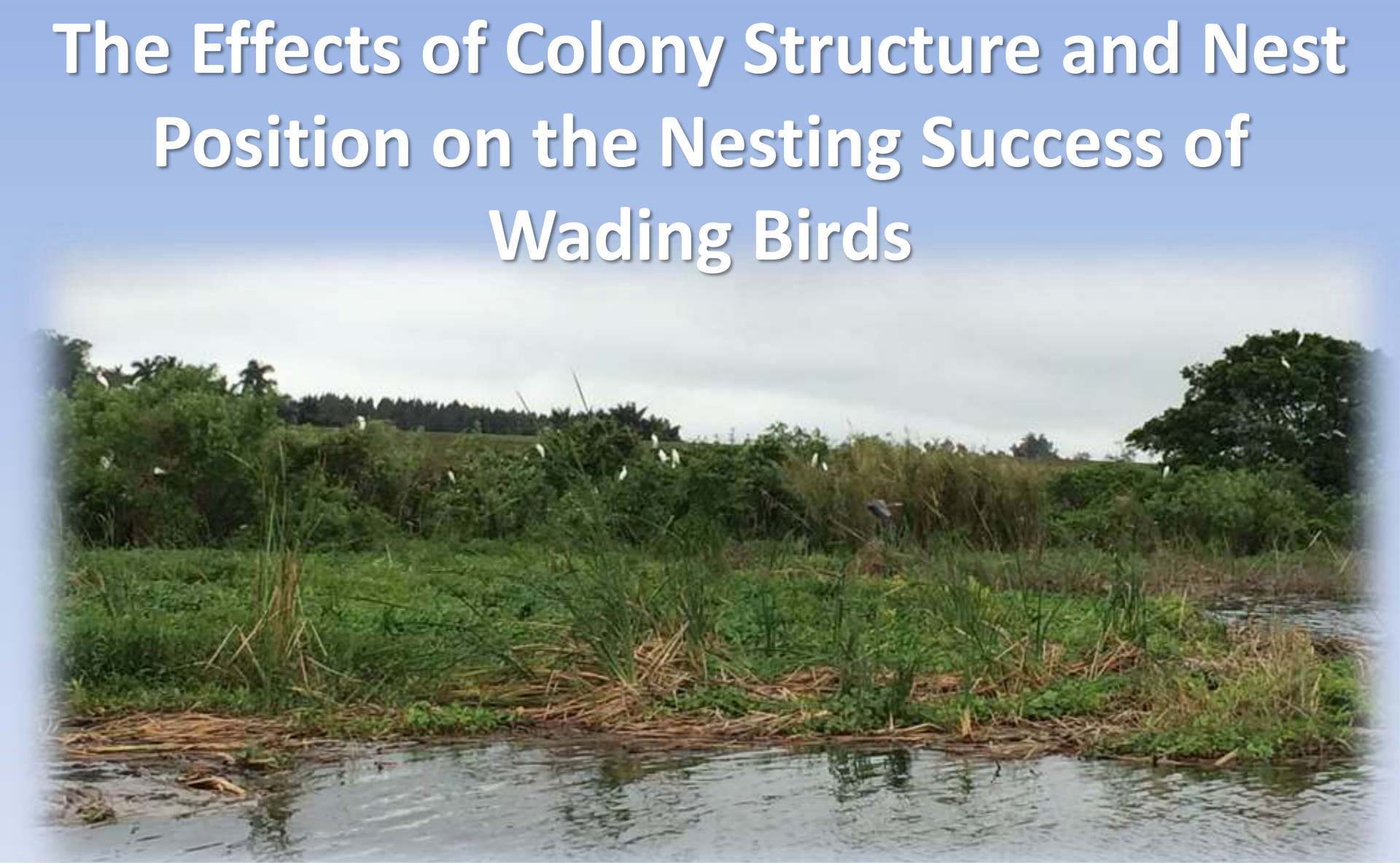
The Effects of Colony Structure and Nest Position on the Nesting Success of Wading Birds



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Avian Reproductive Success

- Measures of avian reproductive success vary depending on environmental conditions, degree of predation, location, and food availability (Martin 1995)

- When food is not limiting, competition for quality nesting space can constrain breeding densities (Krebs 1971, Huhta et al. 1997, Chamberlain and Fuller 1999)

- Quality nesting space provides
  - Structural support
  - Protection against predators and adverse weather conditions

    (Minias 2014)

Man-made Habitat
Spoil Islands as a Management Tool

- Natural habitat is being rapidly degraded
  - Man-made habitats will become increasingly important
- Spoil Islands are created from the deposition of dredged material
- Important to the maintenance of many bird species in the US
  - Provide feeding, roosting, and loafing sites

Wading Bird Nesting at Lake Okeechobee

Lake Okeechobee supports about 15% of the total wading birds nesting in South Florida

Natural Islands

- Primarily comprised of willow
- Usually inundated
- Large spatial extent

Spoil Islands

- Narrow strips of land
- Higher elevation
- Exotic vegetation

Objective: Compare nesting success of wading birds in colonies with structural differences

Hypotheses:

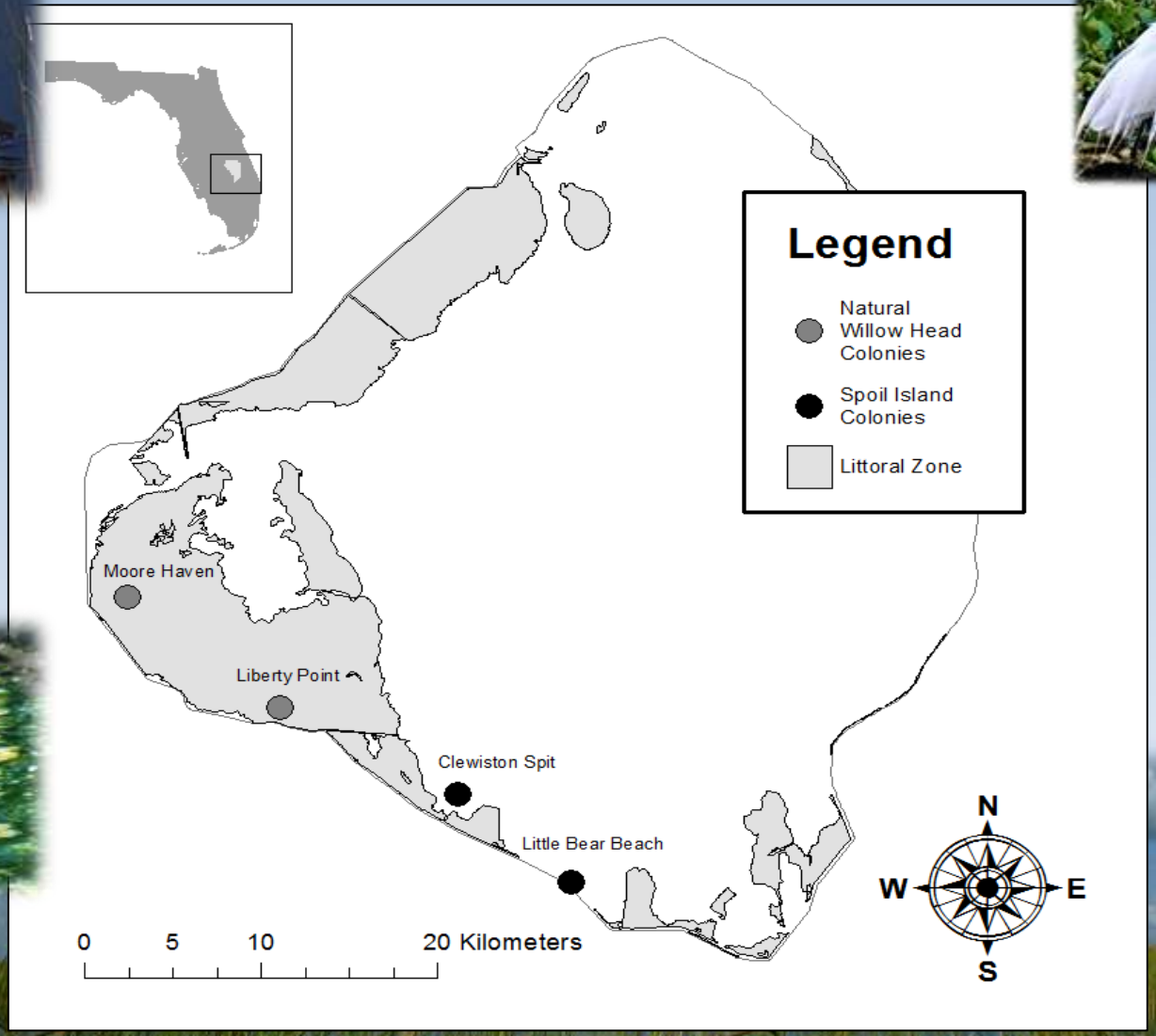
- Colony Type
  - Y = Colony Type (natural or spoil)
- Nest Position
  - Y= Distance from Canopy Edge + Nest Height
- Nesting Substrate
  - Y = Substrate Category (herbaceous, shrub, tree - DBH)
- Climate
  - Y = Rainfall + Wind Speed + Temperature

Study Species and Site

Tricolored Heron
(*Egretta tricolor*)

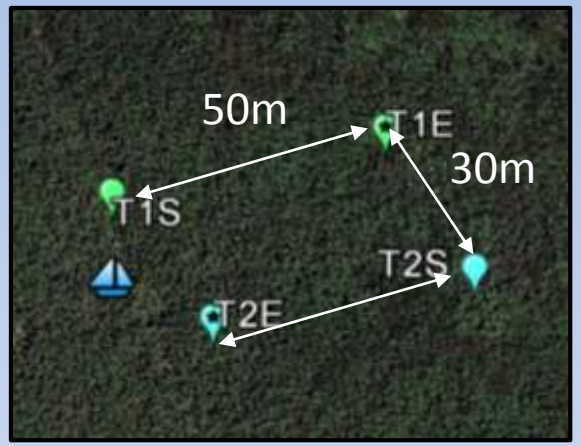
Great Egret
(*Ardea alba*)

Snowy Egret
(*Egretta thula*)



Measuring Nesting Success
Weekly Colony Surveys

- Weekly colony surveys
  - Two 50m transects
  - Monitored nests within 1m of transects
- Assessing nesting structure
  - Species ID
  - Quantitative measurements
    - DBH of nest tree
    - Nest height
    - Distance to canopy edge



Nest Success Analysis

- Logistic-exposure method (Shaffer 2004)
- Information theoretic approach
- AIC (or AICc) to determine most parsimonious model

Predictor Variables	Description
Colony Type	Man-made spoil island or natural tree island
Nest Height	Distance from the ground to the base of the nest.
Substrate Category	Categories 1-8 determined by substrate type (herbaceous or tree/shrub) and DBH
Canopy	Distance from nest to canopy edge
Rainfall	Dry season rainfall during the 1 week before survival estimate
Wind Speed	Maximum wind speed during the 1 week before the survival estimate
Colony	Colony site (*Random effect*)
Year	Nesting year (*Random effect*)
Response Variables	**Description**
Nest Fate	Success (at least one chick reaching predefined age threshold) or Fail
Fledgling Production	Number of chicks reaching predefined age threshold

Results and Discussion

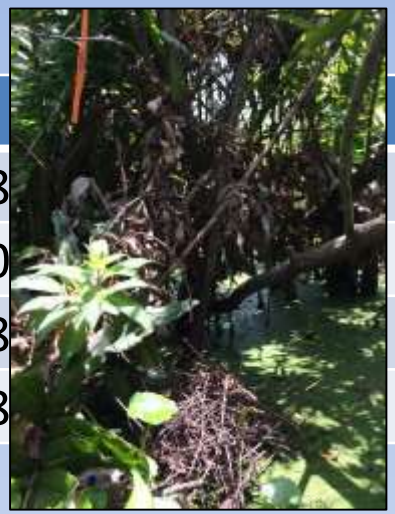
Great Egret Incubation (N =110)

Model	K	Log-likelihood	AICc	Δ AICc	Akaike Weight
Null	3	-79.72	165.52	0	0.101
Substrate Category + Nest Height	5	-77.99	166.20	0.68	0.072
Substrate Category	4	-79.15	166.46	0.94	0.063
Rainfall	4	-79.17	166.48	0.96	0.062
Canopy Edge*Wind	6	-77.18	166.68	1.16	0.057
Canopy Edge + Temperature	6	-77.18	166.68	1.16	0.057
Colony Type	4	-79.35	166.85	1.33	0.052
Temperature	4	-79.50	167.15	1.63	0.045
Substrate Category + Rainfall	5	-78.56	167.36	1.83	0.040
Canopy Edge	4	-79.61	167.37	1.84	0.040
Nest Height	4	-79.62	167.39	1.86	0.040
Global	16	-75.28	171.42	5.90	0.005

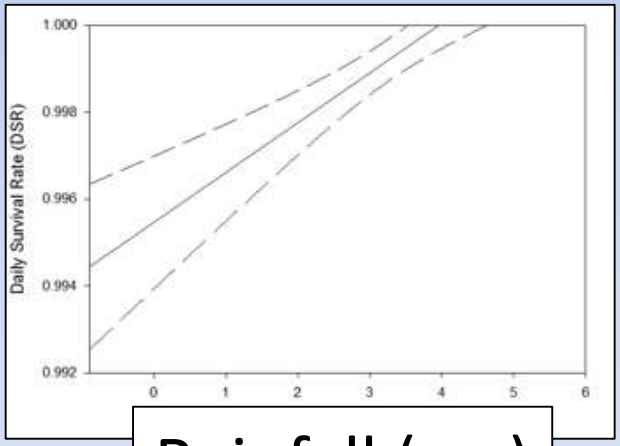
Great Egret Nestling

Model	K	Log-likelihood	AICc	Δ AICc	Akaike Weight
Rainfall + Nest Height + Canopy Edge	6	-38.67	89.71	0	0.496
Global	16	-37.78	96.52	6.81	0.016
Null	3	-46.23	98.57	8.85	0.006

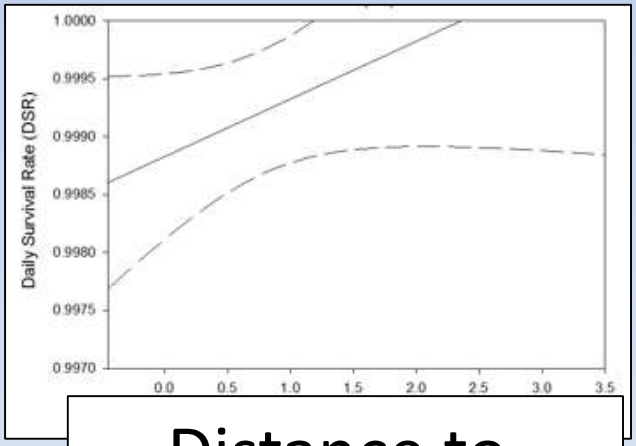
Great Egret Nestling



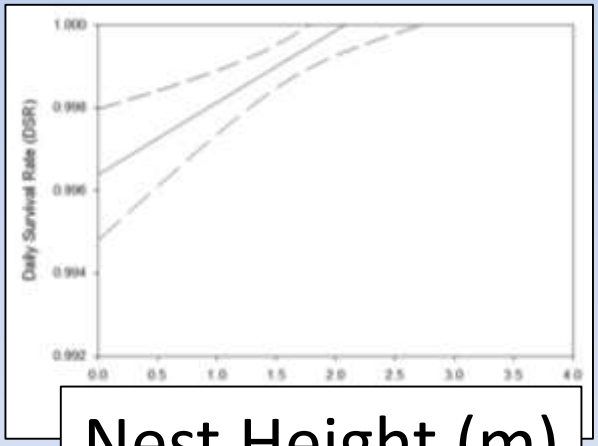
	β		U
	1.8		7.
	1.0		1.
	0.8		1.
	1.8		3.



Rainfall (cm)



Distance to Canopy Edge (m)



Nest Height (m)

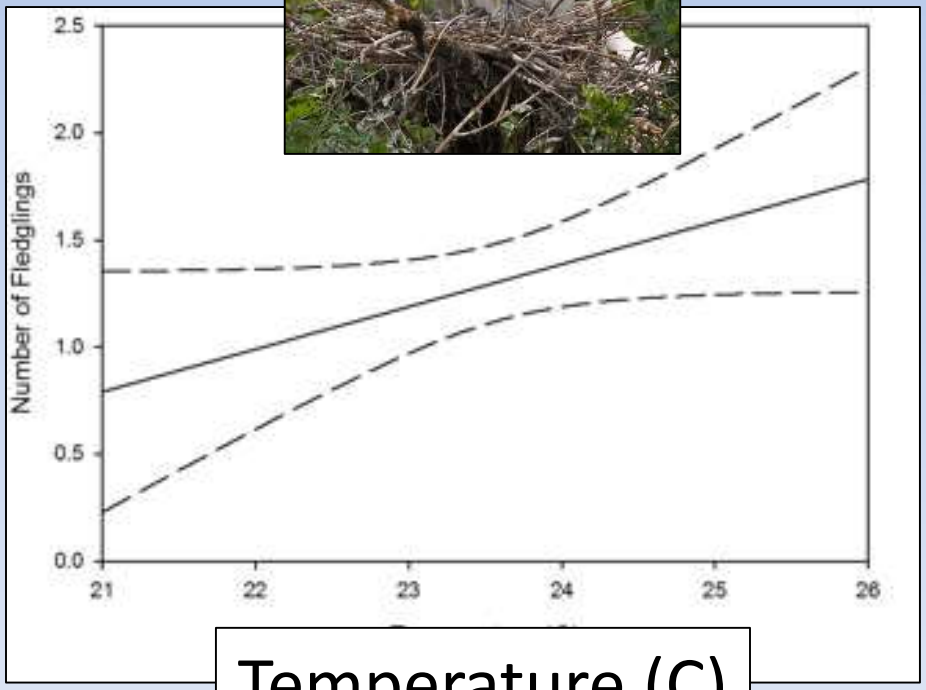
Great Egret Fledgling Production

Model	K	Log-likelihood	AICc	Δ AICc	Akaike Weight
Temperature + Canopy Edge	5	-147.00	304.59	0	0.190
Temperature	4	-148.49	305.37	0.77	0.129
Rainfall*Canopy Edge	6	-146.40	305.63	1.03	0.113
Null	3	-150.50	307.24	2.64	0.051
Global	16	-144.32	313.39	8.79	0.002

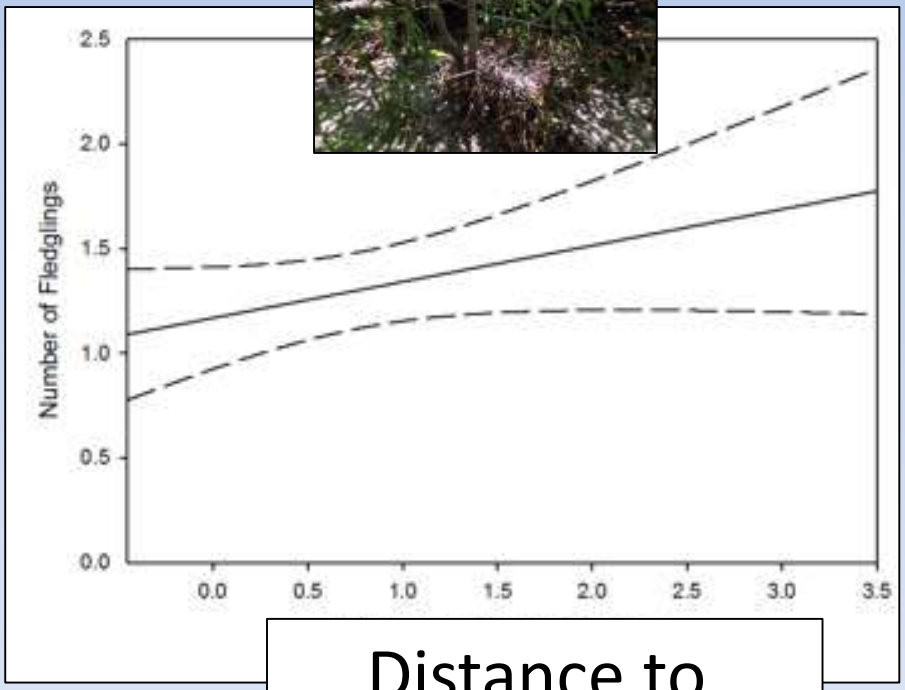
Great Egret Fledgling Production




Paramete	β	LCL	$\sum w_i$
intercept	-5.54	-10.32	--
Canopy Ed	0.17	-0.02	0.64
Temperatu	0.24	0.04	0.53



Temperature (C)



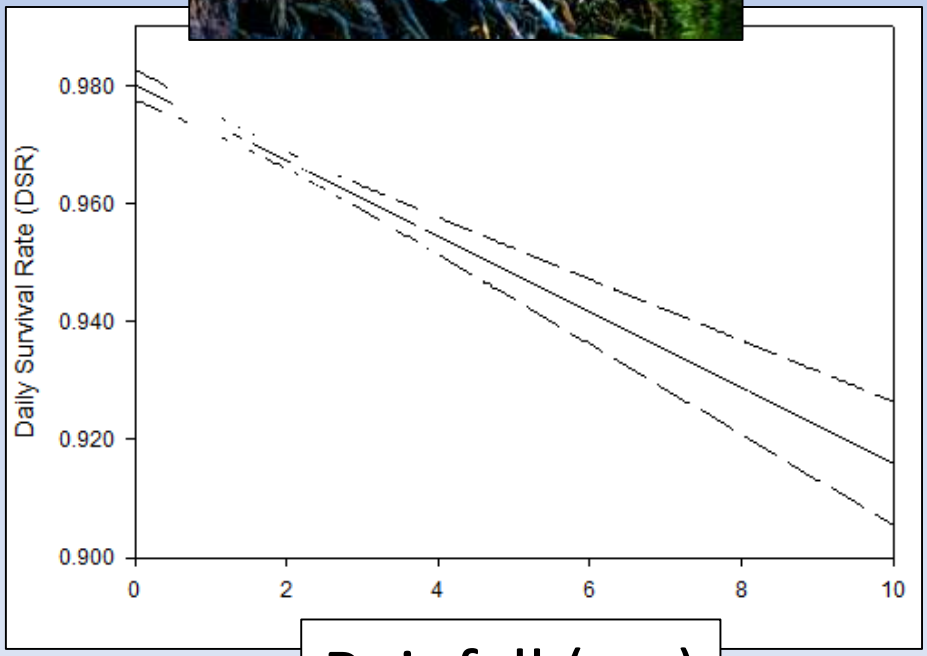
Distance to Canopy Edge (m)

Small Heron Incubation (N=223)

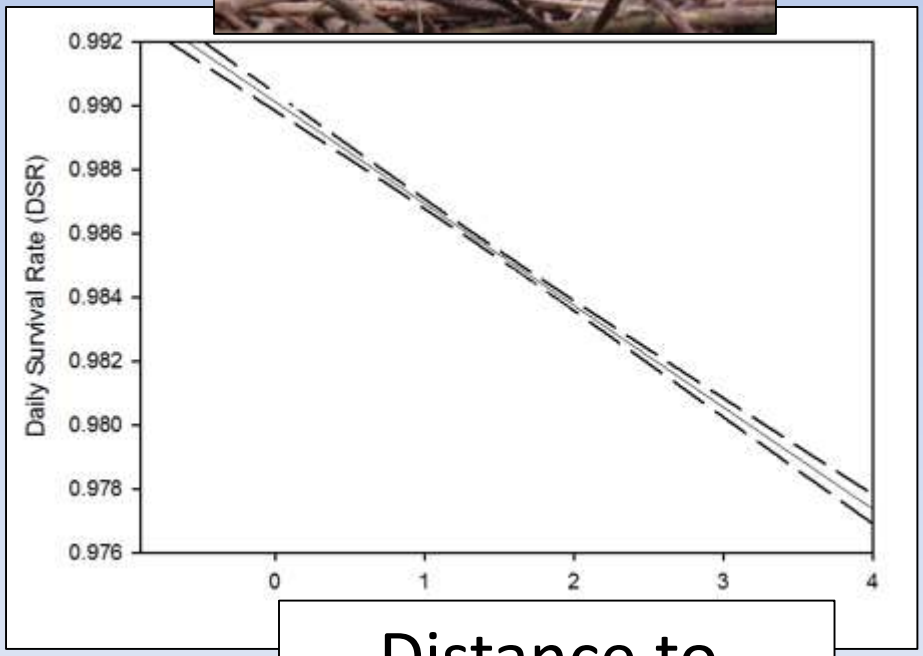
Model	K	Log-likelihood	AICc	Δ AICc	Akaike Weight
Canopy Edge*Rainfall	6	-304.31	620.71	0	0.317
Null	3	-309.89	625.81	5.10	0.025
Global	10	-304.13	628.53	7.81	0.006

Small Heron Incubation

Paran		LCL
interc	4	0.80
Cano	7	-0.76
Rainf	5	-0.43



Rainfall (cm)



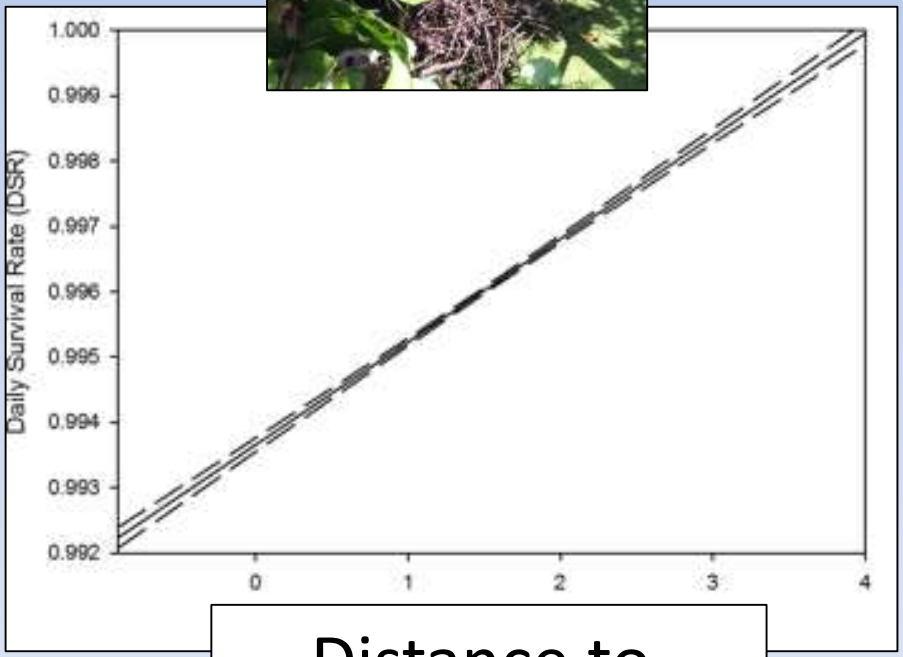
Distance to Canopy Edge (m)

Small Heron Nestling

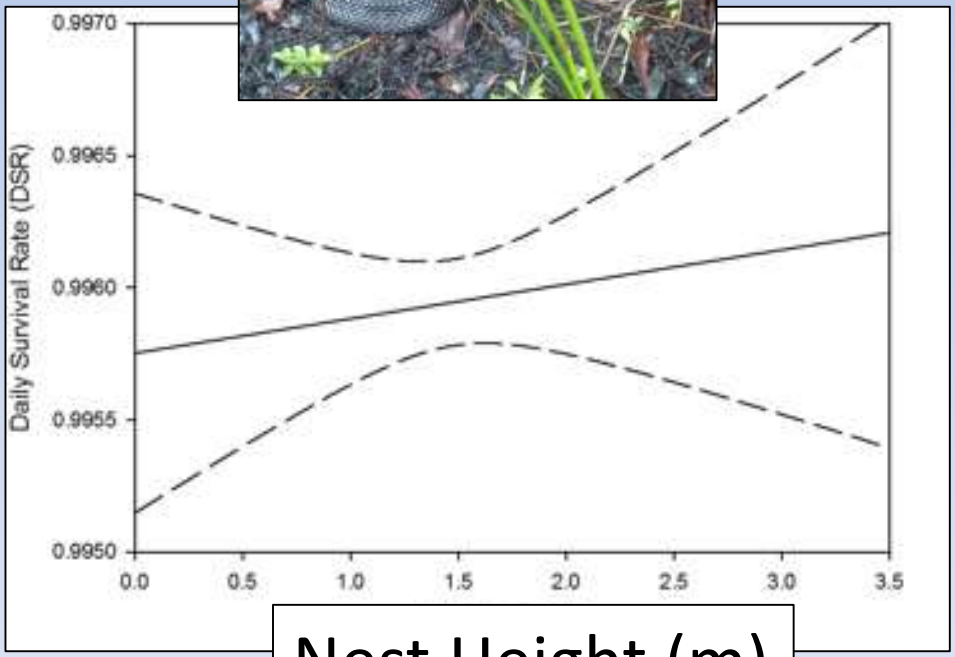
Model	K	Log-likelihood	AICc	Δ AICc	Akaike Weight
Canopy Edge + Nest Height	5	-108.70	227.50	0	0.111
Canopy Edge	4	-109.81	227.69	0.19	0.101
Canopy Edge* Rain	6	-107.79	227.73	0.23	0.099
Canopy Edge + Temperature	5	-109.04	228.19	0.69	0.079
Canopy Edge + Wind	5	-109.42	228.95	1.45	0.054
Nest Height	4	-110.55	229.18	1.68	0.048
Canopy Edge + Nest Height + Colony Type	6	-108.59	229.32	1.82	0.045
Null	3	-111.70	229.45	1.95	0.042
Canopy Edge+ Substrate Category	5	-109.67	229.45	1.95	0.042
Global	16	-107.983	236.35	8.85	0.001

Small Heron Nestling

Paramet	β	LCL	γ_i
intercep	5.02	3.12	
Canopy	0.43	-0.01	0
Nest He	0.64	-0.19	0



Distance to Canopy Edge (m)



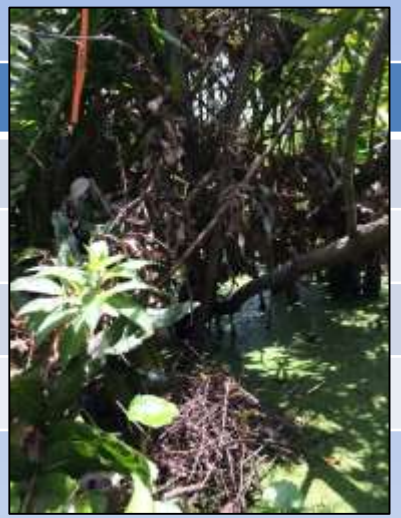
Nest Height (m)

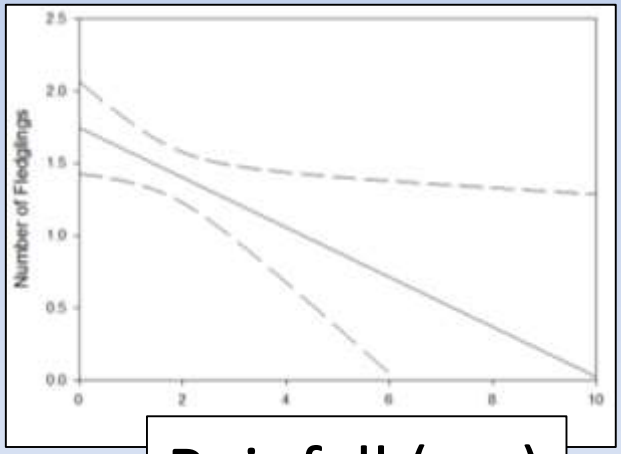
Small Heron Fledgling Production

Model	K	Log-likelihood	AICc	Δ AICc	Akaike Weight
Rainfall + Temperature + Canopy Edge	6	-498.75	1009.77	0	0.57
Rainfall + Temperature + Wind	6	-499.11	1010.47	0.71	0.40
Global	16	-490.22	1023.16	13.39	0
Null	3	-513.49	1033.05	23.28	0

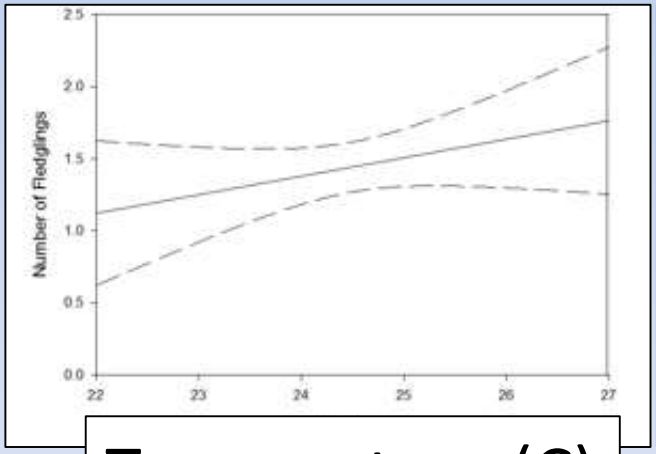
Small Heron Fledgling Production

			UCL
			0.17
			0.30
			-0.05
			0.29

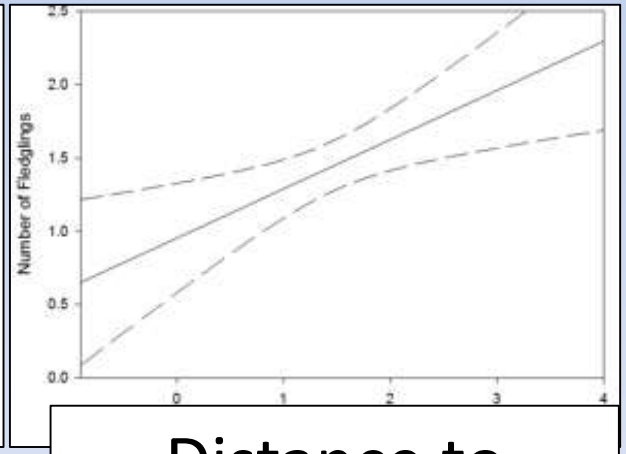




Rainfall (cm)



Temperature (C)



Distance to Canopy Edge (m)

Conclusions

- Nest distance from canopy edge can affect DSR differently depending on nest stage

- Slight increases in rainfall can create foraging conditions favorable for GREG

- Temperature was positively associated with fledgling production
  - May facilitate thermoregulation and prey activity

- Nest height may be limiting access for mesopredators

- Little evidence for Colony Type effects on DSR and fledgling production

Thank you!

Many thanks to:

- David Essian
- Volunteers
- Gawlik Lab

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US Army Corps of Engineers

RECOVER

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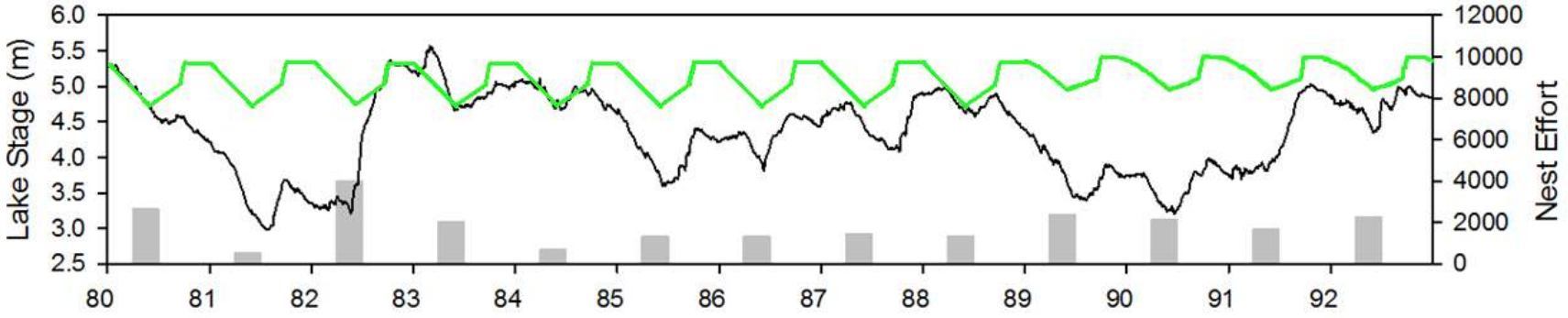
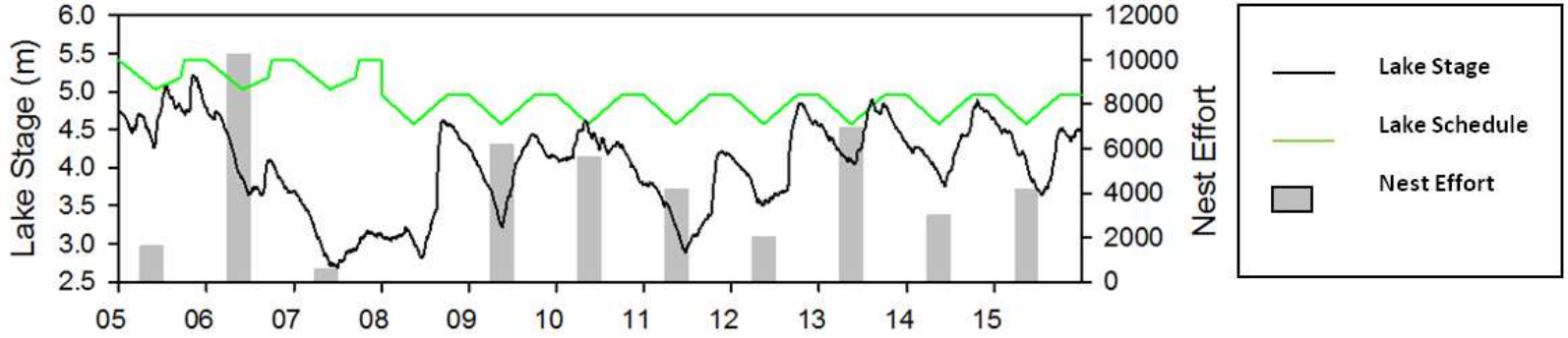
Lake O - Lake Schedule

- Past water management schedules generated high fluctuations of water levels
- Nest numbers have responded positively since the implementation of the current regulation schedule (LORS)





However, habitat remains altered …