

A Decade of SEAKEYs DATA: SST Trends and Patterns

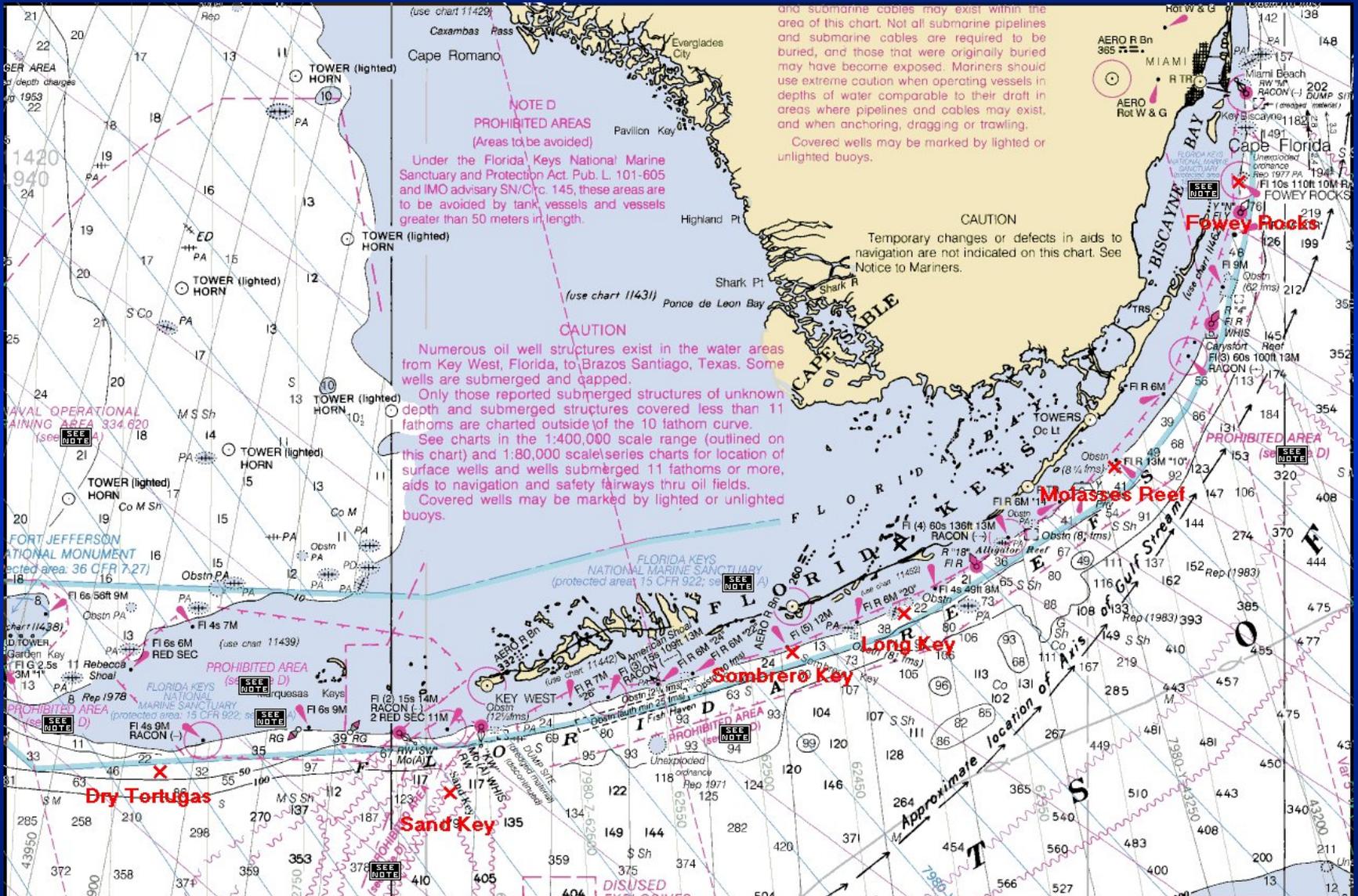
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Location of 6 SEAKEYS Stations



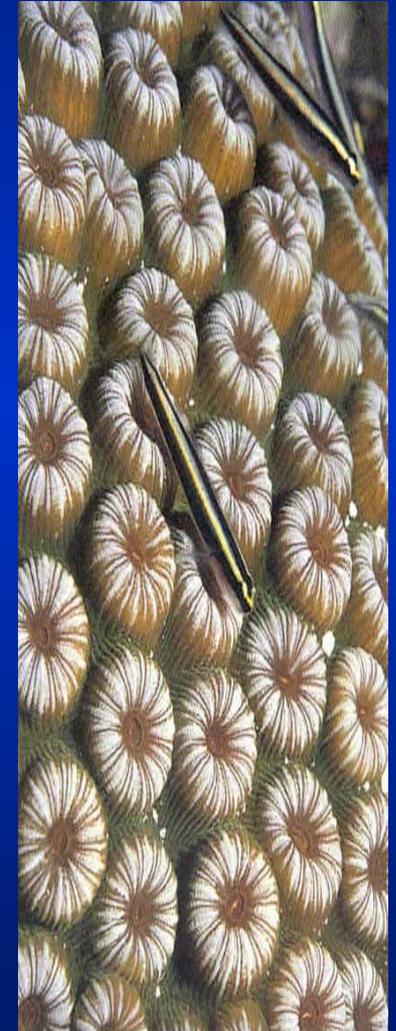
Capabilities of SEAKEYS

- ***In Situ* hourly measurement of multiple parameters**

- Air Temperature
- Dew Point
- Wind Direction, Max Wind Speed, Wind Gust, Wind Speed
- Barometric Pressure
- Sea Surface Temperature (SST)
- Tidal Amplitude
- PAR, UVR
- Transmissometry, Fluorometry
- Conductivity, Salinity, Voltage

- ***Problems***

- Keeping instruments “ground truthed” and properly calibrated
- Biofouling



**Have Sea Surface Temperatures
in the Florida Keys shown any
trends in the past decade?**

**H_0 : Monthly mean SSTs in
the Florida Keys have
remained constant over
the past decade (1992 –
2002)**



Locale	Thermal threshold
Jamaica	29.2
Phuket	30.2
Tahiti	29.2
Raratonga	28.3
Northern GBR	28.3
Central GBR	29.2
Southern GBR	30.0

Estimated temperatures (° C) at which corals bleach (thermal threshold). Thermal thresholds were calculated by comparing bleaching events since 1979 with weekly SST records obtained from IGOSS-nmc blended data from the Lamont Doherty Climate Center at Columbia University. (Source: Hoegh-Guldberg 1999)

Sustained SSTs of 31 ° C for one month will result in significant coral bleaching and mortality (Goreau and Hayes 1994)

Methodology



- Data “clean up”
- Analyze monthly mean SSTs for 6 SEAKEYS stations for past 10 years
- Specific interest in late summer (i.e., August)

Why?

“Bleaching Season”

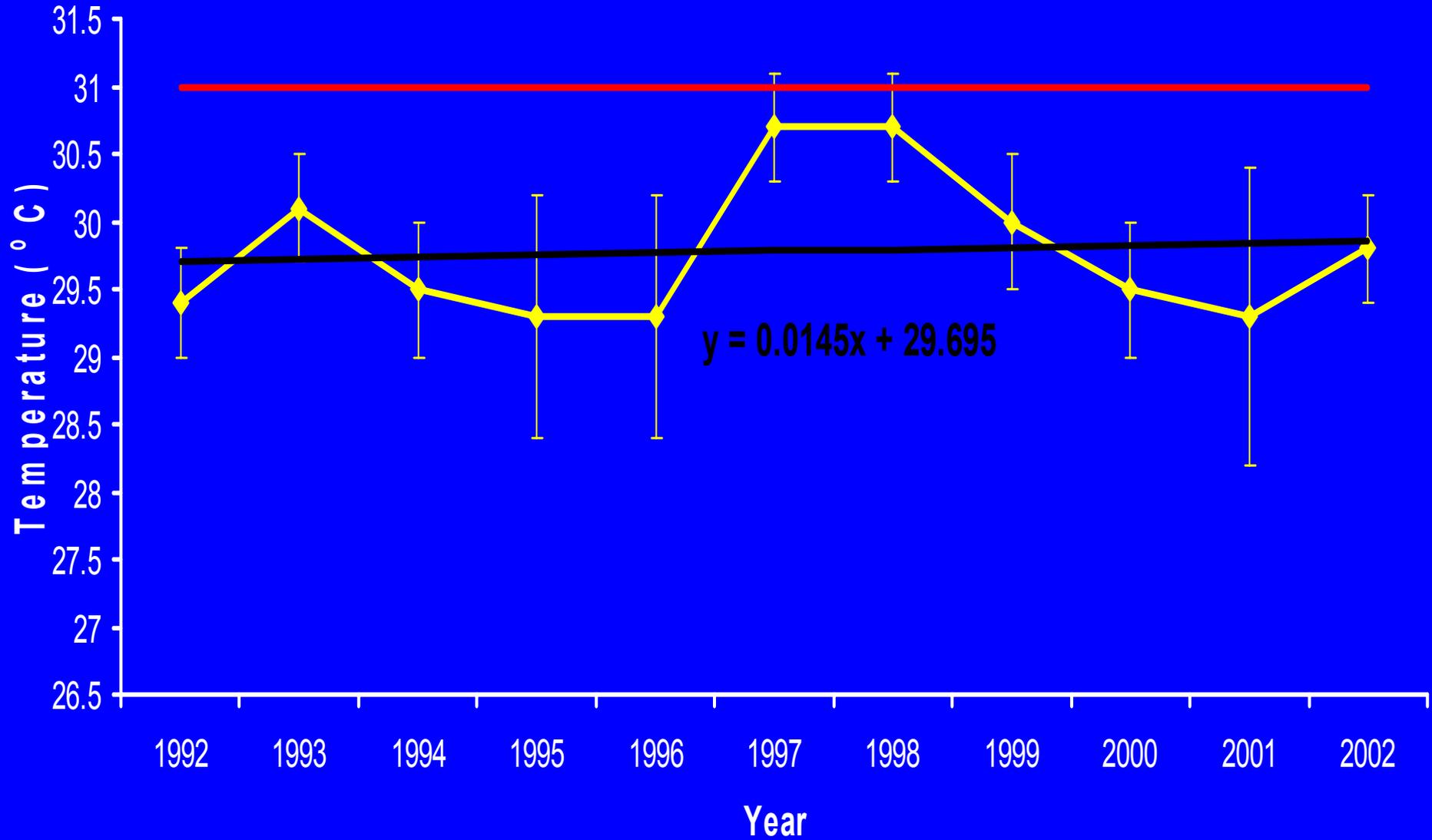


H_0 : Monthly mean SSTs have remained constant in August for the Florida Reef Tract over the past decade

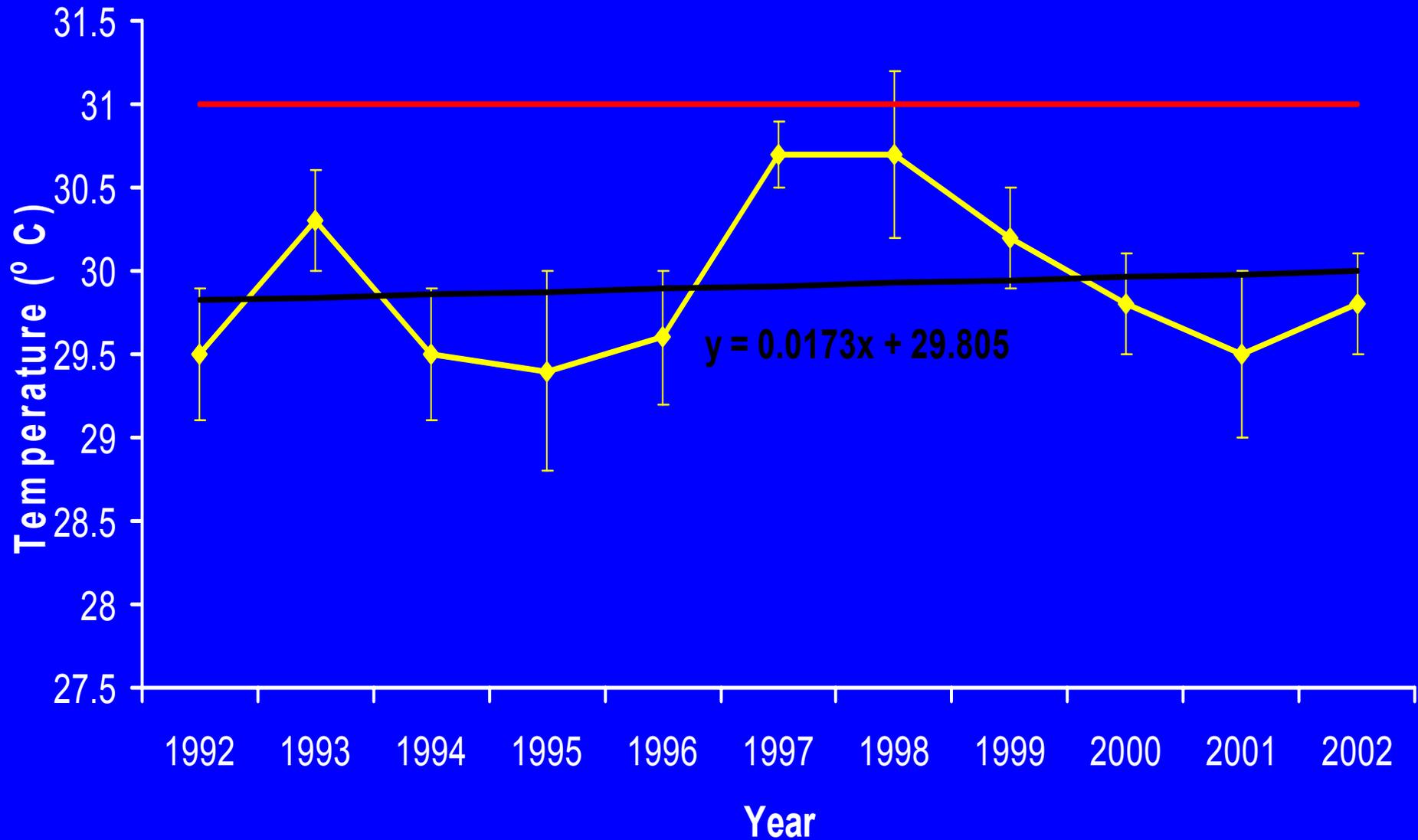
Are corals in the Florida Keys *already* experiencing significant thermal stress?



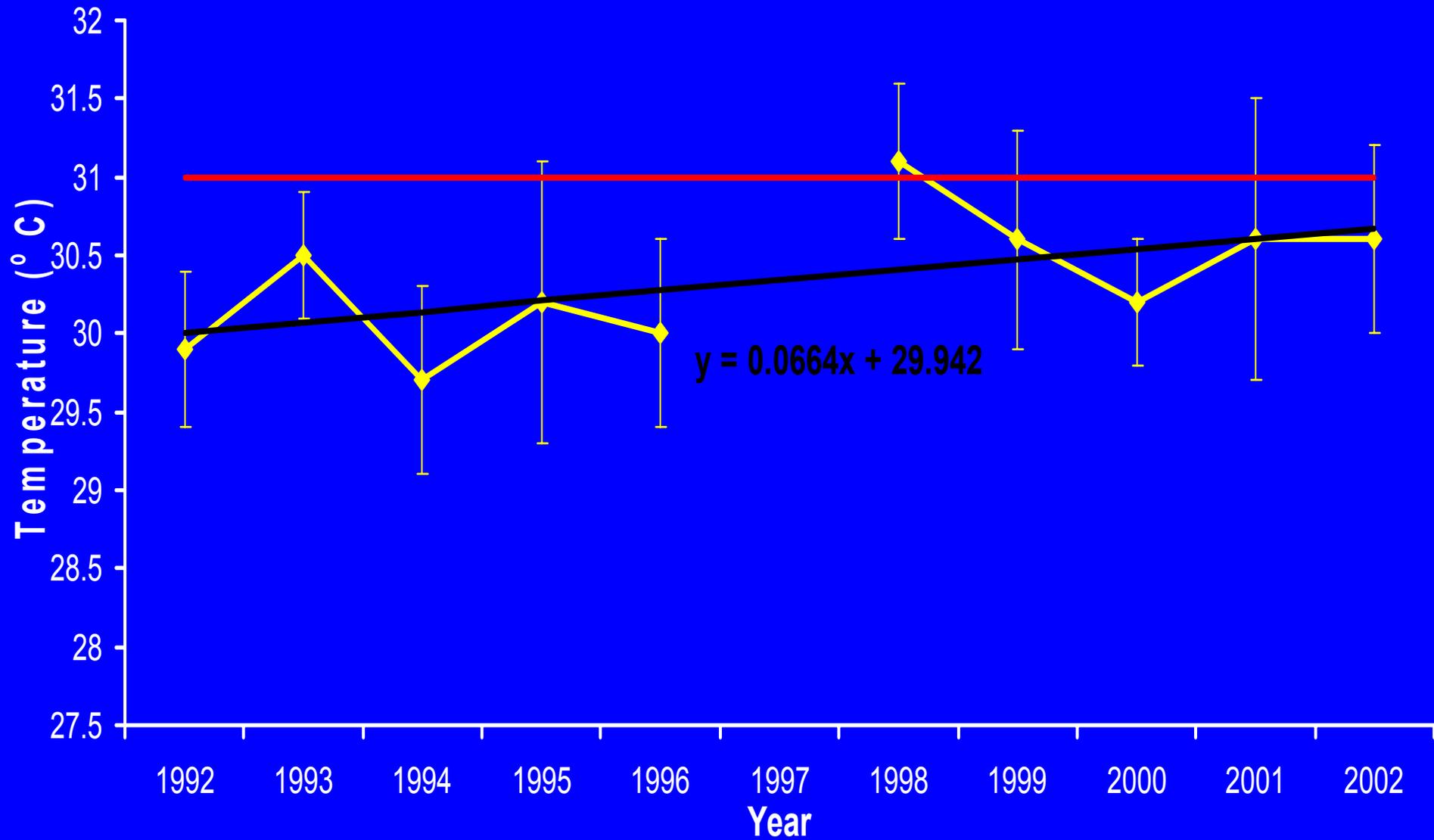
Mean SST for August at Fowey Rocks (1992 - 2002)



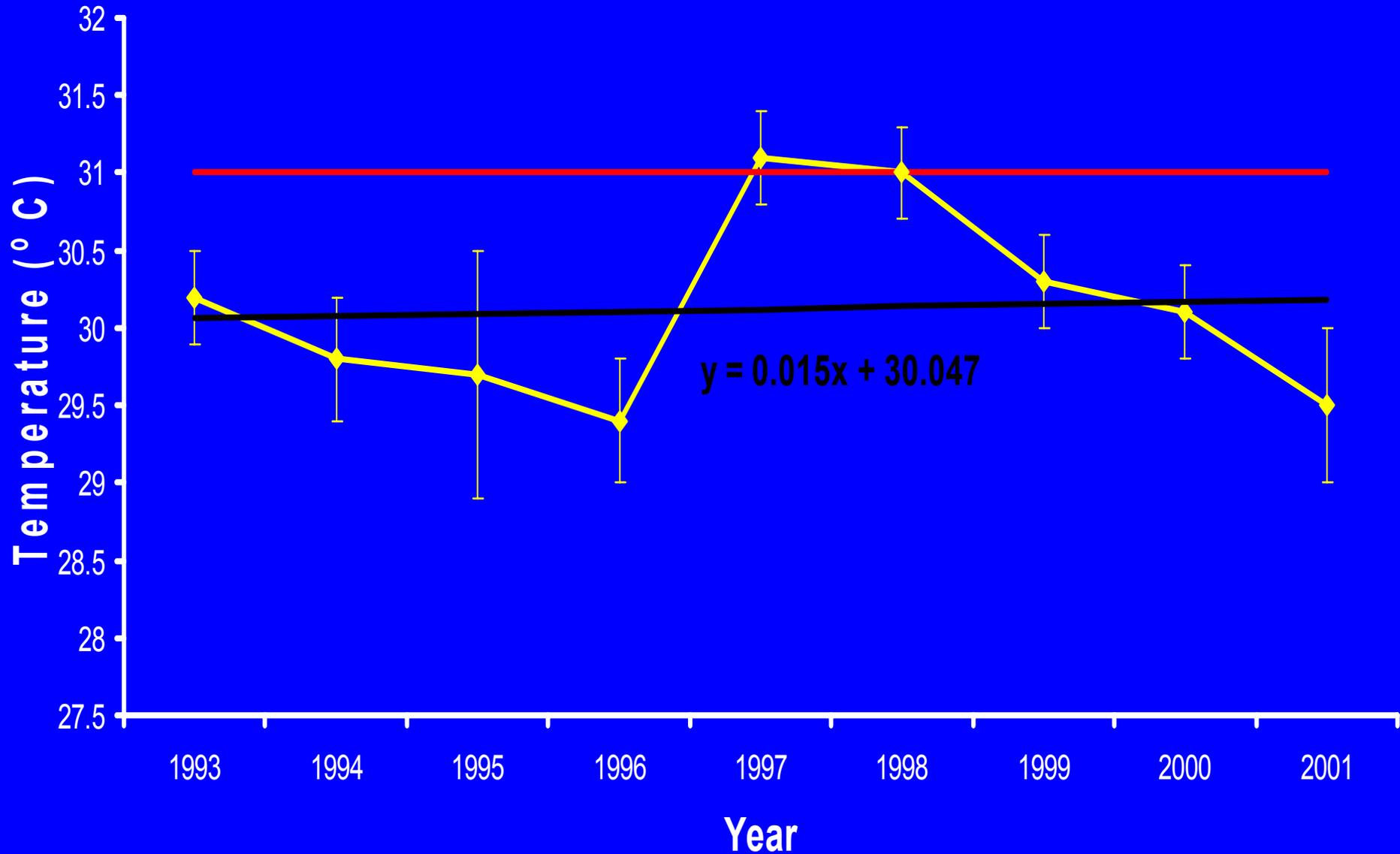
Mean SST for August at Molasses Reef (1992 - 2002)



Mean SST for August at Sombrero Key (1992 - 2002)



Mean SST for August at Dry Tortugas (1993 - 2001)



Station	Line of Regression	Mean SST (° C) for August (1992 – 2002)	Predicted Year Mean August SST will annually be 31 ° C
Fowey Rocks	$Y=0.0145x + 29.695$	29.8	2063
Molasses Reef	$Y=0.0173x + 29.805$	29.9	2061
Long Key	$Y= -0.0036x + 30.64$	30.6	ns
Sombrero Key	$Y=0.664x + 29.942$	30.3	2008
Sand Key	$Y=0.0027x + 29.984$	30.0	ns
Dry Tortugas	$Y=0.015x + 30.047$	30.1	2057

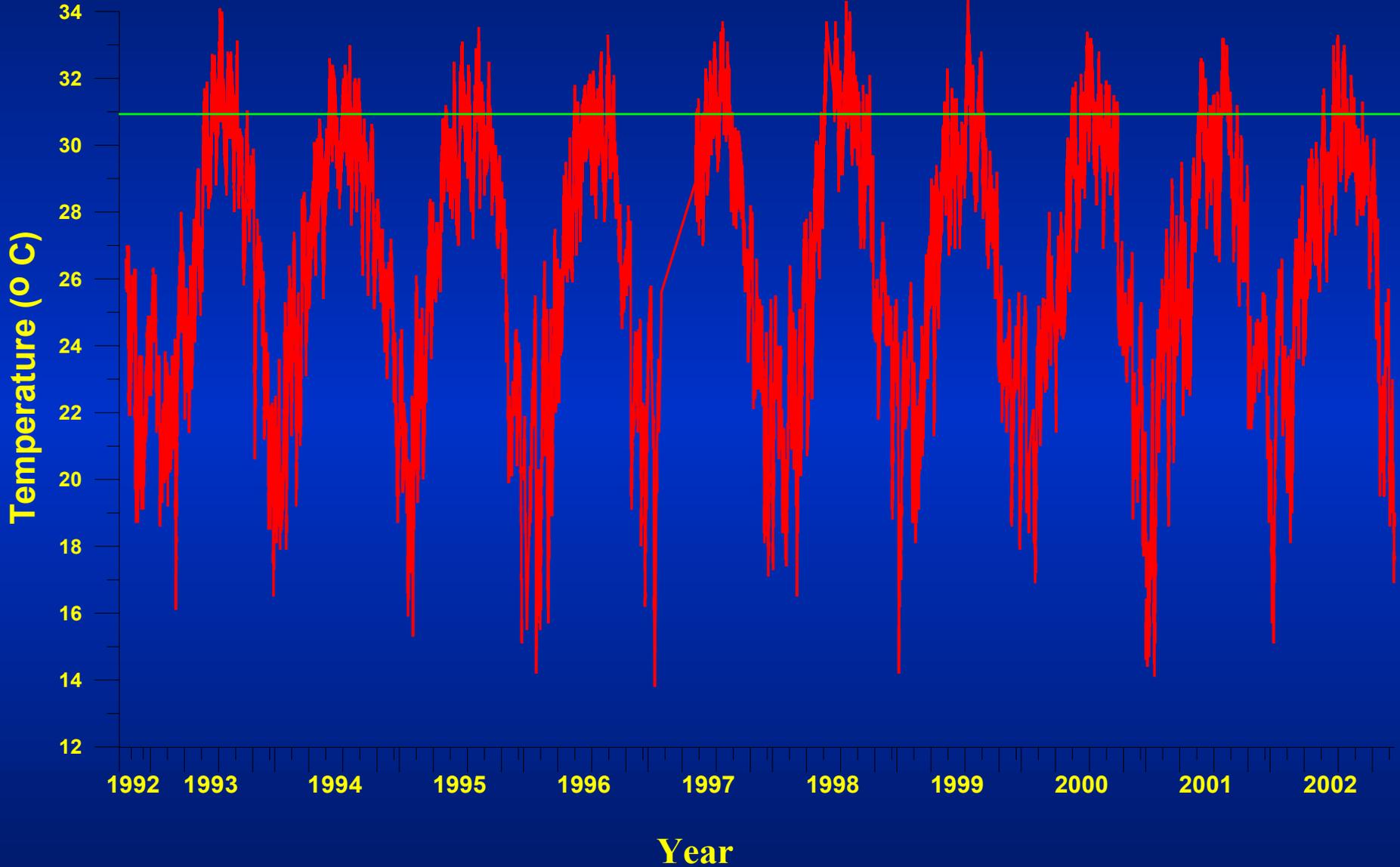
Long Key

Sombrero Key

Year	July	August	July	August
1992	-	-	-	29.9 (0.5)
1993	31.6 (1.0)	30.9 (0.9)	30.2 (0.7)	30.5 (0.4)
1994	30.2 (0.9)	30 (1.1)	29.4 (0.4)	29.7 (0.6)
1995	30.8 (1.1)	30.5 (1.5)	30.4 (0.5)	30.2 (0.9)
1996	30.3 (1.0)	30.1 (1.1)	29.9 (0.7)	30 (0.6)
1997	31.0 (0.8)	31.5 (0.9)	-	-
1998	31.1 (1.2)	31.6 (1.0)	30.7 (0.5)	31.1 (0.5)
1999	30.3 (1.7)	30.5 (1.2)	29.8 (1.0)	30.6 (0.7)
2000	31.4 (1.1)	30 (1.2)	31.1 (1.0)	30.2 (0.4)
2001	29.7 (1.0)	30.6 (1.8)	29.8 (1.2)	30.6 (0.9)
2002	30.4 (1.3)	30.5 (1.0)	30.8 (1.0)	30.6 (0.9)

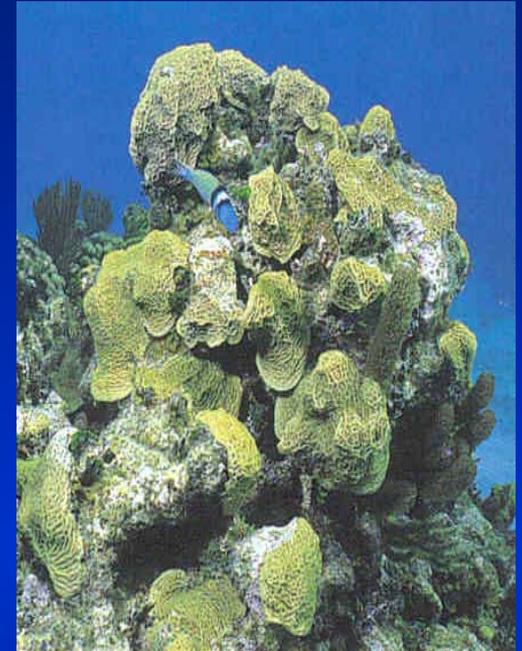
Monthly Mean (+/- SEM) SSTs for July and August
at Long and Sombrero Key (1992 – 2002)

SST Readings from Long Key, FL 1992 - 2002



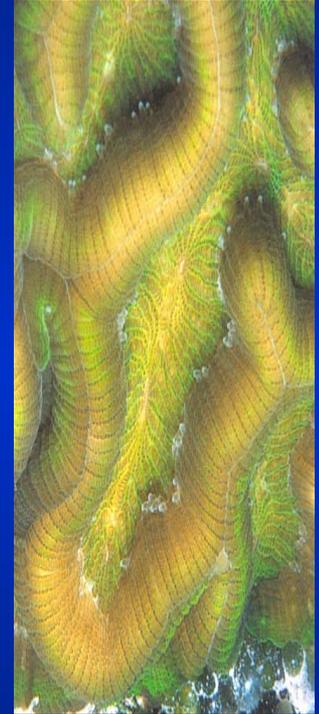
Conclusions

- 5 of 6 stations display a warming trend from 1992 – 2002
- Sombrero Key and Long Key are already experiencing thermal stress annually
- SSTs of the Florida Reef Tract appear to be increasing at a rate that concurs with previously reported predictions (Hoegh-Guldberg 1999)



Future Research Needs

- Continued long-term monitoring of SSTs in the Florida Keys *in situ*
- Comparison of *in situ* SST data with that obtained from satellites (i.e., AVHRR)
- Further analyses of factors thought to be associated with, or to act synergistically in, eliciting the bleaching response (i.e., UVR, PAR, Wind conditions, turbidity)
- Draw correlations between physical parameters with patterns, rates, and occurrences of coral disease



Research Directions

- Use of SEAKYs data stations *not only* for coral reef monitoring (i.e., red tide alerts)
- Have corals near Long Key and Sombrero Key evolutionarily adapted to extreme SSTs and variable water quality due to influence of Florida Bay waters?
- Many ecological questions related to physical parameters experienced by coral reefs
 - Change in coral community structure, dynamics, and zonation?



Acknowledgements

–Dr. James C. Hendee
(NOAA/AOML/OCD)

–Dr. Peter W. Glynn
(RSMAS/MBF)

–Clarke Jeffris (NOAA/AOML/OCD)

–Jeffrey Judas (NOAA/AOML/OCD)

