Florida Field Naturalist

PUBLISHED BY THE FLORIDA ORNITHOLOGICAL SOCIETY

VOL. 32, NO. 1 FEBRUARY 2004 PAGES 1-41

Florida Field Naturalist 32(1):1-6, 2004.

LOSS OF TAR AND GRAVEL ROOFTOPS IN PINELLAS COUNTY, FLORIDA AND POTENTIAL EFFECTS ON LEAST TERN POPULATIONS

ELIZABETH A. DEVRIES AND ELIZABETH A. FORYS
Natural Sciences Collegium, Eckerd College
4200 54th Ave. South, St. Petersburg, Florida 33711
E-mail: forysea@eckerd.edu

Abstract.—Least Terns (*Sterna antillarum*) commonly nest on flat gravel rooftops in the southeastern United States. Increasingly, these rooftops are being replaced with a smooth, modified surface upon which the birds are unable to nest. Eight commercial roofing contractors in Pinellas County, Florida were interviewed between January and June of 2002 to determine the extent of roof conversion. Seven of eight contractors reported installing modified roofs almost exclusively, while the eighth reported installing an approximately equal number of gravel and modified roofs. In addition, recent changes in the Florida building code will make it unlikely that new gravel rooftops will be installed on commercial buildings because of their lower energy efficiency. Our results suggest the amount of gravel roof-nesting habitat will likely be greatly reduced within 25 years. Measures should be taken now to restore natural nesting habitat or create artificial nesting structures.

The Coastal Least Tern (*Sterna antillarum antillarum*) is a small seabird (20-25 cm) found along the coasts of the Atlantic and the Gulf of Mexico from Maine to Venezuela; two subspecies also live along the Mississippi River (*S. a. athalassos*) and the coast of California (*S. a. browni*; Gore 1996). The species is migratory, spending the winter months in the southern portion of its range and arriving on the east coast of the United States in late March or early April to breed before returning to South America and the Caribbean in late summer. These terns feed primarily on small fish by plunge-diving and dipping (O'Meara and Gore 1988).

Least Terns have historically nested colonially on broad, flat, undisturbed beaches with a substrate of sand and coarse shells or gravel (Zambrano et al. 1996). As early as 1890, scientists noted that Least Terns were abandoning former nesting sites due to newly constructed

seaside resorts (Gochfeld 1983). Many of the beaches have now been developed to the point where terns can no longer nest, and of the few that remain, many are subject to frequent human disturbance (Zambrano et al. 1996). In addition, encroaching vegetation and predation by raccoons (*Procyon lotor*), feral cats (*Felis catus*), and even domestic dogs (*Canis familiaris*) further reduces the tern's reproductive success. Along with habitat loss, extensive hunting for the millinery trade in the 1870s, which killed as many as 1,000 Least Terns daily, greatly reduced the Least Tern's population (Gochfeld 1983). Data suggest that Least Tern populations along the eastern seaboard declined by as much as 80% between 1940 and the mid-1970s, and the trend may be continuing (O'Meara and Gore 1988). As a result, the California and Interior subspecies are federally listed as endangered and the Atlantic coast populations are listed in various states throughout their ranges as endangered or threatened (U.S. Fish and Wildlife Service 1980, 1985). In Florida, the Least Tern is listed as a threatened species, primarily because beachfront development has eliminated most suitable nesting habitat (Zambrano et al. 1996).

In the southeastern United States, loss of their natural nesting habitat has been linked to Least Terns use of new nesting areas on flat gravel rooftops. The first report of roof-nesting Least Terns came from Pensacola, Florida in 1957 (Fisk 1975). As many as 80% of Least Tern colonies in Florida are now found on roofs, where colonies can consist of fewer than five breeding pairs or contain as many as several hundred pairs (Burger 1988). In northwestern Florida rooftop colonies may produce as many chicks and fledgling young as beach colonies (Gore and Kinnison 1991). Unfortunately for the Least Tern, this adopted habitat may also become difficult to find as many of the gravel roofs are converted and replaced with a more recent technological advance, a smooth, modified roof surface (without gravel) on which the birds are unable to nest. Loss of gravel roofs may also have an impact on other species that nest on rooftops such as Killdeer (*Charadrius vociferus*), American Oystercatchers (*Haematopus palliates*) and Black Skimmers (*Rynchops niger*), although these species are generally not as dependent on rooftop habitat or as productive on rooftops as Least Terns (Greene 1976, Douglass et al. 2001).

Methods

To determine the extent of roof conversion and its implication for Least Tern populations, eight commercial roofing contractors in Pinellas County, Florida were interviewed by telephone between 10 January 2002 and 15 June 2002. Pinellas County, Florida has more rooftop nesting colonies (43 as of 2001, St. Petersburg Audubon Society, unpublished data) than any other county in the state. We chose commercial roofing contractors rather than residential because most large, flat roofs are commercial. Contractors were first asked which type of roof was most commonly installed by the company they repre-

sent. We then asked them to compare the two types of roof, gravel and modified, and explain the advantages and disadvantages of each. We also inquired about the life span and cost of each type, and, finally, how long the modified systems have been in use.

Results

In 2002, both gravel and modified roof systems were being installed on new commercial flat roofs in Pinellas County. A gravel roof consists of a layer of tar spread over the roof covered with a layer of gravel. Use of the modified systems appears to have become commonplace in the mid-1980s and can be constructed several different ways, the simplest of which is a single-ply bitumen surface. Before the introduction of the modified surfaces, fiberglass was used as the top layer of some roofs rather than gravel. Both gravel and modified systems can have additional layers underneath the top layer; these have an effect on both the life span and the cost of the roof. While historically some modified roofs also used gravel, for this paper, when we refer to "modified roof" we mean a roof without gravel. In general, better quality material beneath the surface and a greater the number of plies installed will increase a roof's longevity.

Seven of the eight contractors surveyed agreed that gravel roofs are being phased out and referred to them as obsolete. All seven of these contractors reported installing far fewer gravel roofs in recent years (one reported not installing a gravel roof in 10 years); while the eighth contractor reported that his company installs an approximately equal number of gravel and modified roofs.

Each contractor cited a number of advantages of a modified roof over a gravel roof. All eight of the contractors indicated that modified roofs were less expensive, although the estimated cost difference given by the roofer ranged from \$1-\$4/ft^2. The major reason for a cost difference between the systems is the labor involved in installation. Construction of a tar and gravel roof is much more labor-intensive and dangerous due to large quantities of hot tar and the equipment and personnel necessary to handle it. In contrast, the material to construct a modified roof comes ready to install on a large roll from the manufacturer and can be moved quickly and efficiently to cover the roof by fewer workers. Four of the contractors indicated that the time to install a modified roof was significantly faster than a gravel roof and this attribute was valued by their customers. Three of the contractors said that many of their customers preferred the look of the modified roof and two of the contractors offered that the lighter weight of the modified roof was an important feature.

Despite the fact that they were mainly installing modified roofs, five of the contractors said there were advantages to gravel roofs. Four of the eight contractors said that gravel roofs are better at preventing

leaks when a rooftop has standing water after heavy rains. Two roofers said that some clients prefer the look of gravel over the newer modified surfaces.

Six of the contractors said the average life span of a gravel roof appears to be longer than the life span of modified roofs, although they all noted that this is assuming the gravel roof is properly installed. Seven of the contractors said that well-installed gravel roofs can easily last up to 25 years in Pinellas County. One contractor felt that 12 years was a more reasonable maximum life span for a gravel roof. For a modified roof, six of the contractors felt that they generally last 10-12 years, the remaining two did not have opinions. However, several contractors mentioned that modified roofs come with a 10-12 year manufacturer's warranty that can be increased by installing more plies. In contrast, a gravel roof is only warranteed for labor by the contractor, usually for 3-5 years.

Unfortunately for the Least Tern, most of the contractors would recommend gravel only to a customer whose roof had ponding water or a steep slope. Both of these situations are unsuitable for nesting Least Terns, so installation of gravel roofs in these cases will not make more nesting habitat available.

Discussion

An assessment of the contractors' responses reveals a clear trend toward phasing out gravel roofs and replacing most with modified surfaces. While some gravel roofs are still being constructed, all but one of the contractors interviewed are recommending modified surfaces nearly exclusively to their customers, with gravel being an alternative in only a few special cases. In Pinellas County, five roofs that supported rooftop colonies have been converted to a modified surface in the past seven years and three buildings were demolished and replaced with buildings without gravel and tar roofs (Forys, unpublished data).

After our surveys were conducted, the Florida Building Commission agreed to update the Florida Building Code to comply with some of the ASHRAE (American Society of Heating, Refrigerating, and Air-Conditioning Engineers) 90.1-2001 energy standards. This energy code is stricter than the federal required ASHRAE 1-1999 energy standards that the state must comply with. New buildings built in Florida must comply with the Florida Building Code (Southern Building Code Congress International 2003) and this code contains the Florida Energy Code which has minimum standards for the energy efficiency of roofs. The energy efficiency of a roof is determined by both the reflectance/emittance of the roofing material and insulation. In addition, the Florida Code allows for trade-offs in other energy areas if the roof is designated a "cool roof". Cool roofs have a high solar reflectance and a

normal to high heat emittance. To have a high solar reflectance the roof generally must be entirely light in color and this is generally done by either coating the roof with a light-reflecting ceramic outer-coating or using other modern roofing materials (Cool Roof Rating Council 2003). Tar and gravel roofs are generally considered to be poor reflectors and emitters because of the underlying tar. Builders using gravel and tar roofs will have to spend significantly more money to save energy elsewhere in roof construction to make up for the loss of energy due to this type of rooftop. A similar policy is in place for the state of Georgia (Cool Roof Rating Council 2003) where Least Terns also nest on rooftops. Unfortunately for the Least Terns, with the changes in the energy policy it seems even less likely a building owner will want a gravel and tar roof. Gravel and tar roofs on existing buildings might be coated to increase reflectivity, rendering them useless for the birds.

How long it will take for this trend to have a significant effect on the Least Tern population is uncertain, but given that the life span of a gravel roof was estimated by most at 20-25 years, it seems reasonable to expect that within 20 years the availability of this important nesting habitat for the Least Tern and other rooftop-nesting birds could be greatly reduced as roofs reach the end of their life span and need replacement. Measures should be taken now to determine what can be done to protect the terns' natural nesting habitat on beaches or create elevated artificial nesting structures.

Acknowledgments

We thank the following contractors who consented to being interviewed: J. Hogan, John Hogan Roofing; G. Porter, Mr. Roofer of Pinellas; P. Cote, Comfort Cover Systems; N. Osborne, Louis Hite Contracting; B. Heaberlin, Heaberlin Roofing; R. Stratton, Albritton Roofing; K. Shade, All Performance Roofing; and E. Williams, Tar Heel Roofers. Thanks also to M. Abrams and the St. Petersburg Audubon Society for the wealth of information and assistance; and N. Douglass for reviewing the initial draft of the manuscript.

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