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# The factors affecting nest and brood survival and chick body condition of American oystercatchers

Amanda Anderson  
University of Houston-Clear Lake

Dr. George Guillen  
Dr. Susan Heath

# Introduction

## Daily survival rates (DSR)

There are several factors that influence DSR

1. Seasonality
  - Nest initiation date has been found to influence DSR
2. Nest and brood age
  - As nests' and broods' age, studies have found DSR increases
3. Others – Predators, weather, temperature

(Dinsmore *et al.* 2002 Ruthrauff and McCaffery 2005; Tjorve and Underhill 2008; Murphy 2010; Smith and Wilson 2010)

# Introduction



## Chick body condition

- Body condition is a measure of energetic reserves available for use by individuals for daily processes
  - Condition indices are calculated to reflect the health of an animal
- Chick fledgling weights are positively related to juvenile survival
  - Poorer body condition may reduce the probability of juvenile survival for oystercatchers
- Environmental stressors and food availability also influences body condition

(Tella *et al.* 2001; Virzi 2008; Peig and Green 2009; Smith and Wilson 2010)

# Research Objectives

1. I examined various factors that may influence daily nest and brood survival
2. I determined if chick body condition was influenced by laughing gulls (*Leucophaeus atricilla*)

# Methods: Daily nest and brood survival

- I used Program MARK to model DSR

## Models

1. Constant daily survival
2. Temporal– linear and quadratic time trend
3. Top temporal model + covariates

Covariates: nest and brood age, number of gulls, A-P of nesting gulls, territory size

- 27 day incubation period and chick survival to 35 days
- Used Akaike's information criterion for small samples
- $\Delta AIC_c$  values  $< 2$  to be top competing models
- Significant results: 95% confidence limits did not include zero

# Methods: body condition

Calculated scaled mass indices instead of using the traditional method

- Traditional method– many studies have scrutinized the validity of using OLS residuals as indices

Scaled mass indices: a method developed by Peig and Green (2009)

$$M = M_i \left[ \frac{L_o}{L_i} \right]^{b_{sma}}$$

$M_i$  and  $L_i$  are the body mass and linear body measurements of individual  $I$

$b_{sma}$  is the scaling exponent = slope of OLS regression / Persons R coefficient

$L_o$  is the arithmetic mean value of  $L$  for the study population

## Analysis

Determined if gulls significantly effected mass indices using two-tailed T-tests in Minitab 17

Gull variables:

1. Absent (0) and Present (> 0)
2. Low (0-40)
3. High (41-140)
4. A-P of nesting gulls

# Results: Daily nest survival

N = 142

Constant DSR = 0.968 (SE 0.003)

Probability of nest survival = 0.418 (0.003)

Model	AIC <sub>c</sub>	Δ AIC <sub>c</sub>	Wi	K	Deviance
LT + Age	459.9068	0	0.62989	3	453.8973
LT + Age + NTSz + gulls + Nesting	461.4848	1.578	0.28616	6	449.4517
LT	465.8507	5.9439	0.03225	2	461.846
LT + nesting	467.4673	7.5605	0.01437	3	461.4579
LT + gulls	467.6204	7.7136	0.01331	3	461.6109
LT + NTSz	467.6204	7.7136	0.01331	3	461.6109
QT	468.0935	8.1867	0.01051	2	464.0888
S(.) constant	476.0657	16.1589	0.0002	1	474.0641



# Daily nest survival beta results

Covariate	Beta	SE	Lower	Upper
Linear trend	-0.012	0.003	-0.018	-0.005
Age	-0.043	0.015	-0.072	-0.012
Number of gulls	-0.085	0.170	-0.419	0.248
A-P nesting gulls	0.178	0.286	-0.384	0.739
Territory size	-0.085	0.170	-0.419	0.248

# Results: Daily brood survival

N = 56

Constant DSR = 0.985 (SE 0.003)

Probability of fledging = 0.591 (0.003)

Model	AICc	$\Delta$ AICc	$W_i$	K	Deviance
QT + gulls	171.7211	0	0.49586	3	165.7039
QT + nesting	174.0411	2.32	0.15545	3	168.0239
QT + gulls + NTSz + Nesting + Age	174.7293	3.0082	0.11019	6	162.669
QT + Age	175.5541	3.833	0.07295	3	169.5369
QT	175.8318	4.1107	0.06349	2	171.8232
QT + NTSz	176.1367	4.4156	0.05452	3	170.1195
LT	176.4824	4.7613	0.04586	2	172.4738
S(.) Constant	183.0931	11.372	0.00168	1	181.0903

# Daily brood survival beta results

Covariate	Beta	SE	Lower	Upper
Quadratic trend	-0.001	0.000	-0.002	-0.001
Age	0.033	0.022	-0.010	0.076
Number of gulls	-0.007	0.002	-0.011	-0.002
A-P nesting gulls	-0.839	0.434	-1.690	0.011
Territory size	0.628	0.622	-0.591	1.847

## Results: chick body condition

1. Absence and presence of gulls

$$t_{42} = 2.62, P = 0.012$$

Absent  $\bar{X} = 407.6, SD = 48.8$

Present  $\bar{X} = 364.3, SD = 60.4$

2. Number of gulls

$$t_{42} = 2.33, P = 0.025$$

Low  $\bar{X} = 399.28, SD = 50.74$

High  $\bar{X} = 357.30, SD = 65.40$

3. A-P of nesting gulls

$$t_{42} = -2.2, P = 0.033$$

Absent  $\bar{X} = 398, SD = 52$

Present  $\bar{X} = 357.2, SD = 65$

# Discussion: Daily nest survival

## DSR

- Findings were similar to Koczur (2013) for Texas oystercatchers
- Atlantic coast
  - 0.979 and 0.966 (Sabine *et al.* 2006 and Borneman 2013)
  - 0.928 and 0.950 (Davis *et al.* 2001 and Schulte 2012)

## Top model included a linear time trend and nest age

- DSR decreased significantly with time and age
1. Weather – High tide events later in the season resulted in synchronous nest loss
  2. Colonial nesting birds – predict their arrival in mid April strongly affected reproductive success
    - 49% hatching success for birds nesting near mean initiation date (March 25) vs. 32% nesting after
    - Renesting attempts in mid season were also less successful (30%)
    - Other studies have found higher hatching success for early season nesters
  3. Recreationalists – nests were left unattended when boaters and fisherman were present
  4. Predators increased

(Johnson and Walters 2008; Tjorve and Underhill 2008)

# Discussion: Daily nest survival

## Territory size

- DSR decreased with territory size but not significantly
  - Many larger territories were on the large islands, large dredge spoils or the mainland
  - Similar results found by Koczur (2013) and Atlantic coast studies
- 1. Mammalian predators – mainland and islands connected to mainland
- 2. Colonial nesting birds – large islands and large dredge spoils supported colonies

## Number of laughing gulls

- DSR decreased as the number of gulls increased, but not significantly
  - Only 1 predation event was camera verified, but other evidence suggested gulls are a major threat
  - 1. Adults frequently flushed nests to chase off gulls
  - 2. Found eggs with small holes or presence of yolk near cracked eggs
- I predict egg predation occurred when nests were left unattended

(Harris and Wanless 1997; Magella and Brousseau 2001; Hazlitt 2001; O'Connell 2003; McGowan *et al.* 2005; Virzi 2008)

# Discussion: Daily nest survival

## Nesting laughing gulls

- Conversely, DSR slightly increased in the presence of nesting gulls but not significantly
- The size of colonies and proximity to nesting gulls may explain these findings
  - Dredge spoils typically supported  $\leq 20$  breeding gull pairs
  - Oystercatcher pairs may be capable of defending against several gulls versus a large aggregation of gulls.

# Discussion: Daily brood survival

## Top model included quadratic time trend and number of laughing gulls

- Top model and DSR decreased significantly with time and as gulls increase
1. Colonial nesting birds – gull predation of young chicks
    - I hypothesize that young chicks (< 2 weeks) were predated by gulls
    - I documented several instances of gulls harassing or attempting to predate young chicks
  2. Weather – influenced food availability
    - Northerly storms early in the season cause extreme low tide events and result in great reef exposure over a long period of time
    - Southerly storms later in the season cause prolonged high tide events. There were several instances of older chicks dying and I predict it was starvation.



# Discussion: Daily brood survival

## Nesting laughing gulls was the next best model

- DSR decreased when nesting gulls were present but not significantly
  - When nesting gulls were absent more pairs (n = 26) fledged a chick than when nesting gulls were present (n = 6)
  - Predation of young chicks
  - Parents allocating less to chick attendance and more towards vigilance and agonistic behaviors

## Brood Age

- DSR increased with age but not significantly
  - Chick mortality for precocial young typically occurs within the first week of hatching
  - As chicks grew larger, I observed little interspecific interactions when they were near gulls

# Discussion: Chick body condition

I found evidence of laughing gulls negatively affecting body condition

- Breeding near gull colonies did affect parental behavior
  - Foraging – although not significant, foraging decreased in the presence of gulls
  - Vigilance – adults were significantly more vigilant as gulls increased
  - Study on colonial penguins found higher breeding densities affected offspring condition and adults invested in more nest defense (Tella *et al.* 2002)
- Poor body condition can affect juvenile survival
- Intraspecific competition may force poorly conditioned juveniles to disperse to lower quality habitat (Barbraud *et al.* 2003)

# Considerations for body condition

1. Unverified indices must be used with caution
2. I cannot assume a causal relationship between gulls and lower body condition
  - Foraging – did not include tide levels, foraging rates and area of location of reefs
  - Brood size – sibling rivalry may explain variation in body condition



# Conclusions

My study, along with Koczur (2013) study has identified several main factors that explain reproductive success for Texas oystercatchers

- As predicted, early nesters had higher reproductive success than late season nesters
- Colonial nesting species may strongly affect seasonal trends in DSR
- Territory size influences reproductive success
- Northerly and Southerly fronts influence overwash events and food availability

The results supported my hypothesis that laughing gulls are negatively affecting reproductive success and chick body condition

- Management implications: culling, habitat manipulation or both?

## Literature cited

- Tella, J. L., M. G. Forero, M. Bertellotti, J. A. Donázar, G. Blanco, and O. Ceballos. 2001. Offspring body condition and immunocompetence are negatively affected by high breeding densities in a colonial seabird: A multiscale approach. *Proceedings of the Royal Society of London. Series B: Biological Sciences* 268:1455-1461.
- Tjørve, K. M. C. and L. Underhill. 2008. Influence of disturbance and predation on breeding success of the african black oystercatcher, *haematopus moquini*, on Robben Island, South aRica. *Waterbirds* 31:83-96.
- Virzi, T. 2008. Effects of urbanization on the distribution and reproductive performance of the American oystercatcher (*Haematopus palliatus*) in coastal New Jersey.
- Smith, P. A. and S. Wilson. 2010. Intraseasonal patterns in shorebird nest survival are related to nest age and defence behaviour. *Oecologia* 163:613-624.
- Peig, J. and A. J. Green. 2009. New perspectives for estimating body condition from mass/length data: The scaled mass index as an alternative method. *Oikos* 118:1883-1891.
- Dinsmore, S. J., G. C. White, and F. L. Knopf. 2002. Advanced techniques for modeling avian nest survival. *Ecology* 83:3476-3488.
- Murphy, S. P. 2010. Population dynamics of the American oystercatcher (*Haematopus palliatus*) near the northern limit of its range. The City University of New York.
- Ruthrauff, D. R. and B. J. McCaffery. 2005. Survival of western sandpiper broods on the Yukon-Kuskokwim delta, Alaska. *The Condor* 107:597-604.
- Harris, M. and S. Wanless. 1997. The effect of removing large numbers of gulls larus spp. On an island population of oystercatchers *Haematopus ostralegus*: Implications for management. *Biological Conservation* 82:167-171.
- Magella, G. and P. Brousseau. 2001. Does culling predatory gulls enhance the productivity of breeding common terns? *Journal of Applied Ecology* 38:1-8.
- Hazlitt, S. L. 2001. Territory quality and reproductive success of black oystercatchers in British Columbia. *Wilson Bulletin* 113:404-409.
- McGowan, C. P., T. R. Simons, W. Golder, and J. Cordes. 2005. A comparison of American oystercatcher reproductive success on barrier beach and river island habitats in coastal North Carolina. *Waterbirds* 28:150-155.
- Colwell, M. A., S. J. Hurley, J. N. Hall, and S. J. Dinsmore. 2007. Age-related survival and behavior of snowy plover chicks. *The Condor* 109:638-647.
- Koczur, L. M. 2013. Reproductive success of the american oystercatcher in texas. Thesis M.S.Texas A&M University-Kingsville, Kingsville, exas.
- Schulte, S. 2012. Ecology and population dynamics of American oystercatchers (*Haematopus palliatus*). M.S. North Carolina State University, Raleigh, North Carolina.

Questions or Comments?

