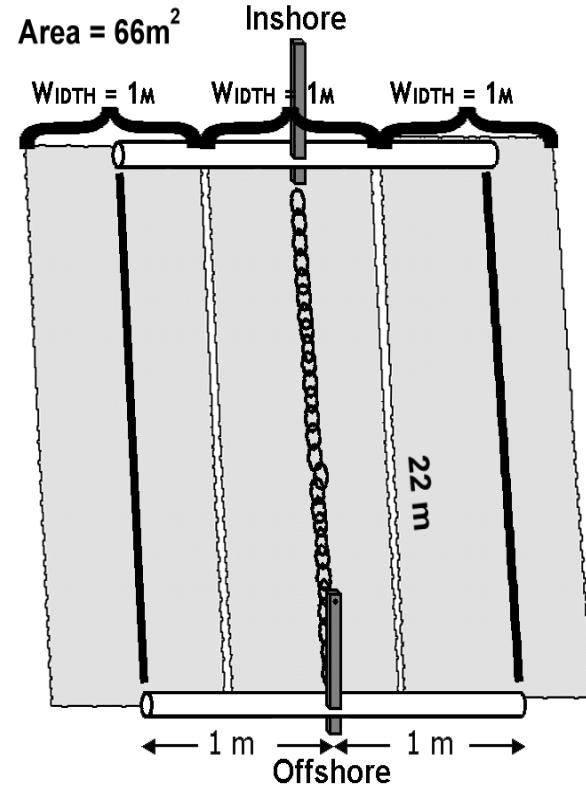
## Video Transects



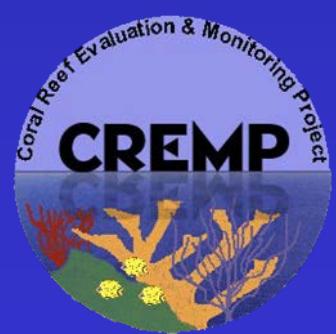
## Demographic Surveys



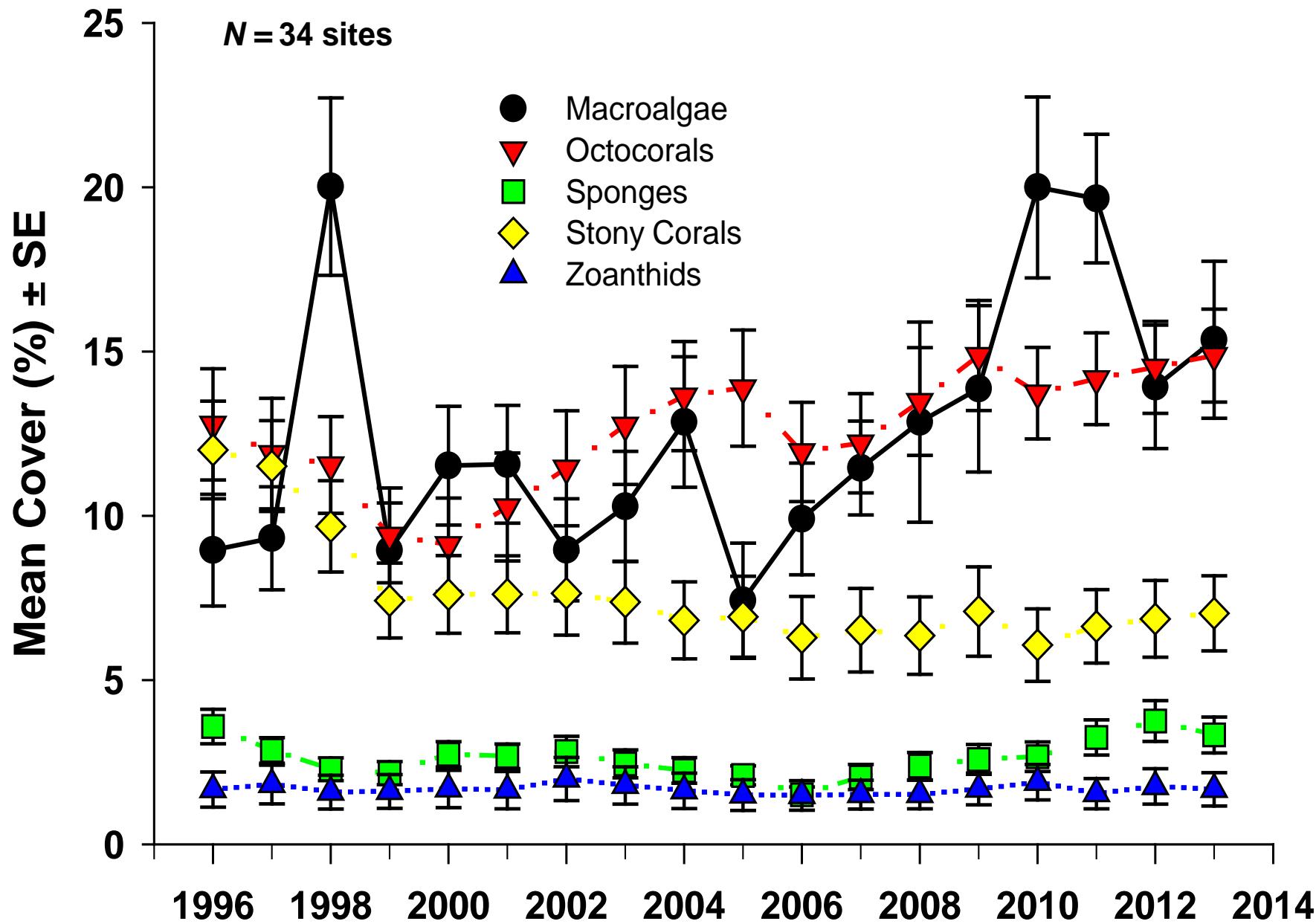
## *Xestospongia muta*



- Camera surveys on 300 transect – 40 sites
- Stony coral demographics – 40 sites
- Octocoral demographics – 18 sites
- Xestospongia demographics – 11 sites



# Long Term Trends in Benthic Cover – Florida Keys



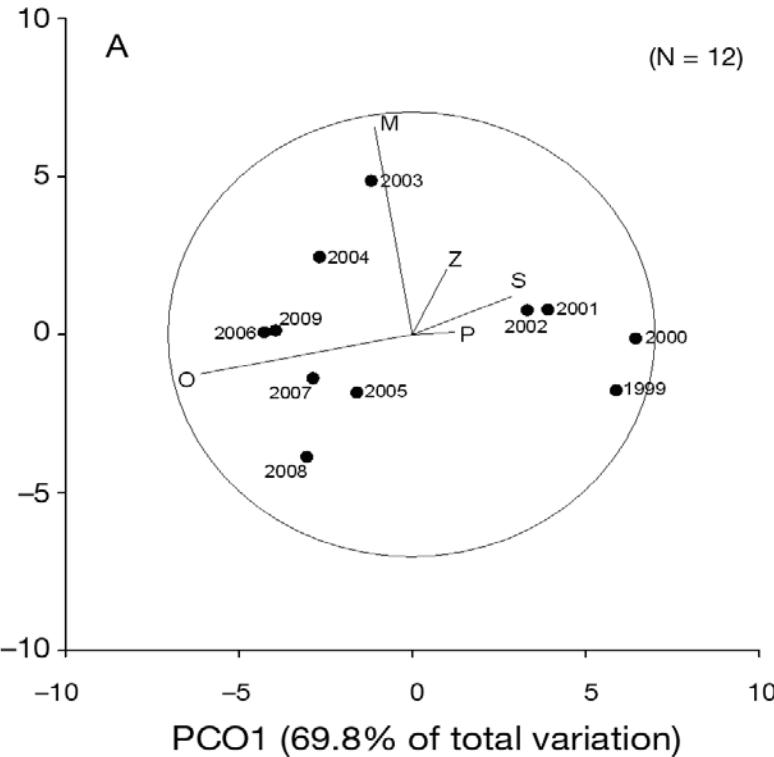
# Herbivorous Fishes & Macroalgae





# Temporal changes in benthic assemblages on Florida Keys reefs 11 years after the 1997/1998 El Niño

R. R. Ruzicka<sup>1,\*</sup>, M. A. Colella<sup>1</sup>, J. W. Porter<sup>2</sup>, J. M. Morrison<sup>3</sup>, J. A. Kidney<sup>1</sup>,  
V. Brinkhuis<sup>1</sup>, K. S. Lunz<sup>1</sup>, K. A. Macaulay<sup>1</sup>, L. A. Bartlett<sup>1</sup>, M. K. Meyers<sup>2</sup>, J. Colee<sup>4</sup>



A) Molasses Shallow



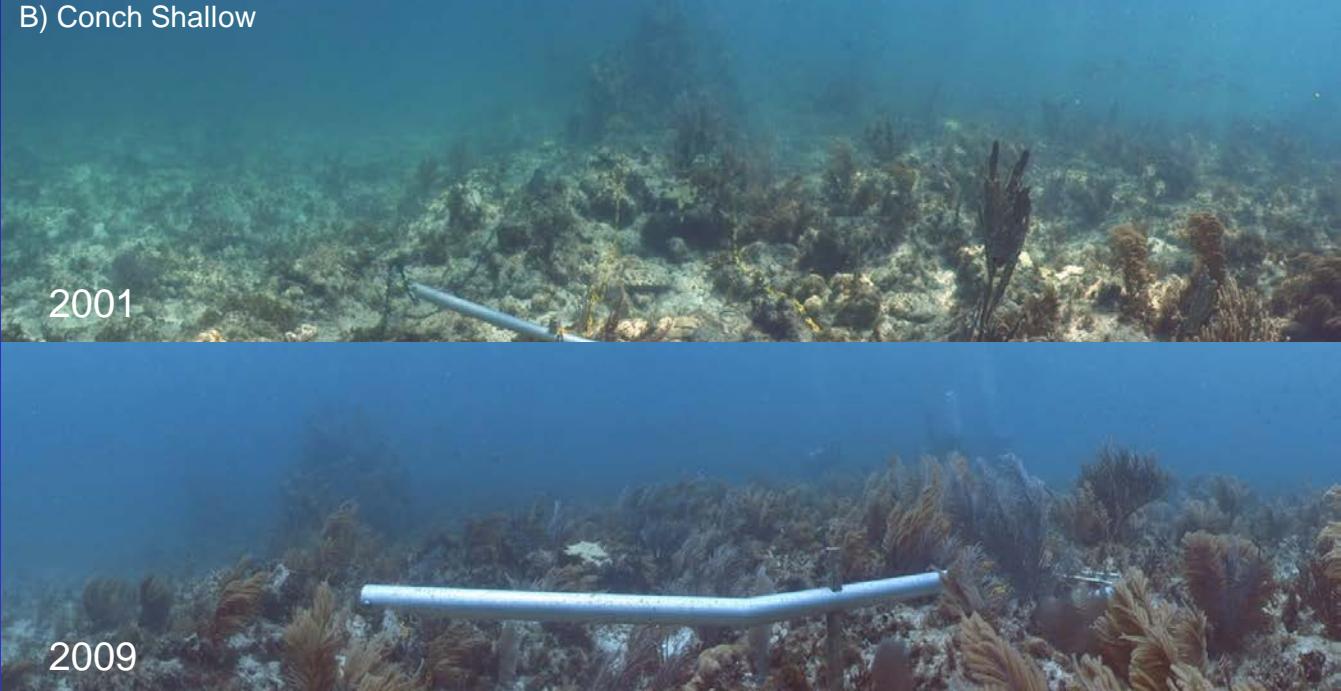
2001

B) Conch Shallow



2001

2009



1965



2001



1979



2010

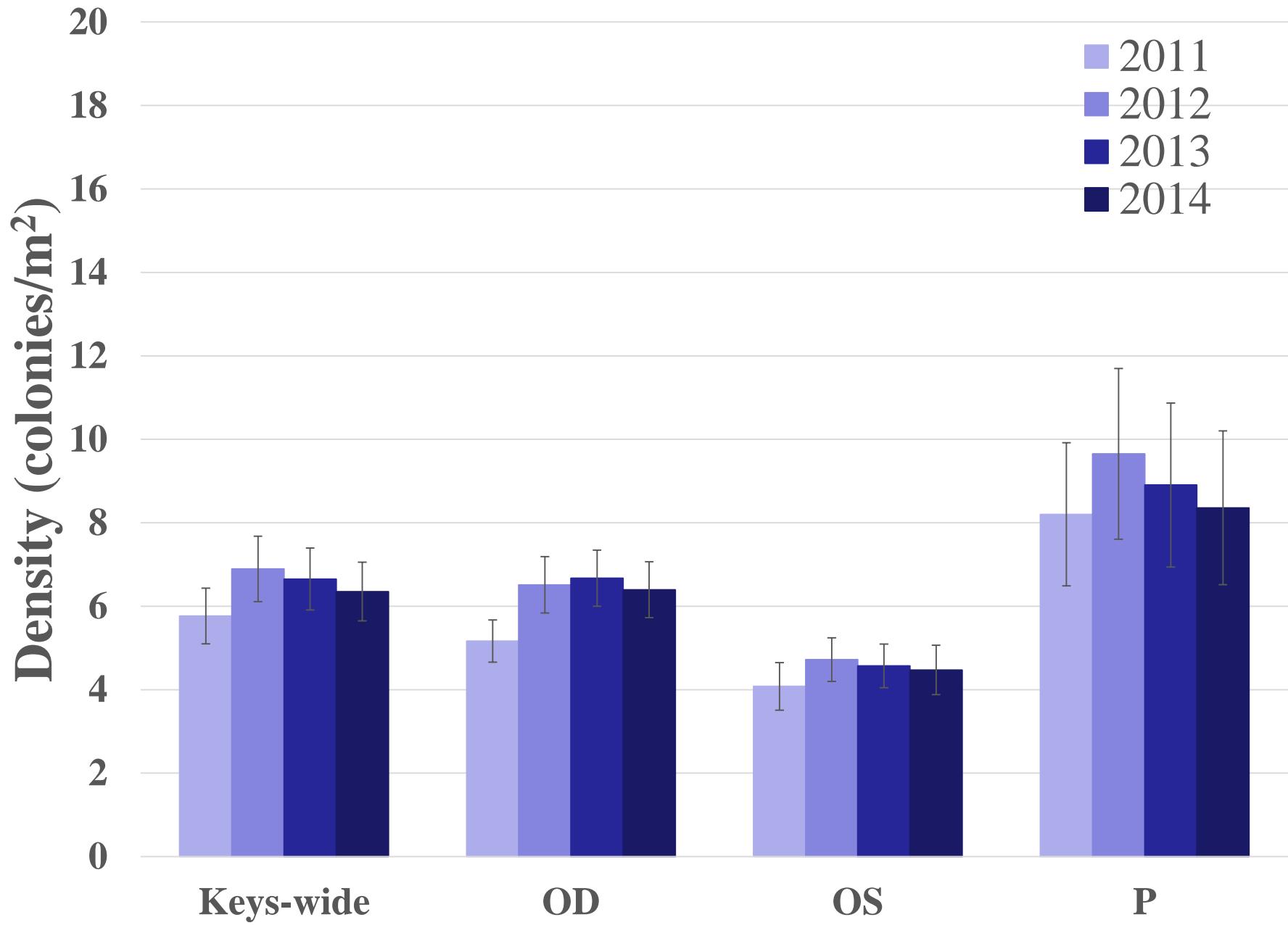


1988

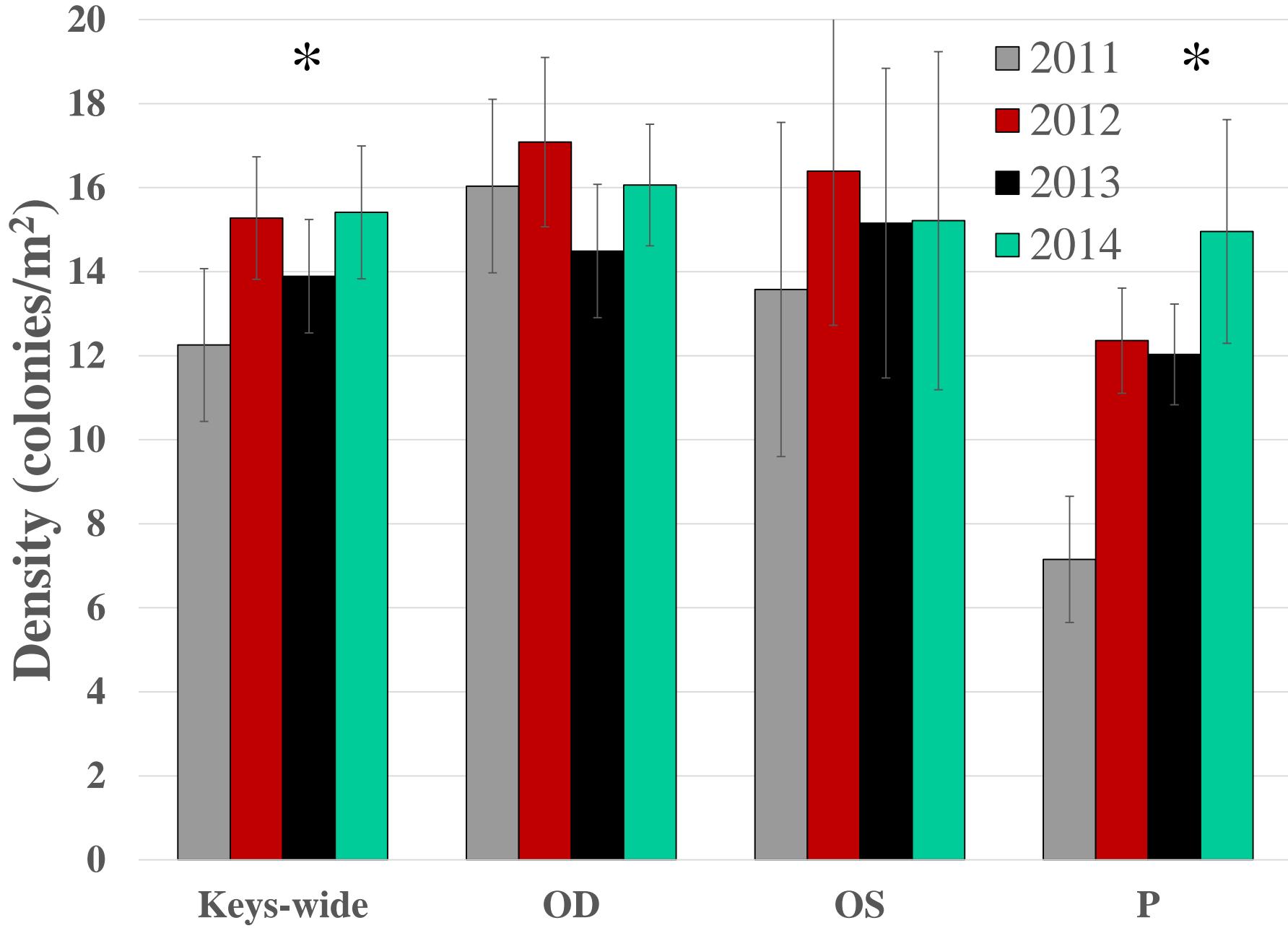


➤ Images from Gene Shinn in Tropical Treasures - South Florida Marine Environments

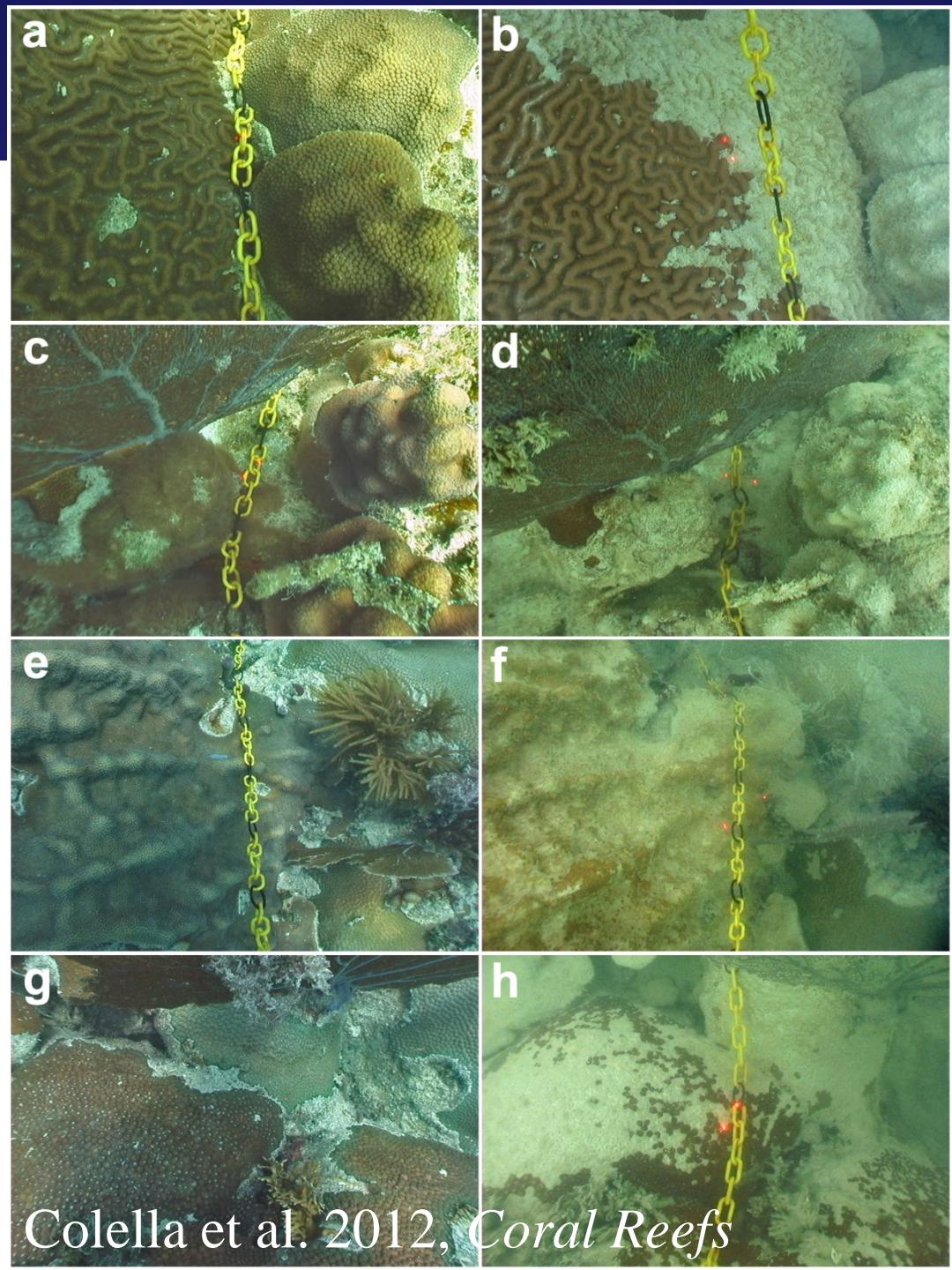
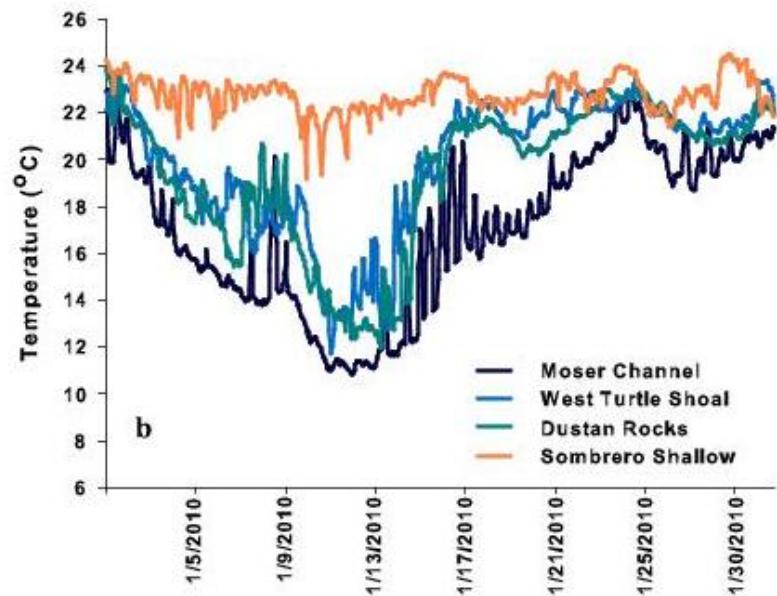
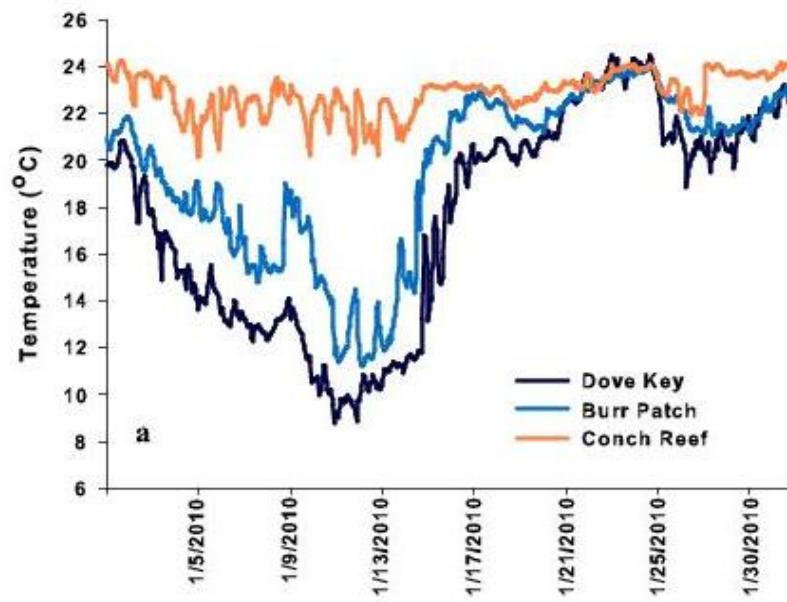
# Stony Coral Density



# Octocoral Density



# Record Breaking Winter 2010



Colella et al. 2012, *Coral Reefs*



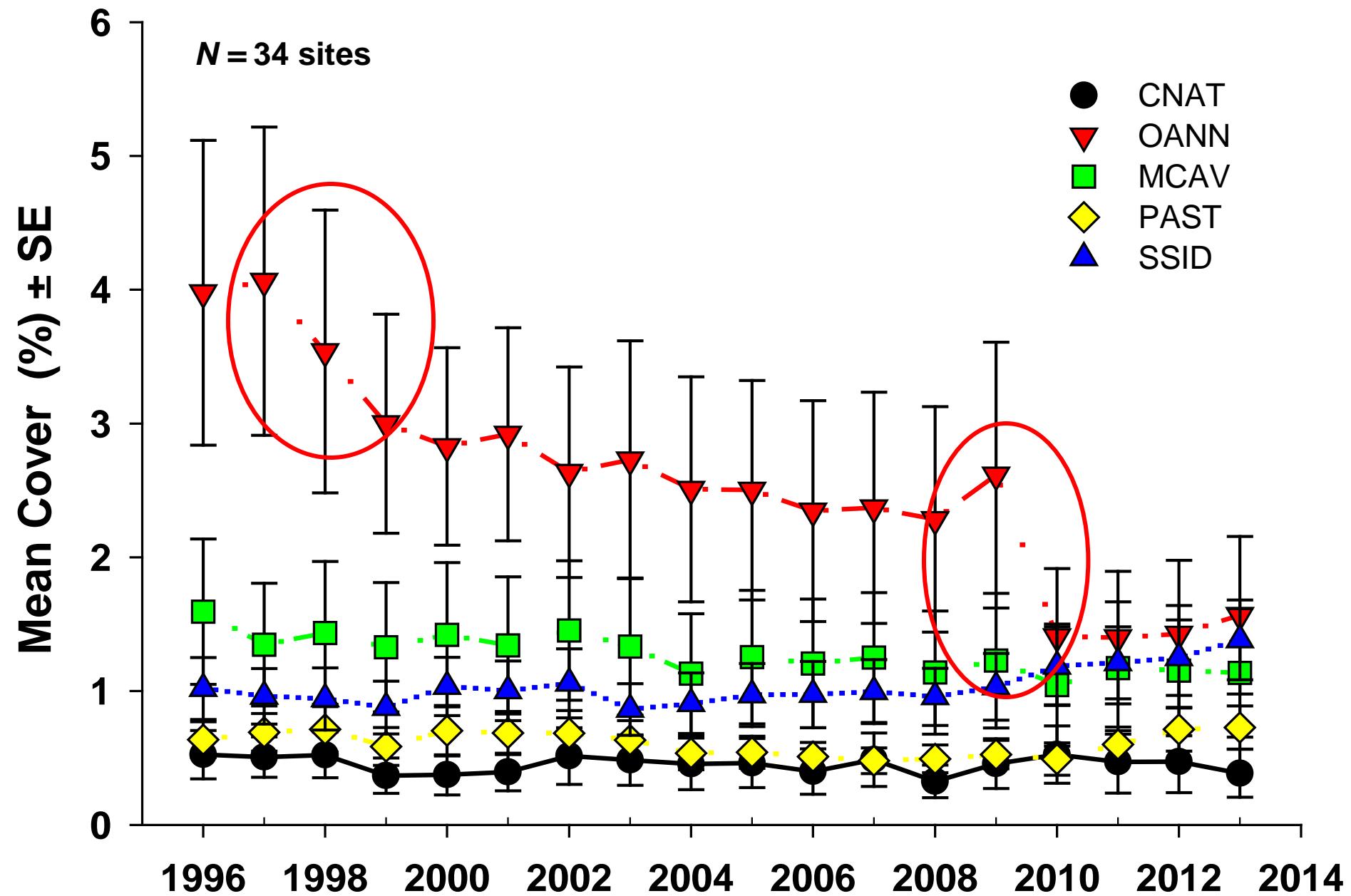
Admiral Reef  
Florida Keys  
2007



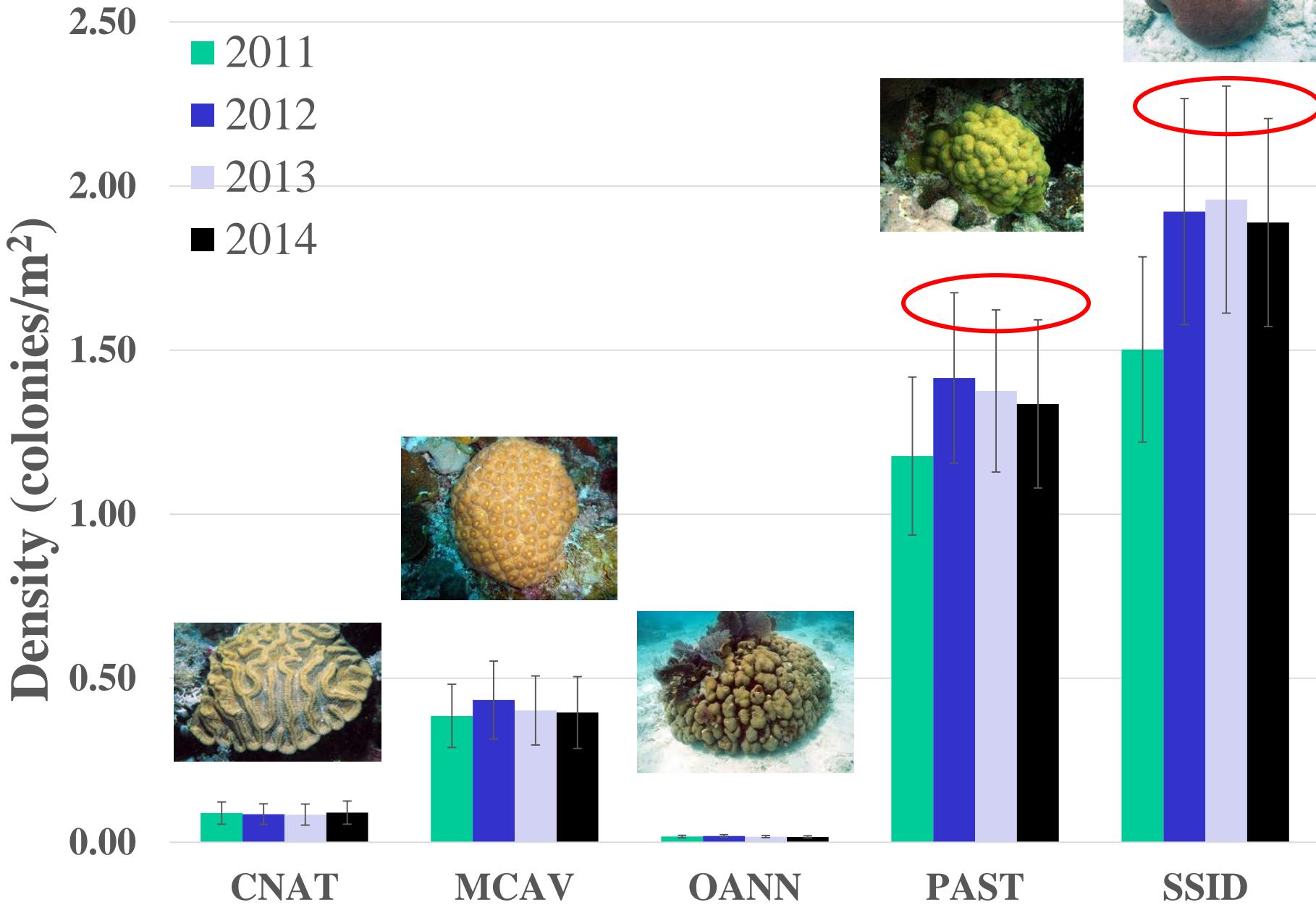
Admiral Reef  
Florida Keys  
2014



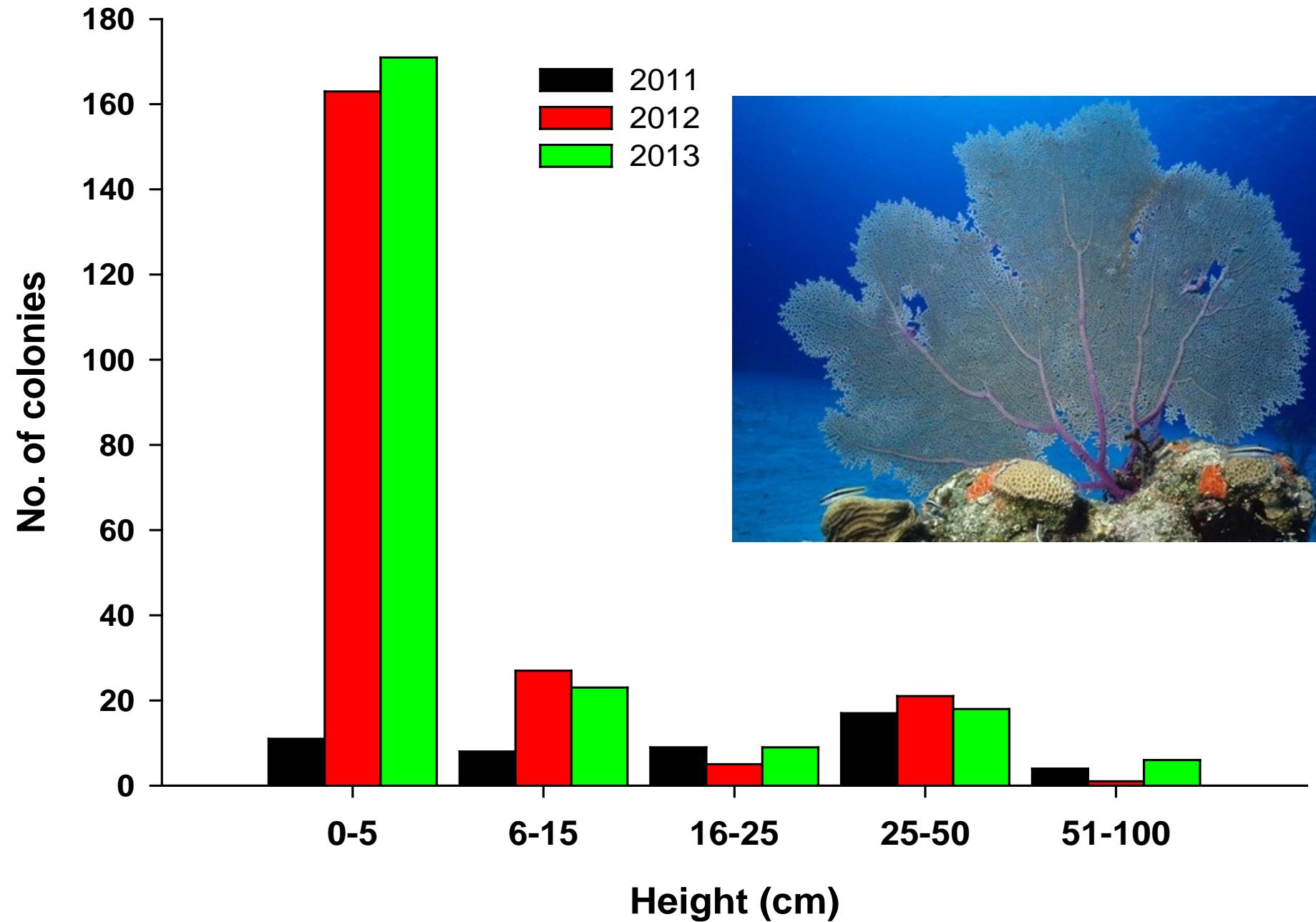
# Long Term Trends in Benthic Cover – Coral Species



# Coral Species Density



# Octocoral Recruitment After 2010

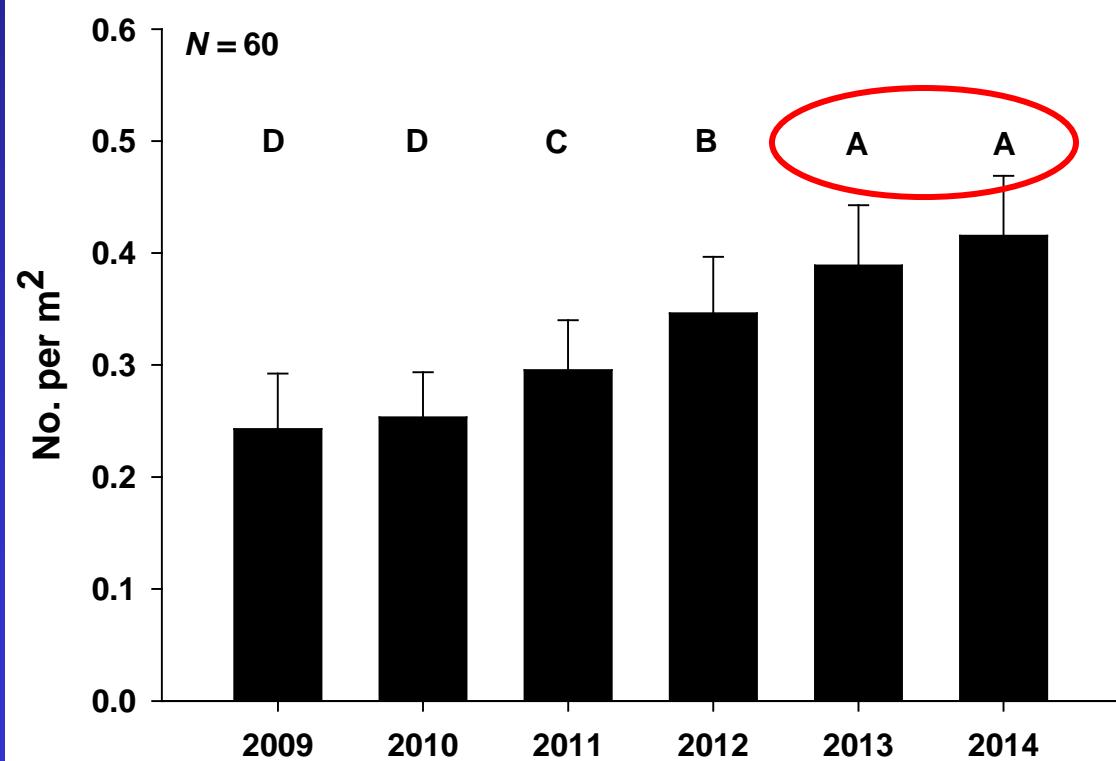


# Keys-Wide *X. Muta* Density

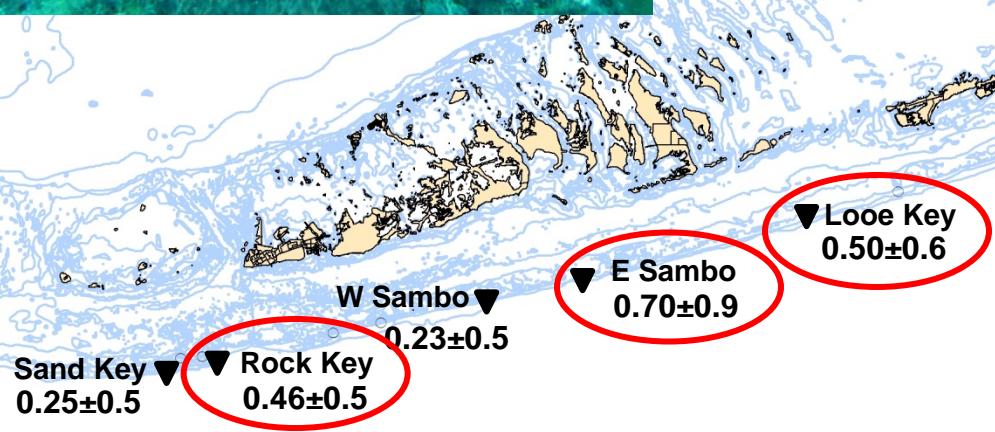
Source of Variation	DF	Sum of Squares	Mean Square	F	P
Site	9	<b>102.949</b>	<b>11.439</b>	<b>6.454</b>	<b>&lt;0.001</b>
Transect	50	<b>88.612</b>	<b>1.722</b>		
Year	5	<b>27.758</b>	<b>5.552</b>	<b>91.419</b>	<b>&lt;0.001</b>
Site x Year	45	<b>7.823</b>	<b>0.174</b>	<b>2.863</b>	<b>&lt;0.001</b>
Residual	250	<b>15.182</b>	<b>0.0607</b>		
Total	<b>359</b>	<b>242.323</b>	<b>0.675</b>		



1. Density in 2013 and 2014 higher than other years
2. Interaction effect because density not increasing at all sites
3. N = ~650 colonies



# Site Density – No. of *X. muta* m<sup>-2</sup> ± SE in 2014

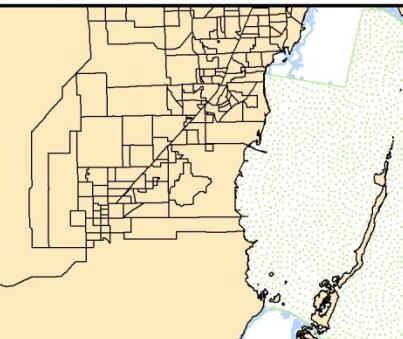


81°0'0"W

82°0'0"W

0 2.75 5.5 11 16.5 22

Nautical Miles



25°0'0"N

# Growth

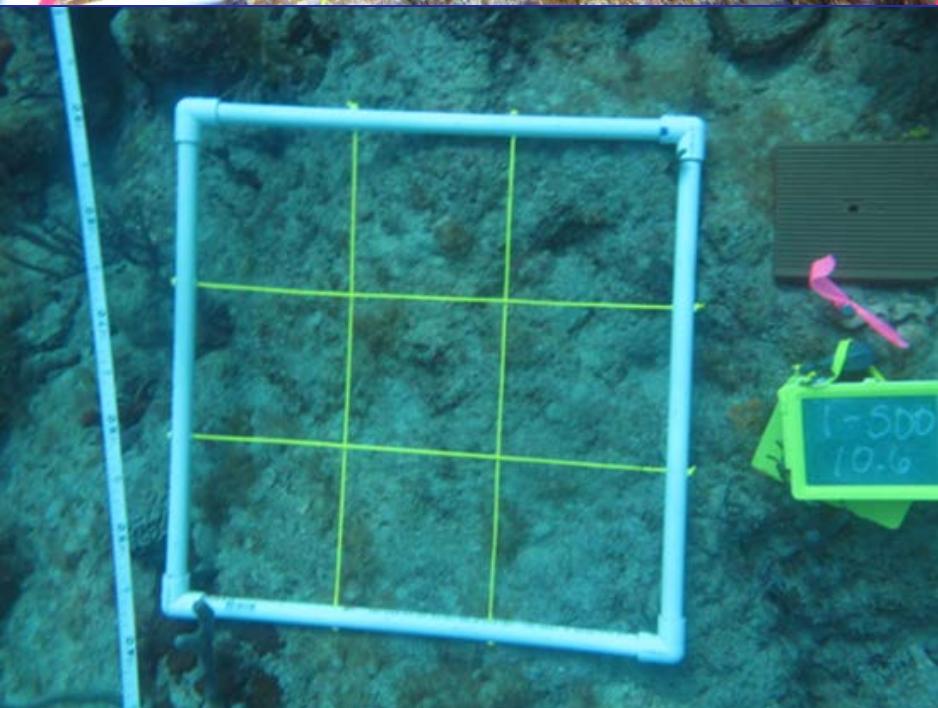
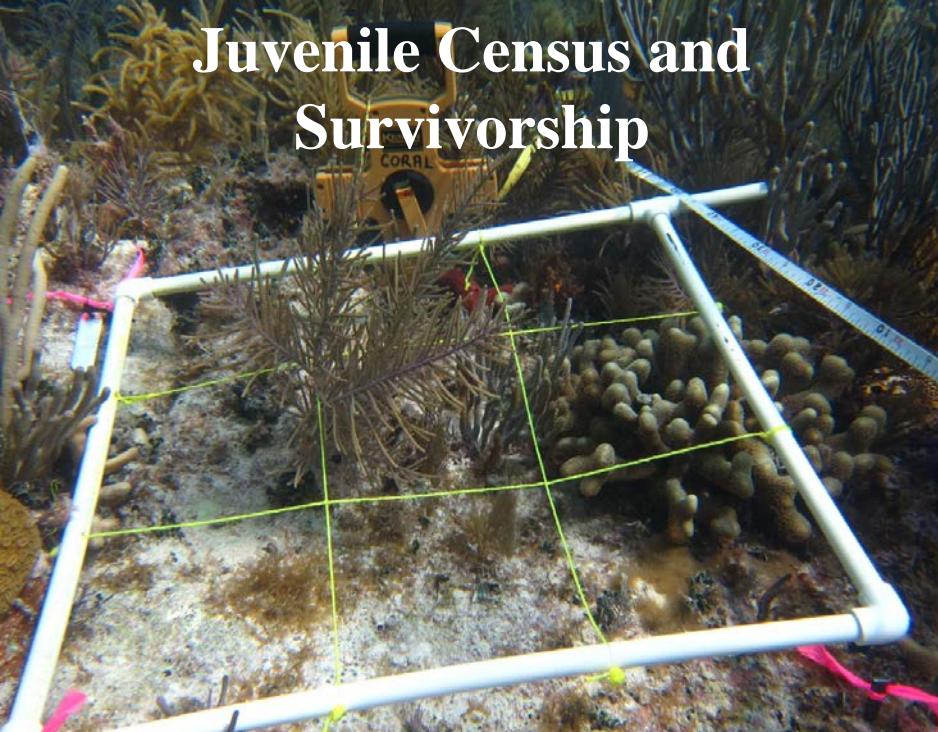
Size Class	2009	2014
I	6	1
II	31	7
III	78	19
IV	64	75
V	60	74
VI	50	112



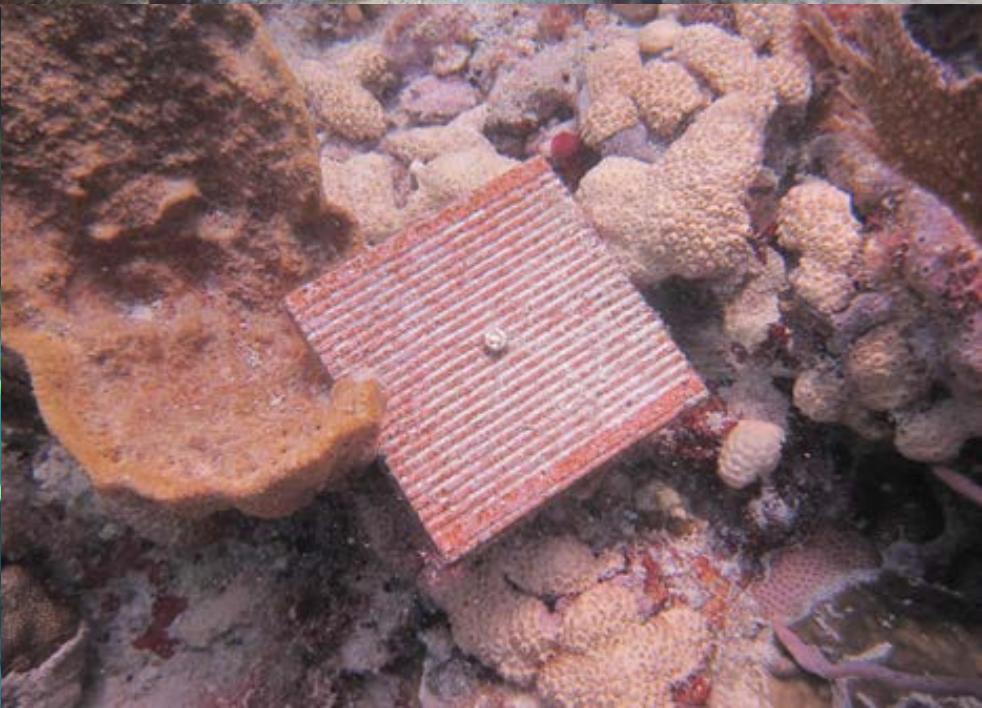
Change in Size Class	No. of Colonies
0	98
1	152
2	39

*N* = 289

## Juvenile Census and Survivorship



## Settlement on tiles



# CRCP Coral Recruitment Study

- Three Year Study
  - First tile deployment in 2015
  - Focuses on both stony and octocorals
- Goals:
  - Create an annual index of recruitment success across a broad spatial scale
  - Identify recruitment hotspots in FL
  - Determine if early life history processes are limiting recovery (e.g., larval settlement, juvenile survivorship)





# Summary

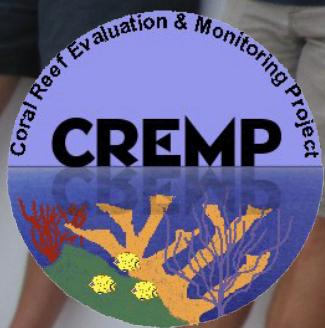
1. Keys reefs are changing
  - Extreme fluctuations in conditions
2. Shifts in abundance of corals, octocorals, and sponges.
  - Not all bad news
3. Continue to bolster local management in face of global climate change
  - Herbivorous fish protection
  - Improve water quality
  - Spatial planning

Status and Trends  
of Caribbean Coral Reefs:  
1970-2012

# Bonaire

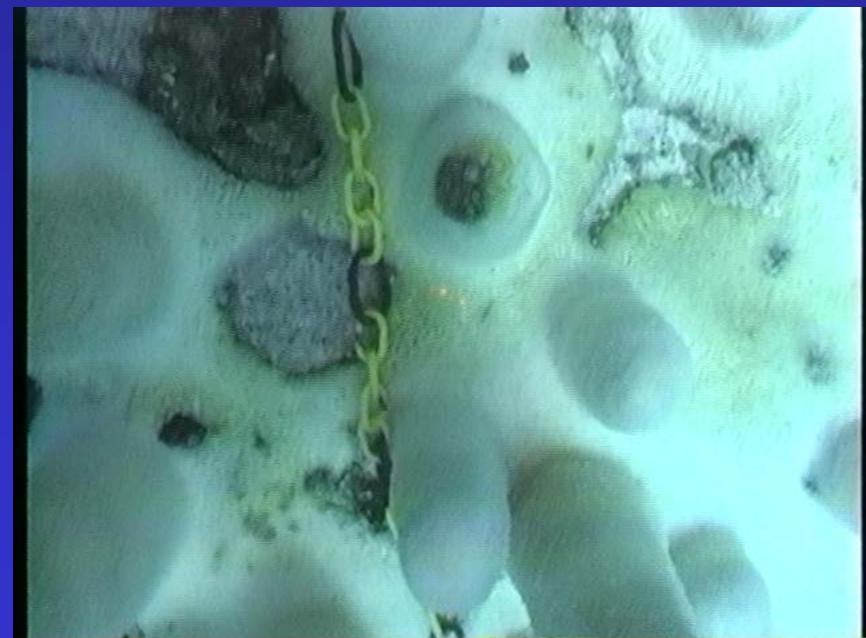
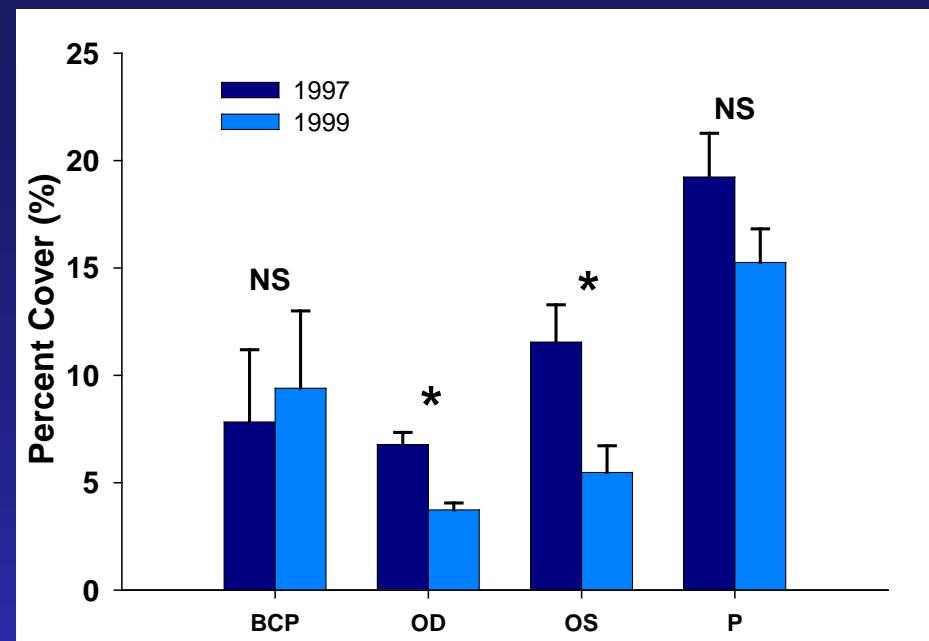


**CREMP Publications and Reports available at**  
**<http://research.myfwc.com/>**

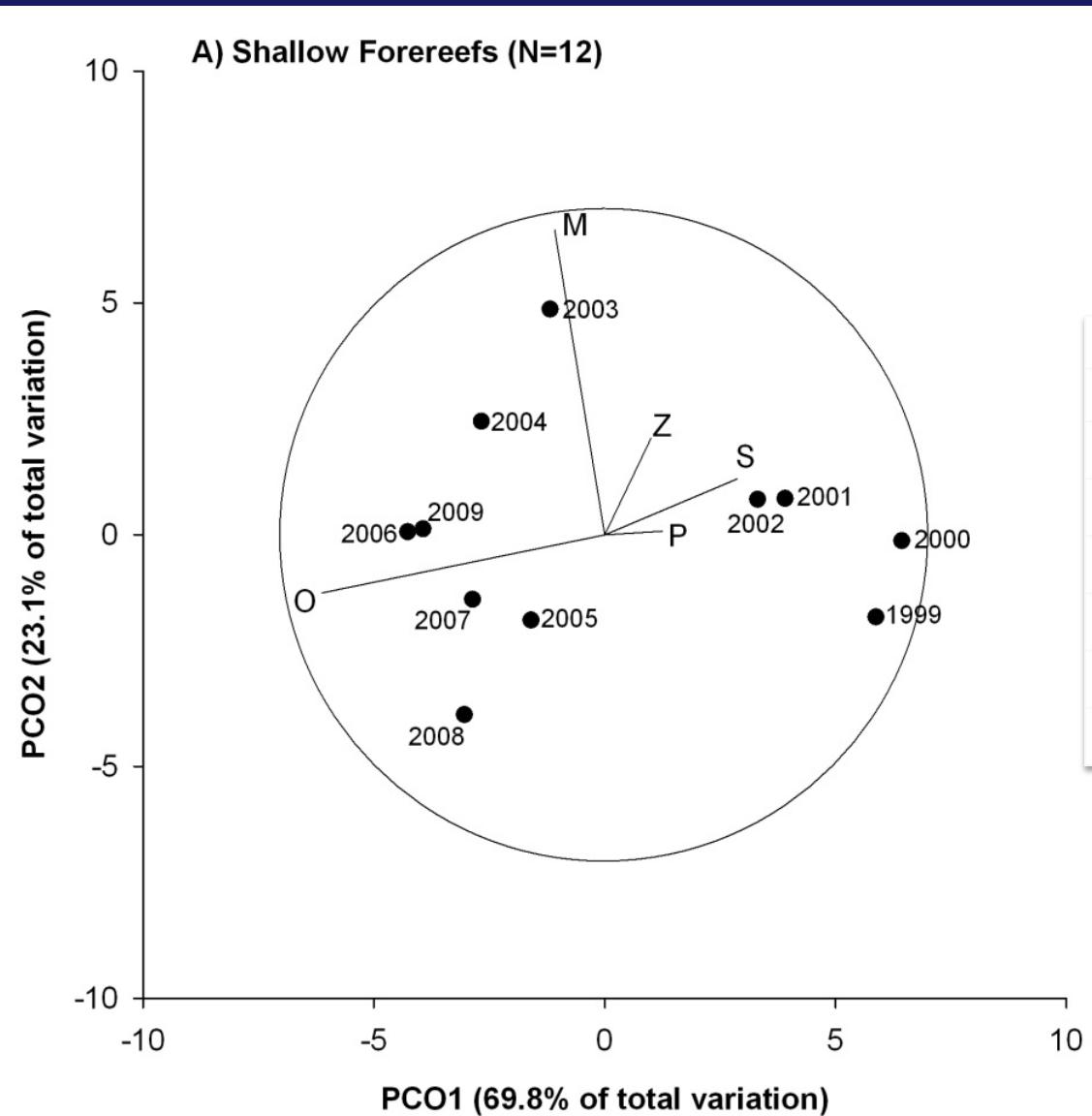




# Mass Bleaching Event – 1997/1998 El Niño



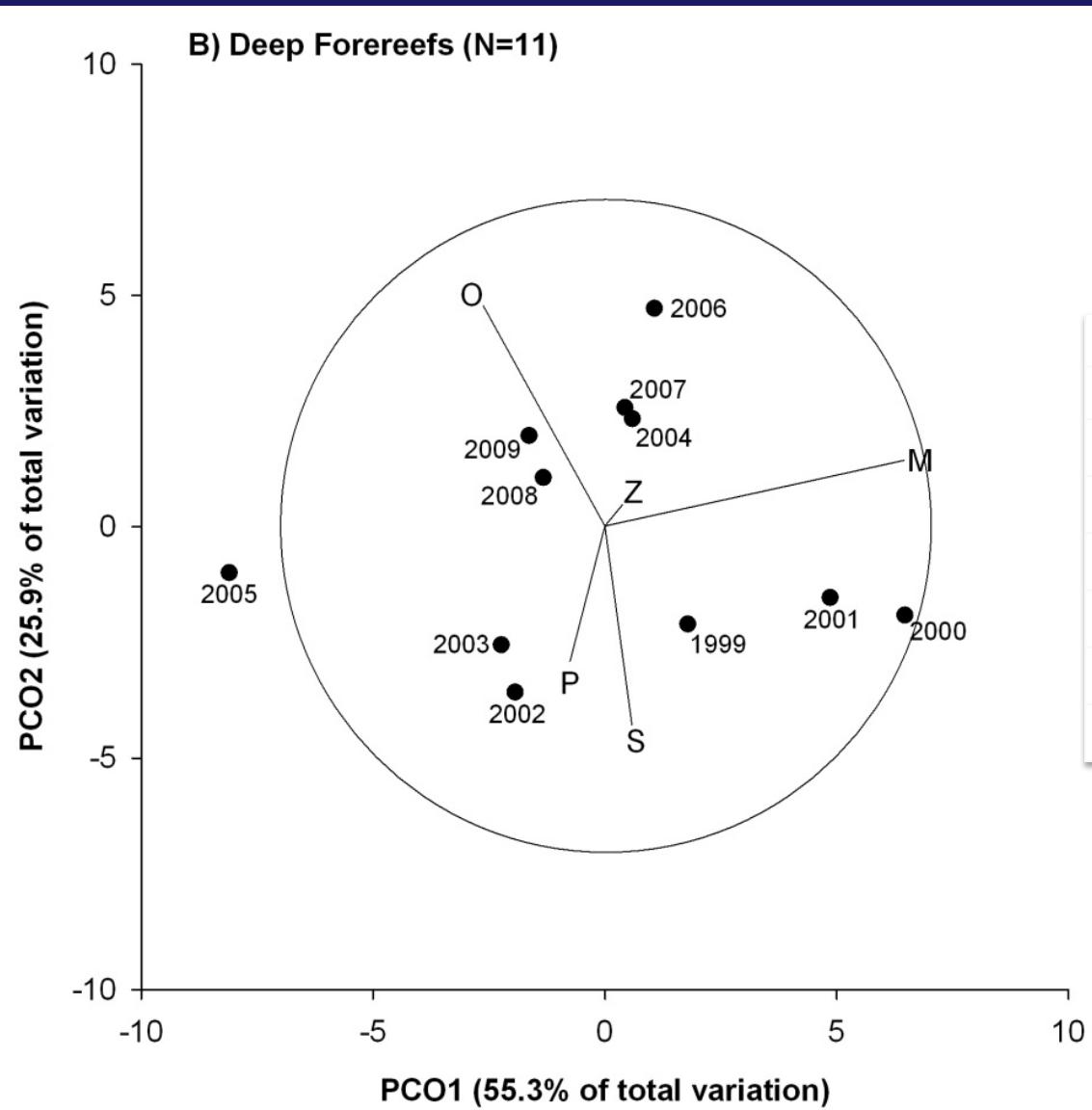
# Change in Community Structure 1999 – 2009



Shallow Forereefs		
Variable	Axis 1	Axis 2
Macroalgae	-0.2980	<b>0.9086</b>
<b>Octocoral</b>	<b>-0.8513</b>	-0.1905
Sponge	0.1908	0.0250
<b>Stony Coral</b>	<b>0.3625</b>	0.1943
Zoanthid	0.1263	0.2787
Variance Explained	69.8%	23.1%

- Ruzicka et al. *MEPS* 2013 (in review)

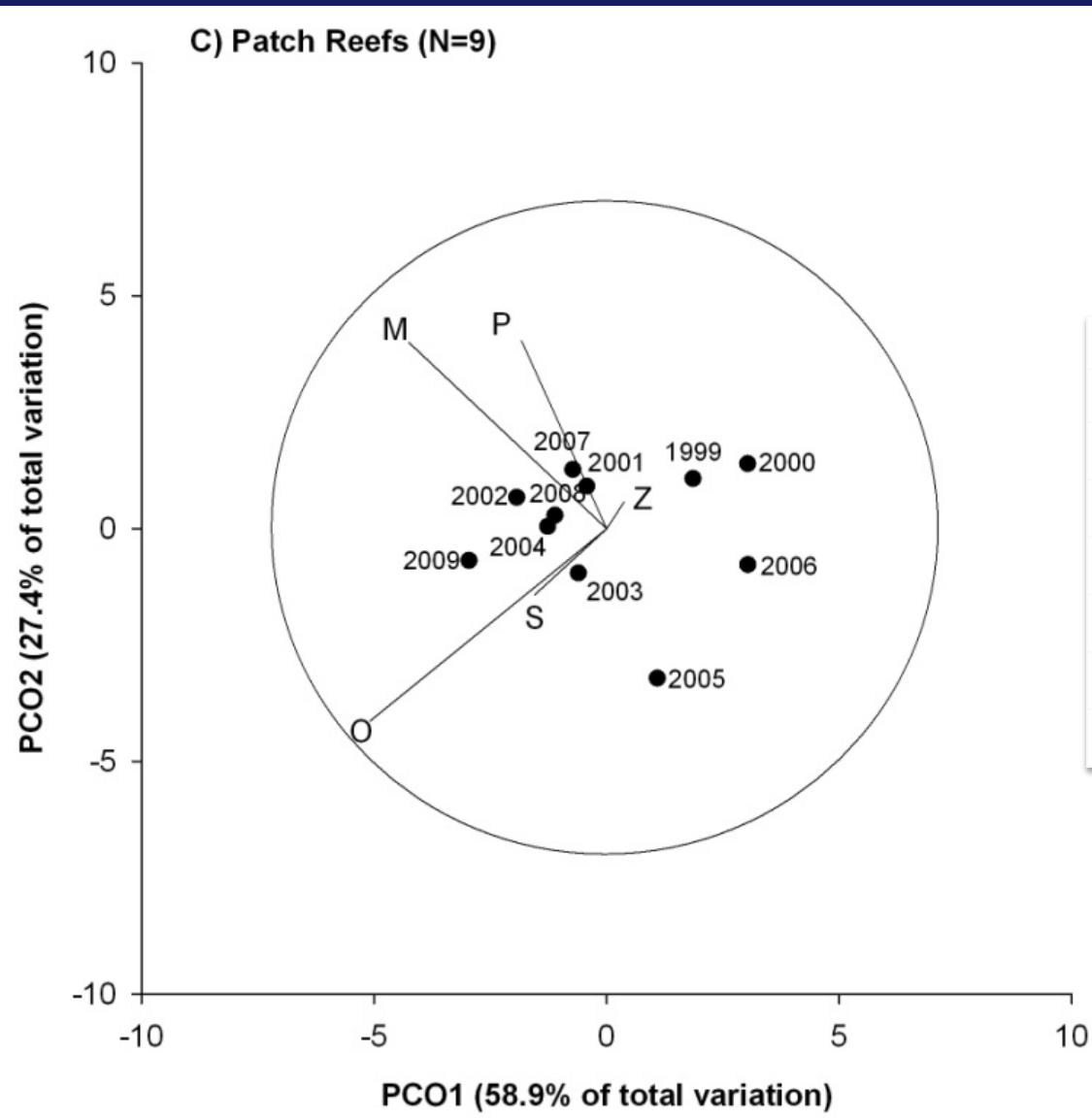
# Change in Community Structure 1999 – 2009



Deep Forereefs		
Variable	Axis 1	Axis 2
<b>Macroalgae</b>	<b>0.8867</b>	0.2402
<b>Octocoral</b>	-0.4234	<b>0.5672</b>
Sponge	-0.0891	-0.4085
<b>Stony Coral</b>	0.0497	<b>-0.6490</b>
Zoanthid	0.0377	0.0308
Variance Explained	55.3%	25.9%

- Ruzicka et al. *MEPS* 2013 (in review)

# Change in Community Structure 1999 – 2009

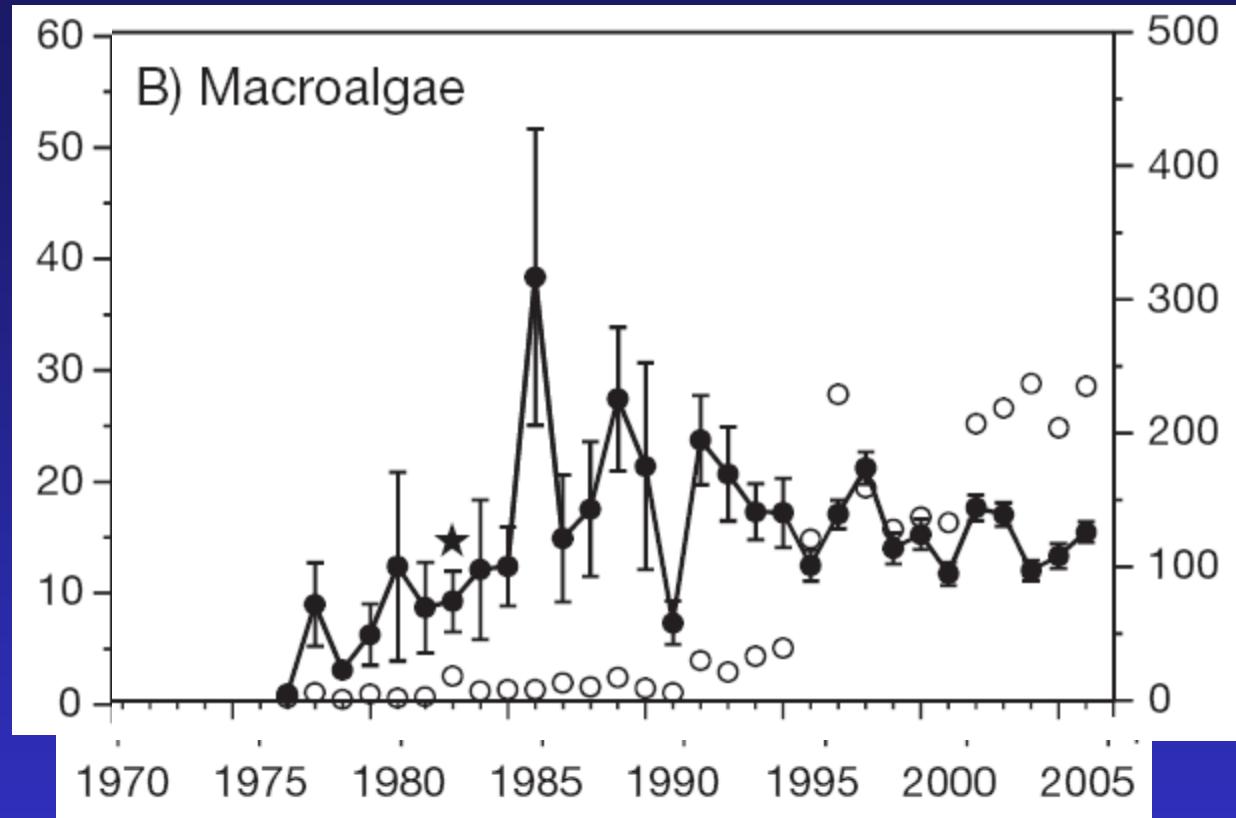


Deep Forereefs		
Variable	Axis 1	Axis 2
Macroalgae	-0.6972	0.4906
Octocoral	-0.6387	-0.6693
Sponge	-0.2555	0.5091
Stony Coral	-0.1737	-0.1961
Zoanthid	0.0523	0.0796
Variance Explained	58.9%	27.4%

- Ruzicka et al. *MEPS* 2013 (in review)

# The Future: Long Term Trends in Macroalgae Cover

- Consistent with findings across wider Caribbean
- Keys reefs have not undergone phase-shift to macroalgae dominated reefs
- Observed short term spikes (e.g. after 1997 thermal stress event)
- Appears Keys' reefs may have appropriate top down controls to regulate macroalgae cover
- Mean macroalgae cover in the Keys slightly less than on Caribbean reefs



From Schutte et al. 2010, MEPS, Vol. 402