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NEST SITE SELECTION IN LEAST TERNS *(STERNA ANTILLARUM)*

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ABSTRACT

Physiognomic characteristics of nest sites were studied in Least Terns *Sterna antillarum* nesting at four separate sites on Pigeon Cay, Bahamas. Three-egg clutches were more frequent and productivity was highest for the windward sites. Internest distances, distances to nearest protective substrate and distances to nearest vegetation were smallest for nests on the windward side of the Cay. Selection of windward sites provide optimal protection against high tides, optimal surveillance against predation and optimal accessibility to eggs and young. Results suggest that physical and ecological variables at nesting sites significantly affect colony fitness and stability.

INTRODUCTION

The Least Tern *Sterna antillarum* is cosmopolitan, and nests on sand or gravel coastal beaches, banks of rivers or lakes, and even on flat roof tops of buildings (American Ornithologist's Union, 1983). Many populations appear to be declining (Massey 1974; Galli 1978). The California Least Tern *S.antillarum brownii* was given Federal and State endangered status in 1970 (King. 1981). Least Terns are colonial (Paterson 1972), but localized breeders in the West Indies (Bond 1971), and were not among. the nine species of seabirds breeding on Culebra and adjacent islands (Kepler and Kepler 1977). It has been suggested that the ecological of the nesting sites (MCNicholl 1975; Atwood and Massey 1988) may affect stability. Finding a small colony breeding on
Pigeon Cay, Bahamas, an area relatively free of human disturbance, provided an excellent opportunity to conduct studies on their nesting ecology.

STUDY SITES

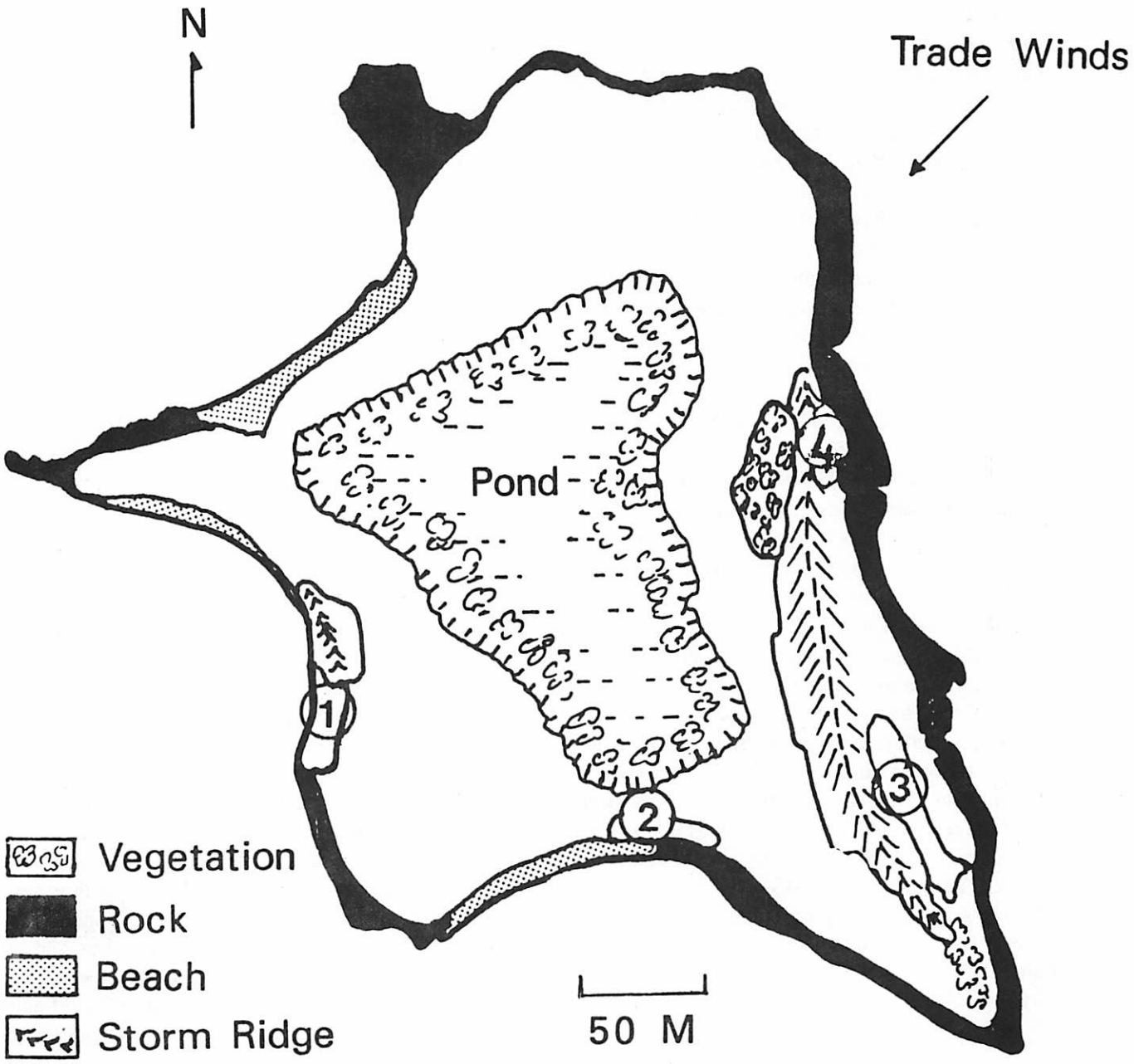
Pigeon Cay, a small limestone island, 5 m above mean sea level and about 475 m across at its widest point (Fig. 1), is located about 2 km east of North Andros Island. A storm ridge of weathered conch, several meters high extends along the eastern side of the cay. Thirty two species of plants representing 24 families and 31 genera have been recorded (Eshbaugh et al. 1980) and Least Terns have been breeding on the cay since 1977 (Eshbaugh et al. 1980).

Little Saddleback Cay is about m above sea level, about 175 m in length and lies 6 km north of Pigeon Cay. Thirteen plant species were tabulated on Little Saddleback in 1986 (unpubl. data). Because Least Terns were found nesting on Little Saddleback in 1989, this colony was also included in the study.

METHODS

The study was conducted for four nesting seasons during mid-May in 1986,1988,1989 and 1990. Nests were censused and their locations mapped. Clutch sizes were determined along with the seaward direction of nest exposure. In an attempt to estimate the degree of nest protection, I measured the distance from the center of each nest to the nearest exposed protective cover (rock, coral, etc.), characterized cover type, and measured the distance to the nearest plant species.
The degree of clumping of nests within sites was also examined and data were collected on internest distance within each site. I measured wind speed and wind direction at the center of the nests and at chest height above each nest to obtain an estimate of protection of eggs and young against wind and salt spray. Time constraints prohibited gathering data on hatching success.

Fig. 1. Distribution of Least Tern colony nesting sites (1-4) on Pigeon Cay, Bahamas.



RESULTS

The distribution of four Least Tern colonial nesting sites on Pigeon Cay are shown in Figure 1 and characterized in Table 1. All eggs were laid in sand depressions, which included fragments of weathered conch and seagrass *Thalassia* and were very close to limestone outcroppings or exposed coral. The two leeward sites (sites 1 and 2), utilized in 1986, were not favorable for nesting in 1988 and 1990.

The most consistantly productive sites were the windward sites (3 and 4) along the Storm Ridge above the jagged *dogtooth* limestone (Fig. 1). Pigeon Cay supported on the average of 13 (range: 10-17) nests over four nesting seasons, which was similar to Least Terns nesting on Little Saddleback in 1989 (Table 2).

Two-egg clutches dominated the nests on Pigeon Cay, whereas 1-egg clutches predominated for Least Terns nesting on Little Saddleback (Table 2).

Table 1. Distribution of Least Tern nests by site, May, 1986-1990, Pigeon Cay, The Bahamas.

Site	Year				
	1986	1987	1988	1989	1990
1	4	-	1	none	none
2	4	-	none	none	none
3	9	-	8	7	7
4	none	-	5	3	5
TOTALS	17	-	14	10	12

Table 2. Clutch size distribution of Least Terns (*Sterna antillarum*) breeding on Little Saddleback Cay, The Bahamas, May, 1989.

Species	No. Nests	Clutch Size	No. Eggs
Least Tern	12	1	12
	7	2	14
	1	3	3
TOTALS*	20		29

*Totals are for Least Tern nests which were clumped in an area measuring 4m x 65m (260m^2).

Clutch size distributions for three sites on Pigeon Cay in 1986 were seven 1-egg clutches, nine 2-egg clutches and one three-egg clutch. Pigeon Cay averaged 1.6 eggs per nest for 17 nests, and Little Saddleback averaged 1.4 eggs for 20 nests (Table 2). Average physiognomic characteristics of the Least Tern nests are shown in Table 3. Nest sites with a windward (easterly) exposure (site 3, Fig. 1) showed a greater degree of clumping as evidence by smaller mean internest distances (Table 3) than did colonies having a southern or western exposure to water (48 cm vs 67 cm and 87 cm, respectively). Nests at the windward site also were placed closer to exposed limestone and vegetation than nests at the other sites, suggesting better protection or concealment of the eggs. Two nests (site 1) were probable destroyed by high tide as suggested by the high water mark on 31 May, 1986.

Apparently more optimal nesting habitat was available on the eastern side of the island (sites 3 and 4) for nesting in 1988, 89 and 90). All of the nests were in sand depressions, well protected by limestone, conch and coral, and well above the high-water mark, near the vegetation zone along the storm ridge (Fig. 1). Small internest distances (Table 1) suggest a greater density of nests per area of available nesting habitat as compared to other sites.

Wind characteristics at Least Tern nests were measured for three sites in 1988 (Table 4). In May, nests in the windward site (site 3) along the storm ridge are exposed to very strong speeds, but have a wind stress reduction of up to about four time less than that for the leeward site.

Table 3. Average Physiognomic Characteristics of Least Tern Nests, Pigeon Cay, Bahamas, 1986. Ranges are in Parentheses.

Site	Exposure	No. Nests	No. Eggs	Substrate Type[a]	Substrate Distance (cm)	Plant Distance (cm)	Nearest Nest (cm)
1	Westerly	4[b]	1.75 (1-2)	CON, COR, LIM	5.9 (0.5-9.5)	89 (70-100)	87 (85-90)
2	Southernly	4	1.25 (1-2)	CON, COR	2.7 (1-4)	152 (100-210)	67 (47-85)
3	Easterly	9	1.70 (1-3)	CON, COR, LIM	0.8 (0.2-2.0)	43 (12-72)	48 (8-120)

[a]CON - conch; COR - coral; LIM - limestone
[b]2 nests - (3 eggs) lost to high tide

Table 4. Wind characteristics at Least Tern Nest Sites, Pigeon Cay, The Bahamas, 1988.

Site	Wind Direction	No. Nests	Wind Speed Index Above Nest	At nest	Diff.
1	92°	1	3.0	2.0	+1
2	-	-	-	-	-
3	120°	8	6.1	3.9	+3.9
4	108°	5	2.6	2.2	+0.3

DISCUSSION

Least Terns in this study nested on cays over 3 m above mean sea level. The three most common plant species nearest to tern nests on Pigeon Cay and Little Saddleback were Coccoloba uvif era, *Conocarpus erectus and Rahachicallis americana* , plants typical of Bahamian Coastal Rock Communities (Correll 1979; Nickrent et al. 1988).

Maximum clutch size in Least Terns is three eggs. One and two-egg clutches were the most frequent in this study.

Least Tern nests were highly clumped. Mean internest distance ranged from 48 cm-87 cm at three sites. Goodrich (1982) reported internest distances ranging from 0.5 m to 6.8 m. Burger (1988), using decoys, found that Least Terns preferred sites having singles and pairs when spaced at 1.5 m intervals rather than at 0.5 m.

Clumping of nests have been documented as a defense against predators (Tinbergen et al. 1967; Hunt 1975). Predatory mammals were not noted on Pigeon or Little Saddleback Cay, but Curly-tailed lizards *Leiocephalus carinatus* were frequently seen and could be a predator on tern eggs. Red-winged Blackbirds *Agelaius phoeniceus* nest on Pigeon Cay, and are known to destroy eggs of Common *Sterna hirundo* and Roseate *Sterna dougallii* Terns (Pessino 1968). Turkey Vultures *Cathartes aura* may also represent a threat to nestlings. They are one of the most numerous landbirds found on North Andros Island and solitary individuals were frequently observed on Pigeon Cay. On May 28, 1990 T. K Wilson aggressively chased one vulture from the cay as it approached a Least Tern nest with one young. Least Tern colonies in this study numbered less than ten nests per site and probably are not as vulnerable to predation as has been documented for large mainland colonies (Burger 1984). Also, human disturbance does not seem to be an important factor in nesting success as has been shown for large breeding populations of Least Terns in New Jersey (Burger 1984).

Two leeward sites on Pigeon Cay which were productive in 1986 were not used in 1989 and 1990. Banding returns have shown (Atwood and Massey 1988) that Least Terns have strong site fidelity to previous nesting sites and to their natal colony and move infrequently between colony sites. Vegetational succession on cays and barrier island beaches is minimal and probably not important in colony abandonment of these sites in this study.

Perhaps the greatest threat to colonial site stability and nesting success in small Caribbean populatons of Least Terns are storms and high tides. The gradual sloping sandy beaches along the western and leeward sides of small cays are unfavorable for nesting probably because of less protection as evidenced by greater nest to plant and substrate distances, and because of greater vulnarability to fluctuations in water levels, particularly during storms when winds are out of the northwest. Adequate nesting sites apparently are not as abundant along these coastlines.

Climatic stress along the more favorable windward colony sites may be more predictable. During the tern breeding season (May and June; Bond 1971) winds are traditionally strong, steady, and from the southeast. As a result, nesting birds are exposed to high winds. Least Terns nesting on the windward side of Pigeon Cay adapt to this stress by nesting in sand pockets at the base of the weathered hill of limestone, conch and coral which forms the storm ridge, some 5 m above sea level. This study shows that eggs at the windward nests are quite sheltered against the wind. There may be another advantage for nesting on the windward side of the storm ridge. My observations at site 3 indicate that Least Terns face and hover against the wind directly above their nests prior to settling on the eggs. When disturbed, they also quickly become airborne. This wind pattern of strong updrafts over the storm ridge, not apparent on the leeward nest sites, promote nest accessibility for this colonial nesting species where nests are spaced very close together, and accurate landings and departures are important.

Island height above sea level is also important in nest site selection in Least Terns.

Both Pigeon Cay, 5 m above sea level, and Little Saddleback Island, m above sea level, supported nesting Least Terns. However, Saddleback Cay, only 1 m above sea level, was void of tern nests, probably because adequate nesting substrate above high tide was not available.

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