

# The Effects of Beach Nourishment on Sea Turtle Nesting Densities in Florida

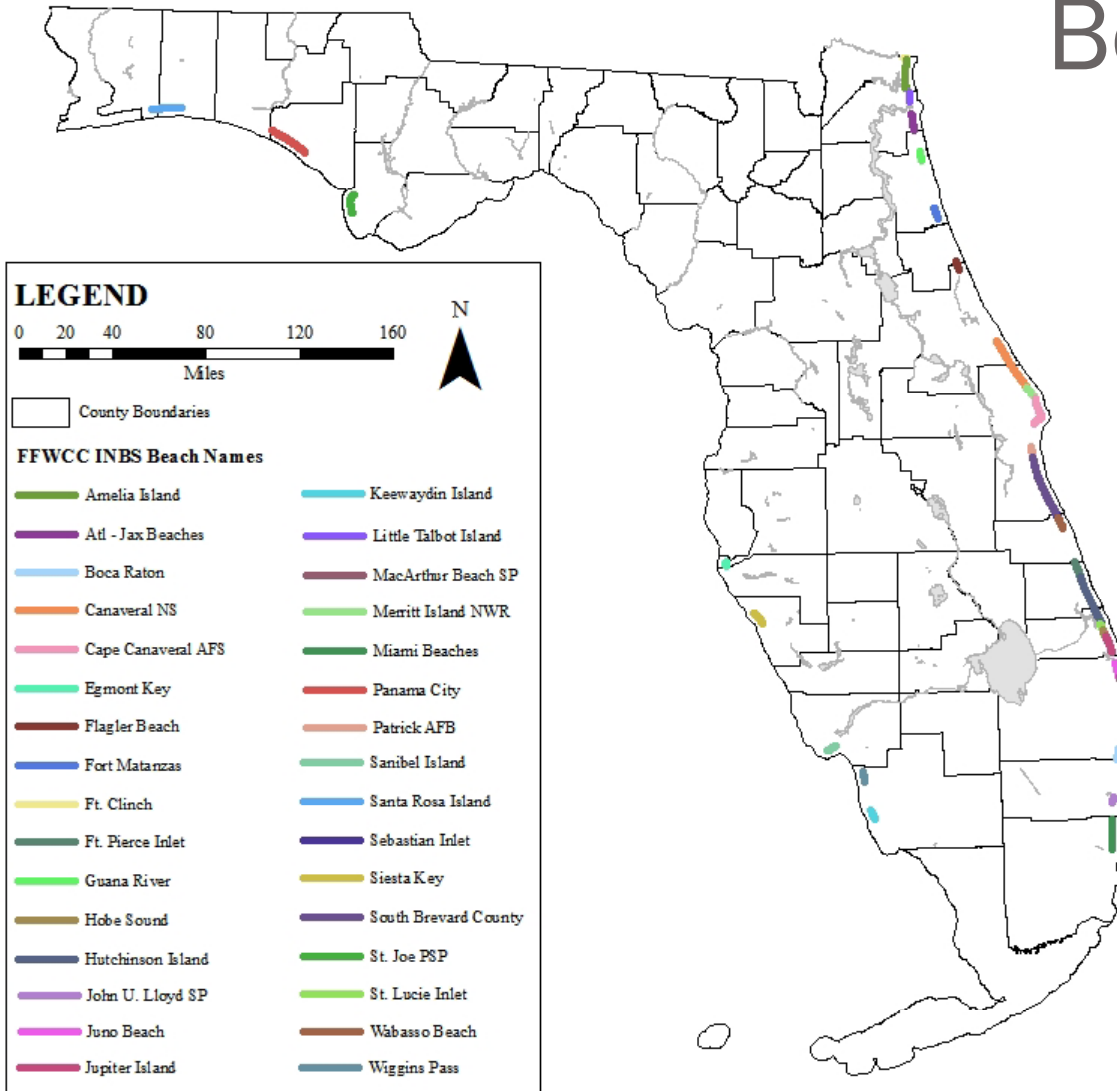
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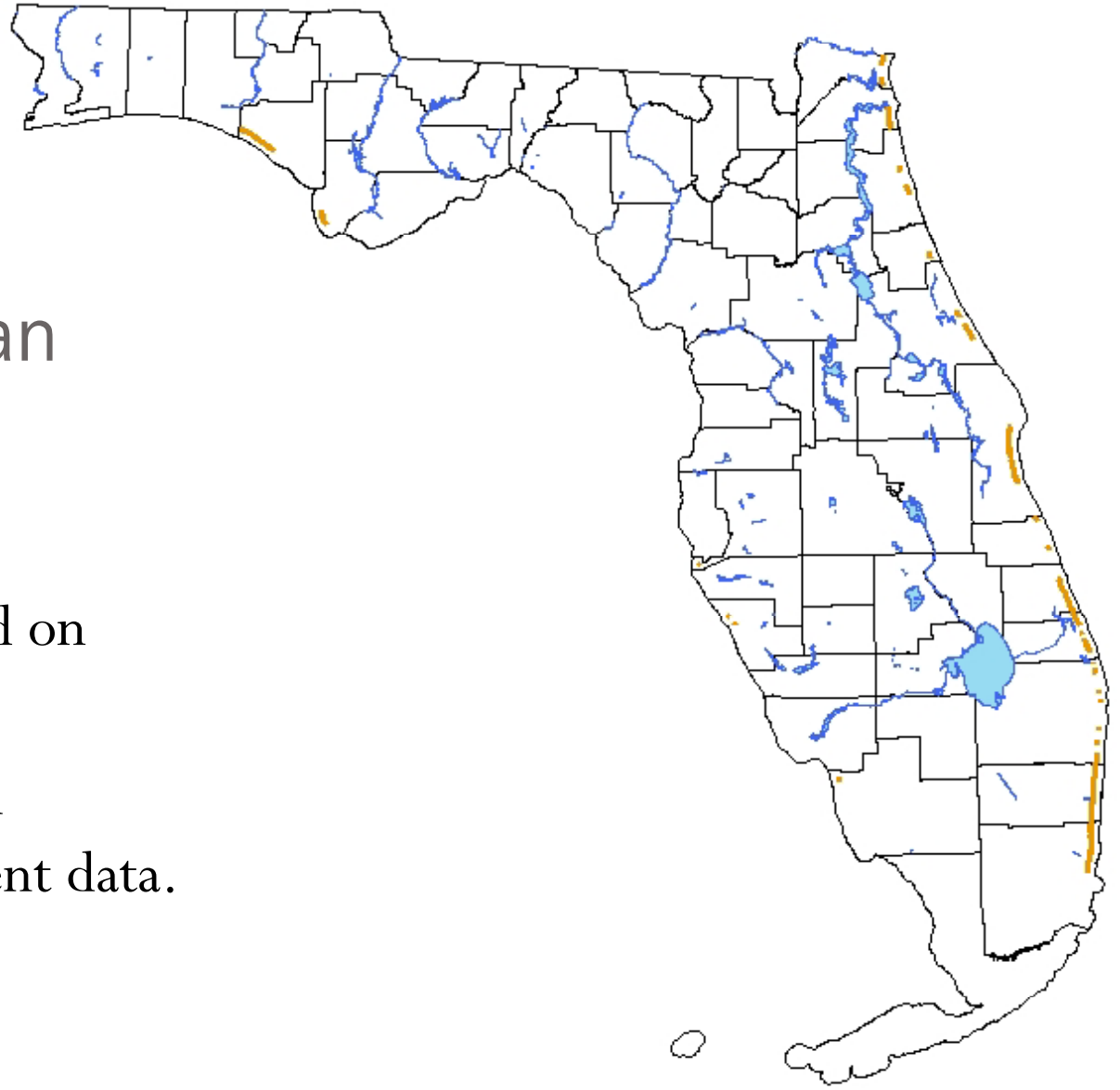
# FFWCC INBS Beaches



- 32 beaches in the INBS program.
- Initiated in 1989 as a subset of the broader SNBS program.
- Statistically viable data.

# FDEP Strategic Beach Management Plan (2008)

- Created shapefile based on reference monuments.
- Removed beaches with overlapping nourishment data.

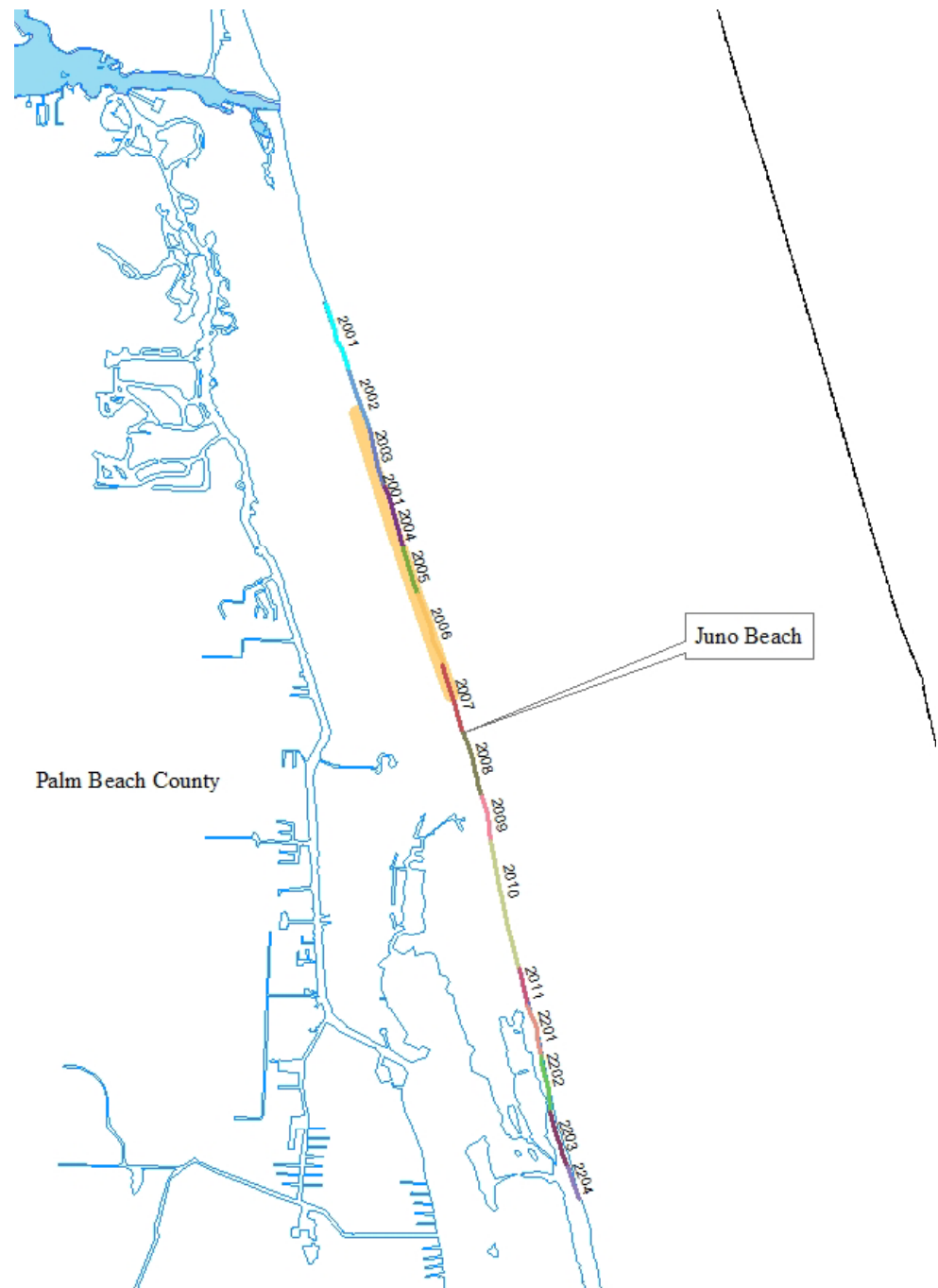


# Locations of 10 Study Beaches



# INBS Survey Zones

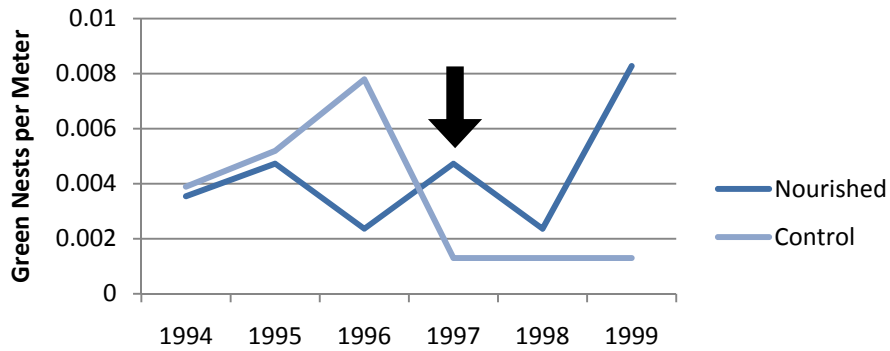
- Overlaid beach nourishment data with IBNS survey zone data.
- Removed zones split by nourishment activities.



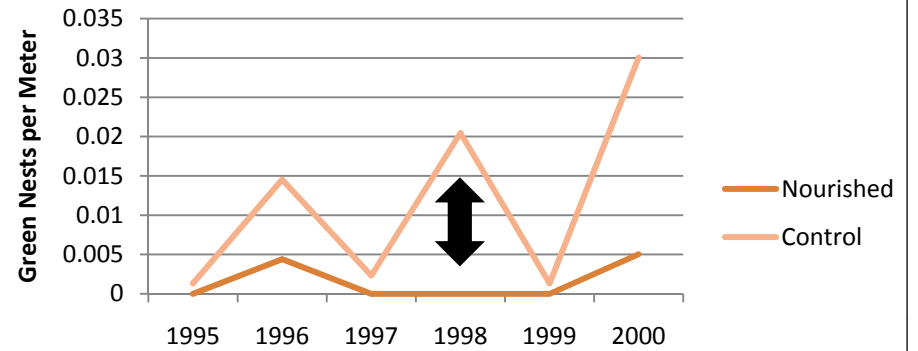
# Statistical Analysis

- Obtained data for three years prior and three years following nourishment event from FFWCC.
- Calculated lengths of each nourished and control beach and divided by loggerhead nests to determine nesting densities for each survey zone.
- Graphed data to visually interpret trends prior to statistical analysis.
  - Useful for nourishment events that had small sample sizes.

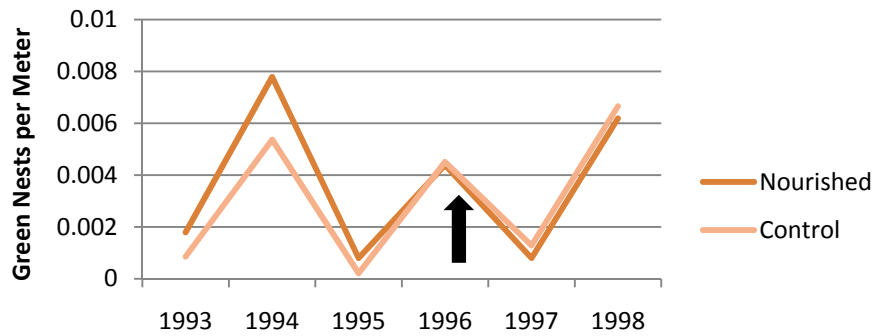
# Green Nesting Densities



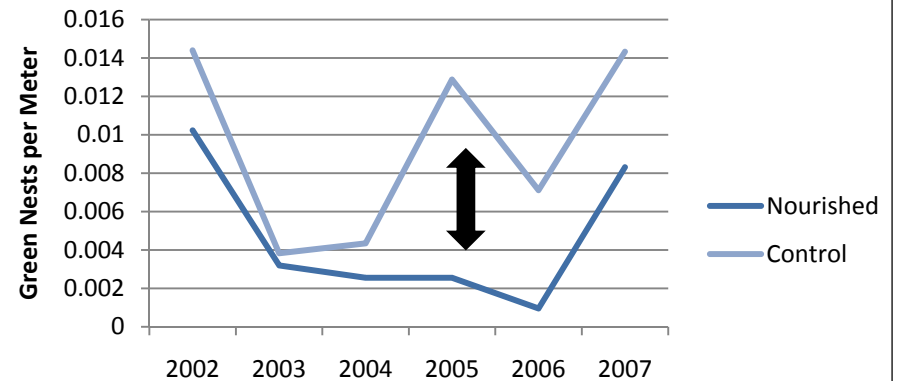
Boca Raton, 1997 Nourishment Event



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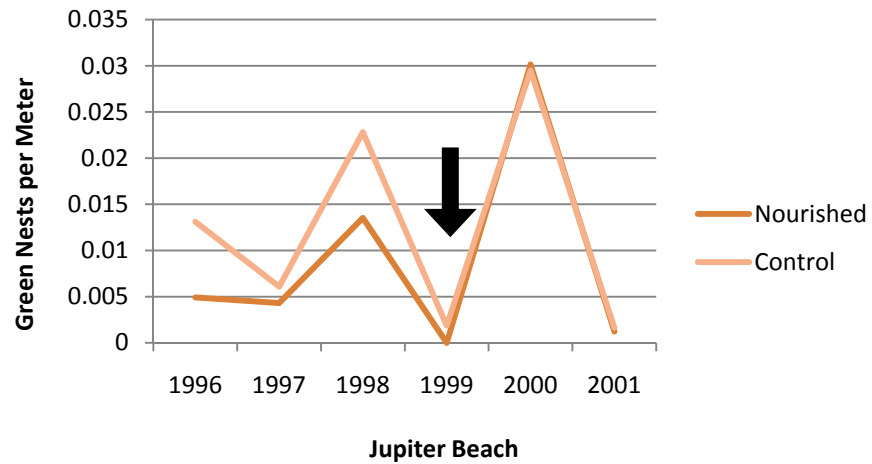
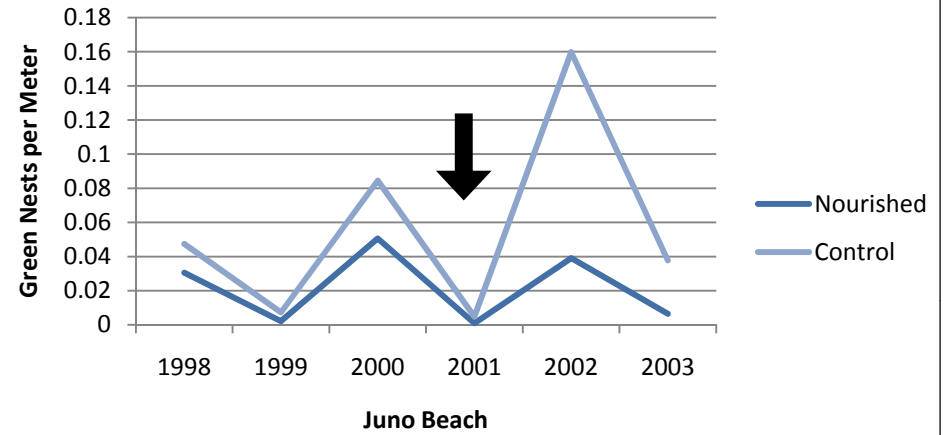
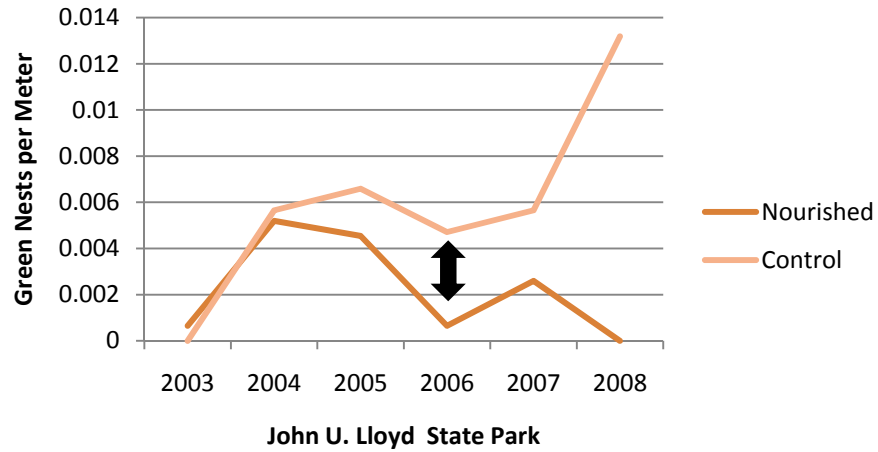


Hutchinson Island, 1996 Nourishment Event

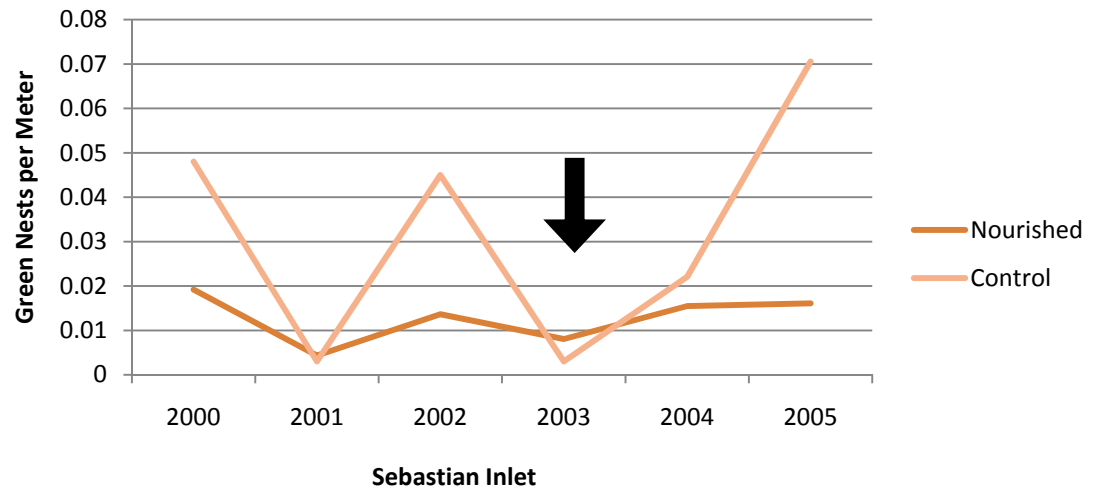
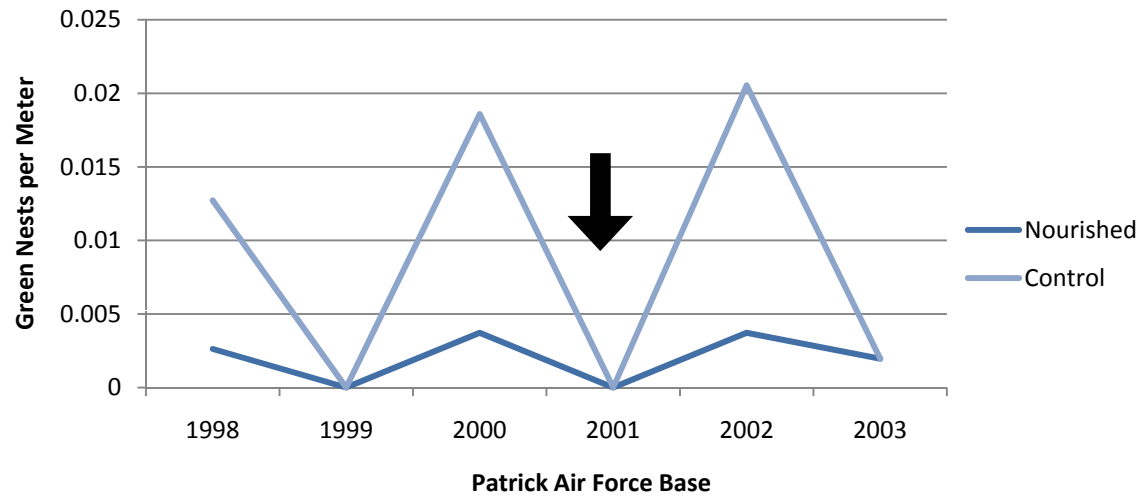


Hutchinson Island, 2005 Nourishment Event

# Green Nesting Densities



# Green Nesting Densities



# Statistical Analysis

- Graphed differences of nesting densities to identify normality of the data.
- Varying degrees of normality of data; conducted both paired t-test and Wilcoxon Signed Ranks test.
- Paired t-test is more robust with respect to deviations from normality.

# Summary of Statistical Results (Loggerheads)

Beach name	Year of nourishme nt event	Pre-N1	Pre-N2	Pre-N3	Pre-N1	Pre-N2	Pre-N3	Pre-N1	Pre-N2	Pre-N3	Pre-C1	Pre-C2	Pre-C3	Pre-C1	Pre-C2	Pre-C3	Pre-C1	Pre-C2	Pre-C3
		- Post- N1	- Post- N1	- Post- N1	- Post- N2	- Post- N2	- Post- N2	- Post- N3	- Post- N3	- Post- N3	- Post- C1	- Post- C1	- Post- C1	- Post- C2	- Post- C2	- Post- C2	- Post- C3	- Post- C3	- Post- C3
Atlantic- Jacksonville Beach	1995	76.2	52.4	-27.6	65.5	65.5	0.0	76.2	52.4	-27.6	0.0	50.0	0.0	0.0	50.0	0.0	-75.0	-50.0	-75.0
Boca Raton	1997	-42.5	-43.8	-29.6	7.3	7.3	26.0	18.7	16.8	33.6	-11.5	-46.5	-45.2	-25.6	-55.0	-54.0	12.4	-31.0	-29.4
Boca Raton	1998	-81.1	-83.1	-66.2	-31.1	-27.7	30.8	-38.6	-45.3	8.6	-7.6	7.6	48.8	-26.4	-13.9	35.6	-28.2	-15.9	34.0
Hutchinson Island	1996	1.5	-1.9	-19.4	-18.1	-17.5	-32.2	-5.8	-8.9	-25.2	34.7	33.0	-7.8	-3.4	-5.8	-41.8	10.5	8.2	-32.7
Hutchinson Island	2005	-11.5	9.5	40.6	-10.6	-13.3	24.4	-29.2	-11.6	25.8	-4.5	4.7	16.2	-28.5	-21.4	-10.6	-22.4	-14.8	-3.0
John U. Lloyd State Park	2006	-67.9	-56.3	-50.0	-24.8	-33.8	-24.3	-48.6	-30.0	-20.0	-5.6	47.1	14.7	-19.4	37.9	0.0	47.1	73.5	57.4
Juno Beach	2001	-25.8	-29.7	-31.1	-43.6	-41.3	-42.5	-18.4	-22.6	-24.1	16.7	15.0	11.1	1.6	-0.5	-4.8	-27.7	-29.2	-32.3
Jupiter Island	1999	-6.6	16.5	-32.5	41.5	41.5	-3.5	3.0	24.3	-25.5	2.3	25.8	-10.8	4.0	27.1	-9.2	-16.7	8.8	-27.4
Patrick Air Force Base	2001	-46.9	-25.4	-28.1	-19.3	-27.2	-29.8	-24.6	5.6	2.1	-13.3	-16.7	-1.7	-54.2	-56.0	-48.1	-42.5	-44.7	-34.8
Sebastian Inlet State Park	2003	-30.0	-2.0	-16.3	-17.8	-25.0	-35.9	-25.2	4.5	-10.5	-39.4	-4.2	-19.6	-63.2	-41.8	-51.2	-28.0	12.2	-4.4
St. Joe Peninsula State Park	2005	-6.7	-6.7	35.7	-33.3	-33.3	10.0	-33.3	-33.3	10.0	-21.4	32.5	24.7	-27.6	26.8	18.3	-32.7	21.2	12.1
Delnor- Wiggins Pass S.P.	1996	0.0	-20.0	-62.5	-25.0	-20.0	-62.5	29.4	11.8	-46.9	31.9	30.1	10.8	11.0	8.7	-14.2	28.5	26.6	6.3
Delnor- Wiggins Pass S.P.	2006	-38.2	-27.6	-30.0	-41.2	-48.3	-50.0	-41.2	-31.0	-33.3	-65.1	-39.3	-2.6	-59.4	-29.5	11.6	-41.5	1.6	38.7



# Recommendations for Future Work

- Ongoing sea turtle surveys, and new information constantly being added to beach nourishment data.
- Develop an interface for scientists to share data, including the SNBS and INBS data.
  - Would allow USACE biologists to track nesting trends for specific shore protection projects and use adaptive management strategies to manage nourished beaches.
- Closer analysis of each study beach to identify causes for decreases in sea turtle nests.
- Conduct similar analysis of study beaches for hatchling success.
  - Compare to the beaches without decreases to identify variables.
- Research needed to determine the potential risk to sea turtle populations.

# Questions?

