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OBSERVATIONS OF A COLONY OF ROOF-NESTING LEAST TERNS, 1988-1997

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Abstract.—I studied a Least Tern (*Sterna antillarum*) roof-nesting colony in St. Petersburg, Florida, for 10 years to obtain long term information on variation in colony size and productivity. Colony size varied greatly between years: numbers of pairs ranged from 4 to 509 and nests from 4 to 807. Predation, especially by Fish Crows (*Corvus ossifragus*), was severe. The colony site was abruptly abandoned early in the 1997 nesting season in response to intense predation pressure. Shelters made of two concrete blocks placed side-by-side were used to provide shade and protection from some predators, but they may not have provided adequate protection against Fish Crow predation. The Least Tern's only defense against intense predation is relocation of the colony, so it is important that a number of suitable potential colony sites are available for relocation.

Least Terns (*Sterna antillarum*) frequently nest on flat, gravel-covered roofs of low buildings (Fisk 1978). Use of roofs seems to be increasing, and in some areas the majority of Least Tern colonies are on roofs (Zambrano et al. 1997). Hatching success in roof colonies can be higher than in ground colonies (Gore and Kinnison 1991). Ground colonies were found to vary considerably in size and reproductive success during studies of seven years (Burger 1984), eight years (Massey and Fancher 1989), and four years (Kirsch 1996). The objective of this study was to survey a Least Tern roof-nesting colony to obtain information on long-term variation in colony size and productivity. In addition, the role of predation in reducing productivity and causing colony site abandonment was also investigated.

STUDY AREA AND METHODS

I surveyed a Least Tern colony on the roofs of the Florida Power Corporation General Office Complex in south St. Petersburg, Pinellas County, Florida, from 1988 through 1997. The first nesting at this site was in 1987: the first year after the roofs were rebuilt using a lighter color of gravel. Least Terns nested only on the two largest two-story office buildings of the seven building complex. Terns from both nesting groups, which were about 800 feet apart, mobbed potential predators, therefore I considered the birds nesting on the two buildings to be a single colony.

Four small raised rooms, some air conditioning equipment, and small ventilators that protruded from the roof cast shadows. Least Terns frequently brooded their chicks in these shaded areas. Starting in 1993, I provided concrete blocks to chicks for additional

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shade and protection from predators. I placed the blocks within the nesting area before the birds returned and arranged them in side-by-side pairs so that the openings formed longer chambers (Fig. 1). Each pair of blocks was orientated generally in an east-west direction so one side was usually shaded. This orientation also allowed me to observe the interior chambers from a nearby office tower. When used as a shelter, concrete blocks are relatively easy to use yet heavy enough to remain stationary.

The roofs had screened drains that permitted little ponding following rains. Least Terns foraged and drank often at an artificial pond on the grounds of the office complex and at Boca Ciega Bay about 1.0 km away from the colony.

I censused Least Terns from early May, shortly after the first eggs were laid, until the colony disbanded, usually in mid to late July. I made observations every 1 to 10 days, except for a few instances of longer intervals. Although my efforts in different years were similar, my methods varied. In 1988 and 1989 I counted nests and chicks during visits to the colony, but in 1990 I began observing terns with a 15× to 60× spotting scope from a nearby office that overlooked the colony. I used the small ventilators and cables that crossed the roofs to divide the roof into smaller sections; I estimated the number of incubating adults and chicks separately in these subsections. I made multiple counts to improve accuracy. In addition, since the observation site was slightly westward of the roofs, I usually observed the colony before solar noon to minimize the areas with shade that could not be seen.

On most weekdays, I searched the grounds and parking areas near the colonies for chicks that had fallen off the roofs. In addition I asked security guards, building maintenance personnel, and other employees to watch for chicks and to inform me if any were found. All downed chicks found alive were captured, inspected for injuries, and returned to the colony.

Access to the roofs was restricted during the nesting season by the Facility Management Department. Only a few visits to the roofs for emergency repairs to equipment were allowed.

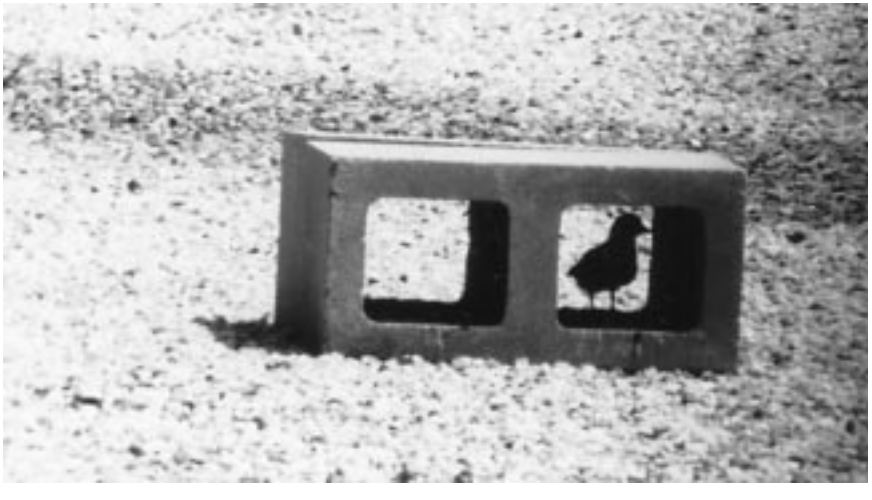

Figure 1. Least Tern chick in a roof colony seeking shade and protection from predators in a shelter made of two concrete blocks placed side by side, St. Petersburg, Florida, 1996.

I estimated the number of nests present at one time by adding the number of nests being incubated and the number of chicks observed in the colony. Since Least Terns usually raise only one young (Burger 1984), I assumed each chick represented a nest that had hatched successfully. I used the largest number of nests (incubated nests plus chicks) recorded at one time during the nesting season to estimate of the number of pairs present in the colony.

Least Tern pairs that have lost their eggs or chicks usually renest within 4 to 16 days (Massey and Fancher 1989) so the total number of nesting attempts is greater than the number of pairs present in a colony. I estimated the total number of nesting attempts during a season by summing the number of new nests from each census. I determined the number of new nests by noting the increase in nests being incubated after subtracting the number of nests that were assumed to have hatched since the previous observation (Gore and Kinnison 1991). I used a hatching period of 21 days (Lohrer and Lohrer 1973). If nests initiated between observations were offset by losses, no change in the number of nests would have been noted. Therefore, my data represent the minimum number of nesting attempts.

RESULTS AND DISCUSSION

Least Terns returned and used the same portions of the roofs each year, but the number of birds varied greatly. The largest colonies were in 1995 when there were approximately 509 pairs and 630 nesting attempts and 1996 when there were 447 pairs and 807 nesting attempts (Table 1). Except for the 1997 colony that was quickly abandoned, the smallest colony was in 1990 when I recorded 17 pairs and 38 nesting attempts (Table 1).

Although the roofs were inaccessible to terrestrial predators, the colony was preyed upon by Fish Crows (*Corvus ossifragus*) and to a lesser extent by Laughing Gulls (*Larus atricilla*) and other predators. Nocturnal predators also may have attacked the colony. On one occa-

Table 1. Numbers of pairs and nests of a Least Tern roof-nesting colony, St. Petersburg, Florida, 1988-1997.

Year[1]	Number of Pairs	Number of Nests[2]	Number of Nests per Pair
1988	66	80	1.2
1989	29	37	1.3
1990	17	38	2.2
1991	61	131	2.1
1992	150	220	1.5
1993	82	148	1.8
1994	191	312	1.6
1995	509	630	1.2
1996	447	807	.8
1997	4	4	—[3]

[1]Data for 1988 and 1989 from site visits. Beginning in 1990 all data was from observations with a spotting scope.

[2]All nesting attempts, including renests.

[3]Colony site was deserted.

sion, the few chicks that remained in the colony were counted late in the evening, but by the next morning some of them had disappeared. Nocturnal aerial predation on Least Terns by Great-horned Owls (*Bubo virginianus*) and Black-crowned Night-Herons (*Nycticorax nycticorax*) has been reported by Kirsch (1996).

During my limited observations of predation, Least Terns appeared to be able to defend the colony from some Fish Crows, but others were unstoppable. Typically, a successful Fish Crow would fly in low and hide along a wall or under machinery where it was safe from the mobbing attacks of the Least Terns. Once secure, it would observe the colony until a prey item was selected. It would then dart out, seize the chick or egg, and return to its shelter, often in five seconds or less. I never saw a Fish Crow chase down a chick or drive an adult off the nest. Fish Crows always seemed to take a chick or egg that was unprotected.

Laughing Gulls employed a less successful foraging strategy. A Laughing Gull would fly over the colony; and if it saw a prey item but was not driven off, it would fly in progressively tighter arcs as it "focused" in and finally seized its prey.

I also observed an immature Red-shouldered Hawk (*Buteo lineatus*) at the small colony in 1990. The hawk sat in the middle of the colony area without being mobbed. A half hour later, the Red-shouldered Hawk was gone, and the Least Terns had returned. I saw no chicks or active nests on this day although three days earlier the colony contained one chick. Two days later 13 nests were being incubated.

In another study Least Terns have temporarily abandoned their colony when confronted with predation by cats and rats (Burger 1984), and Common Terns (*Sterna hirundo*) left their colony during nocturnal predation, probably by Great Horned Owls (Nisbet 1975) and Black-crowned Night-Herons (Hunter and Morris 1976).

Only a few chicks were found on the grounds or parking areas. Some chicks that fell off the roof may have been carried away by predators, but I doubt this happened often. I found very few feather piles or dismembered baby Least Terns, and all dead chicks that were found remained in that location for at least a few days.

The concrete blocks that were placed in the colony were readily used as shelter by chicks and adults, especially on sunny days (Fig. 1). The two chambers and the side of the blocks that was shaded provided three separate areas that usually sheltered a single family grouping. However, these areas also were shared, and I counted at least 17 chicks using one pair of blocks for shelter at the same time. O'Meara and Gore (1988) suggested that a vertical board probably would be used more for shelter than a shelter the birds would have to enter. Apparently the openings in the concrete blocks were large enough that the chicks were not deterred from entering.

The concrete blocks may not have provided adequate protection against Fish Crow predation. Chicks old enough to utilize the concrete blocks were still taken. One apparent reason for this vulnerability was that chicks usually left the protection of the concrete blocks to be fed, giving the Fish Crows an opportunity to seize them. Furthermore, on one occasion, I repeatedly approached an older chick hiding in a concrete block. Each time the chick would sneak away as I approached. When I backed away, it would return to its hiding place. If young Least Terns retreated from the concrete blocks when a Fish Crow approached, they would have been easy prey.

Shelters have been found to protect Least Tern chicks from avian predation by American Kestrels (*Falco sparverius*) and Northern Harriers (*Circus cyaneus*) (Jenks-Jay 1982). However, Fish Crows in this study functioned almost as terrestrial predators by searching for prey while sitting on the roof and then by flying very low to seize the selected prey. It is possible the concrete blocks provided more protection from Laughing Gulls and other avian predators.

A different arrangement of the blocks might have improved their effectiveness against predators. For example, if several blocks were arranged so that their chambers did not line up, the vertical supports of the blocks would have reduced the effective size of the interior chambers and created hiding places behind the supports. Perhaps this would make it more difficult for the Fish Crows to chase the chicks out of the shelters.

I do not have a direct measure of predation pressure, although the ratio of total nests, which includes renests, to pairs could be a crude index of predation pressure. Higher nests per pair values should indicate more losses to predation since successful Least Terns and those that lose a nest to starvation usually do not renest (Massey and Fancher 1989). No trends are evident from these data (Table 1). Even the very large colonies of 1995 and 1996 were not able to prevent substantial predation. The nests per pair values for these years were within the range of values for other years, and the ratio of 1.8 nests per pair in 1996 was one of the highest for the study (Table 1).

Burger (1984) found that colonies of more than 80 pairs suffered proportionately greater predation than small colonies, and she suggested that large colonies may be more vulnerable because they have more prey to attract predators. Furthermore, since large colonies usually occupy the same site for several years, predators can learn to expect a food source at that site (Burger 1984). This may have been the case at this site. I observed Least Terns for the first time in 1997 when at least a hundred terns rose to defend the colony against an attack by several Fish Crows. Two days later I saw only four terns incubating nests. At the same time, four Fish Crows were walking unmolested

through a different part of the colony area. These two instances were the only times when I observed attacks by several Fish Crows at the same time.

The nests were gone on the next day, and I noted no further nesting attempts during subsequent observations. Massey and Atwood (1981) and Burger (1984) found that Least Tern colony sites were abandoned if they experienced heavy predation pressure.

Since the Least Tern's only defense against intense predation is abandonment of the site and relocation of the colony, it is important that a large number of suitable potential sites be available for the relocation of colonies. If Least Terns are limited to a few sites, it is doubtful they can sustain the heavy predation pressure that occurs once predators learn where to expect a ready food source.

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