

PRODUCTIVITY OF WATERBIRDS IN POTENTIALLY-IMPACTED AREAS OF LOUISIANA IN 2011



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ABSTRACT

The Deepwater Horizon oil spill (2010) could potentially affect the productivity of waterbirds nesting along the Louisiana coast. This research compares the productivity of several colonial waterbird species in relation to the degree of shoreline oiling in the nearby environment. Specifically, colonies were classified as follows:

- "moderate/heavy oil" indicates that SCAT peak oiling data reported heavy or moderate oiling of shoreline segments within 2 km of the colony site.
- "light oil" indicates that SCAT peak oiling data reported not greater than light oiling of the shoreline segments within 2 km of the colony site.
- "no oil" indicates that SCAT peak oiling data reported no oiling shoreline segments within 2 km of the colony site.

April 6, 2011 SCAT peak oiling data were used. Because of the uneven distribution of oil along Louisiana's shoreline, breeding colonies in each of the three SCAT oiling categories could not be located for all species. Overall, nests in colonies in the "no oil" category had similar or lower maximum number of chicks per nest than those from birds in colonies categorized as "oiled" segments. Average maximum chick size was either similar to, or smaller than, nests in colonies categorized as "no oil" segments.



INTRODUCTION

- Over 20 species of waterbirds nest in colonies in the northern Gulf of Mexico
- Colonial waterbirds usually nest in mixed-species colonies, usually on offshore islands
- Colonial waterbird nesting success varies temporally and spatially
- Food availability varies temporally and spatially.

OBJECTIVES

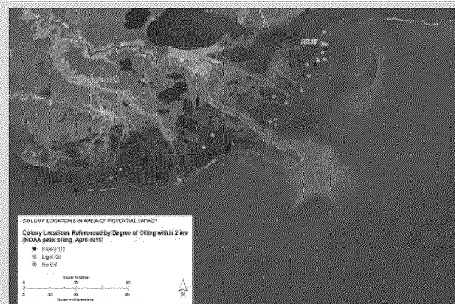
- 1 To compare reproductive measures among species
- 2 To compare reproductive measures as a function of the peak degree of oiling, determined by SCAT survey data as of April 6, 2011, of any shoreline segment within 2 km of each colony

NULL HYPOTHESIS

There are no significant differences among reproductive measures as a function of the colony's oiling category

RATIONALE

- The Deepwater Horizon Oil spill could have affected reproduction in waterbirds.
- There are many endpoints for examining reproductive success
- Nesting phenologies differ among waterbirds nesting in Louisiana
- Nesting waterbirds are not evenly distributed among colonies.
- Developing usable endpoints, given such variability in nesting, is important for management and environmental assessment
- Studies can be intensive in one or a few colonies of one or a few species.
- Studies can be extensive (many colonies, many species).



METHODS

- Collected data on 20 waterbird species nesting in 30 Louisiana colonies from Atchafalaya Basin to the Louisiana/Mississippi border (15 April - 15 August 2011).
- Visit each colony every 3-4 days.
- Select colonies randomly with respect to peak oiling categories (determined by SCAT survey data as of April 6, 2011) of nearby shoreline segments within 2 km of colony (Michel et al. 2013, PLoS One 8: e65087)
- Use only species with at least 20 nests, distributed near SCAT segments in at least 2 oiling categories, with 5 or more nests per oiling category
- Identify SCAT oiling categories for each colony: "no oil", "light oil", and "moderate/heavy oil", based on April 6, 2011 SCAT peak oiling data for shoreline segments within 2 km of each colony.
- Determine oiling categories the first time a nest is found
- Observe birds from afar to reduce human disturbance (which can cause abandonment)
- Determine maximum size of chicks.

METHODS

- Reproductive Measures were:
 - Maximum Mean Number of Chicks in Nests (Measure of Hatching Rate)
 - Maximum Mean Size of Chicks (Measure of Fledging)

Table 1. Species and data set examined for birds from Louisiana in 2011 (all Texas colonies had no oiling).

SPECIES	ADDRESS	NUMBER OF NESTS	NUMBER OF COLONIES	Number of Colonies		
				No Oil	Light Oil	Number of Colonies Mod to Heavy oil
Black-crowned Night Heron	BCNH	23	7	1	2	4
Black Skimmer	BLSK	112	3	0	1	2
Brown Pelican	BRPE	876	14	5	3	6
Great Egret	GREG	188	9	4	2	3
Laughing Gull	LAGU	364	21	7	7	7
Roseate Spoonbill	ROSP	39	6	3	1	2
Snowy Egret	SNEG	36	11	4	3	1
Tricolored Heron	TRHE	142	14	6	4	4

RESULTS: Temporal Pattern of Oiling

Table 2. Phenology of Oiling by date of first Nest Observation. Shown is the percent of moderate to heavy oil for the nests first discovered during the time period, with the total located during that time period in parentheses.

	BCNH	BRPE	GREG	LAGU	ROSP	SNEG	TRHE
4/17 to 4/30	0 (84)	35 (17)	0 (1)	0 (1)	0 (2)	0 (5)	
5/1 to 5/14	66.7 (3)	68 (511)	47 (97)	10 (30)	7 (14)	11 (9)	10 (58)
5/15 to 5/28	0 (6)	17 (24)	48 (62)	43 (35)	46 (115)	43 (7)	13 (8)
5/29 to 6/11	17 (12)	42 (55)	28 (85)	52 (27)	39 (139)	40 (15)	38 (12)
6/12 to 6/25	90 (2)	62 (66)	47 (38)	12.5 (8)	36 (27)	100 (1)	14 (7)
6/26 to 7/9	100 (4)	10 (30)	0 (1)	46 (28)	100 (1)	33 (3)	22 (9)
7/10 to 7/23	7.5 (40)	100 (1)	0 (4)	100 (1)			
7/24 to 8/6	14 (21)	0 (1)					
8/7 to 8/14	0 (3)	100 (1)					
Kruskal-Wallis χ^2	7.3 (NS)	18.1 (0.001)	448 (<0.0001)	21.3 (NS)	30.2 (0.003)	11.1 (NS)	18.1 (0.05)



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RESULTS: Maximum Number of Chicks in Nests

Table 3. Mean maximum number of chicks in nests during observation period as a function of initial presence of oil.

species	NO OILING			LIGHT OILING			MODERATE TO HEAVY OILING			Comparing among Louisiana colonies
	N	Mean	Std Error	N	Mean	Std Error	N	Mean	Std Error	
BCNH	1	1		17	1.24 ± 0.14		5	1.8 ± 0.2		Kruskal-Wallis Chi-square 6.2 (0.05)
BLSK				65	1.69 ± 0.08		47	1.62 ± 0.1		NS
BRPE	204	2.19 ± 0.05		242	2.15 ± 0.04		430	2.29 ± 0.03		8.9 (0.01)
GREG	87	1.9 ± 0.07		17	2.12 ± 0.12		84	2.46 ± 0.1		19.2 (<0.0001)
LAGU	89	1.5 ± 0.06		136	1.6 ± 0.05		139	1.69 ± 0.06		NS
ROSP	22	2.27 ± 0.18		5	2.2 ± 0.2		12	2 ± 0.25		NS
SNEG	16	2.31 ± 0.2		11	2.27 ± 0.3		9	2 ± 0.17		NS
TRHE	53	1.94 ± 0.1		56	1.86 ± 0.1		33	2.21 ± 0.12		4.7 (0.09)

RESULTS: Maximum Mean Hatching Size

Table 4. Mean maximum size of chicks in nests at end of that nest history for birds in Louisiana (2011) as a function of initial presence of oil.

species	NO OILING			LIGHT OILING			MODERATE TO HEAVY OILING			Comparing among Louisiana colonies
	N	Mean	Std Error	N	Mean	Std Error	N	Mean	Std Error	
BCNH	1	2		17	2.65 ± 0.12		5	2.6 ± 0.24		NS
BLSK				65	2.28 ± 0.07		47	1.94 ± 0.04		14.9 (0.0001)
BRPE	204	2.31 ± 0.03		242	2.71 ± 0.03		430	2.42 ± 0.02		79.6 (<0.0001)
GREG	87	2.36 ± 0.05		17	2.82 ± 0.1		84	2.85 ± 0.04		86.4 (<0.0001)
LAGU	89	2.39 ± 0.05		136	2.38 ± 0.04		139	2.61 ± 0.04		18.2 (0.0001)
ROSP	22	2.18 ± 0.08		5	2.2 ± 0.2		12	2 ± 0		NS
SNEG	16	2.13 ± 0.09		11	2.73 ± 0.14		9	2.44 ± 0.18		9.8 (0.007)
TRHE	53	2.15 ± 0.05		56	2.45 ± 0.07		33	2.64 ± 0.09		21.9 (<0.0001)



DISCUSSION: COMPARISON AMONG SPECIES

1. The number of individuals and colonies varied among species, with fewer Black Skimmer colonies and more Laughing Gull colonies.
2. Phenologies differed among species, with Black-crowned Night Herons and Black Skimmers generally initiating nesting later than other species.
3. The percent of birds nesting in colonies categorized as "moderate to heavy oil" varied, with oiling increasing with season for new nests of most species, except for Brown Pelicans.

DISCUSSION: COMPARISON AMONG OILING CATEGORIES

1. Within Louisiana colonies, there were either no differences in the endpoints examined, or the "no oil" category had similar or smaller mean number of chicks/nest, and maximum chick size.
2. There were no Black Skimmers nesting in colonies in the "no oil" category.
3. For Brown Pelicans, nests in colonies in the "moderate to heavy oil" category had a higher mean maximum number of chicks/nest than other colonies.
4. For Great Egrets, nests in the "moderate to heavy oil" category had the highest mean number of chicks/nest.
5. When considering maximum chick size, the nests in colonies in the "no oil" category had similar or lower average sizes than those in the "light oil" and "moderate/heavy oil" categories.

DISCUSSION: METHODOLOGICAL ISSUES

*Research Assistants Collected the Data
*Individual nests should be followed from nest initiation through fledging, with marked chicks
*Intense nest checks (required for above method) causes disturbance

DISCUSSION: NEXT STEPS

*The data set is rich, complicated, and extensive, and more analysis is needed to explore the relationship between productivity and oiling category. This suite of species provides an interesting combination of species with different dietary needs and behavioral adaptations.
*A long-term evaluation would include assessment in subsequent seasons, probably focusing on fewer species in colonies in a range of oiling categories