J. Field Ornithol., 61(1):98–103

LETHAL TEMPERATURES IN ASH-THROATED FLYCATCHER NESTS LOCATED IN METAL FENCE POLES

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Abstract.—In southeastern Arizona grasslands, Ash-throated Flycatchers (*Myiarchus cinerascens*) frequently nest inside cylindrical metal fence poles located along highways. These nests are frequently found abandoned with dead eggs or nestlings during the hot summer months. We measured the temperatures of these nests to determine if the observed mortality could be attributed to lethal nest temperatures. Temperatures in fence pole nests in the summers of 1984 and 1985 were consistently above ambient air temperatures. Many nests experienced temperatures in excess of 41 C (maximum 49°), at which point avian eggs may not survive. In contrast, flycatcher nests in wooden bluebird boxes in a nearby oak grassland usually experienced temperatures equal to or below ambient air temperatures. Nesting in metal fence poles has allowed the Ash-throated Flycatcher to expand its breeding range locally into areas where natural cavities are absent; however, breeding pairs using these nest sites appear to suffer low nest success due directly or indirectly to high nest temperatures.

TEMPERATURAS LETALES PARA NIDOS DE *MYIARCHUS CINERASCENS* LOCALIZADOS EN POSTES DE METAL

Sinopsis.—En los yerbazales del sureste de Arizona, individuos del papamosca *Myiarchus cinerascens* con frecuencia anidan en los postes cilindricos de metal que sostienen las verjas a lo largo de autopistas. Con bastante regularidad durante el verano, los nidos de estas aves se encuentran abandonados con huevos cuyos embriones han perecido o con pichones muertos. Medimos las temperaturas de estos nidos para determinar si la mortalidad observada podía ser atribuida a las altas temperaturas. Durante los veranos de 1984 y 1985, las temperaturas en estos postes resultó ser más alta que la ambiental. La temperatura de muchos nidos excedió los 41 C (máximo de 49), a la cual los embriones de estas aves no pueden sobrevivir. En contraste los nidos de estos papamoscas localizados en cajas de madera mostraron temperatura similar o más baja que la temperatura ambiental. El anidar en postes de metal, le ha permitido al papamosca en discusión, expandir su distribución de anidamiento, a lugares en donde no hay cavidades naturales. No obstante, las parejas que utilizan estos postes parecen tener un bajo éxito de anidamiento debido directa o indirectamente a las altas temperaturas que se desarrollan dentro de estas estructuras.

Ash-throated Flycatchers (*Myiarchus cinerascens*) nest in a wide variety of natural and man-made cavities (Bent 1942, Finch 1982). Since 1983 we have observed flycatchers nesting in metal fence poles in the grasslands of southeastern Arizona. There may be a substantial cost to nesting in these poles, however, since many of the nests we located did not fledge young. Failed nests often contained addled eggs and mummified young. Because ambient temperatures in this region commonly reach 35–40 C during the breeding season, the nest failures may be due to lethal tem-

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peratures inside the metal poles. In this paper we document temperatures inside Ash-throated Flycatcher nests located in metal poles and in wooden or natural cavities, to determine if nest temperatures could affect nest success in this species.

METHODS

From April through July 1983–1985, we surveyed highway fence poles for nests along roads near Sunizona and Sierra Vista, Cochise County, Arizona. In this area, cylindrical steel pipes of 60–140 mm diameter were occasionally used to support barbed wire fencing. Virtually all fence poles are in very exposed areas, since few trees are present in the grasslands. Upon finding a nest inside one of these poles, we measured internal and external diameters of both the occupied pole and all unused poles in the vicinity. We also measured the depth at which the nest was placed inside the pole, and noted whether the pole was upright or leaning.

We used the presence of abandoned eggs or dead young to indicate nest failure. Nests that did not contain dead eggs or young were assumed to have fledged young successfully if the nest was fouled with fecal droppings. Previous experience with nests of this species had shown that successful nests were usually heavily covered with droppings. We found no evidence that any nests in the poles were lost to predation.

On 15 Jul. 1985 we monitored nest temperatures in one nest in a fence pole near Hereford, Arizona. We placed a thermometer probe from a Bailey digital thermometer model BAT-12 inside the nest by snaking a wire probe up from a hole in the bottom of the pole through the nest lining until it rested between the four eggs. We placed a second probe about 10 m away from the pole on a shaded limb of a mesquite shrub to record ambient air temperature. Nest and ambient temperatures were recorded every 10 min from 0935–1655 MST.

We also monitored temperatures on an hourly basis in a variety of occupied and unoccupied poles near Sierra Vista, Arizona. At each pole we recorded the nest temperature by lowering a probe to the upper surface of the nest. Care was taken to record the nest surface temperature at a spot that was away from the sides of the pole and in the shade (unless the entire nest surface was exposed to the sun, which occurred 2–3 times). We also recorded ambient temperature, wind speed and cloud cover. Temperatures inside empty poles were measured at heights within the poles typical of flycatcher nests. We recorded temperatures in July 1984 (two active nests and two nearby unused poles), on 14 and 21 Jun. 1985 (two pole nests), and on 3 Jul. 1985 (four pole nests). We supplemented these data with more limited temperature measurements from 14 nests taken from 1020–1430 MST on 1 Jul. 1984.

We also recorded nest temperatures of flycatcher nests in four wooden bluebird boxes that were part of a bluebird trail operated by Jane Church, of Sonoita, Arizona. These boxes were placed on telephone poles and tree trunks in an oak grassland. Most boxes were shaded during part of the day, unlike the highway fence poles, which were more exposed to the sun. Ambient and nest temperatures were recorded from 1200–1700 MST at hourly intervals on 3 Jul. 1985 using thermometer probes snaked through the nest lining into the nest cup.

RESULTS

During this study we located 33 Ash-throated Flycatcher nests in fence poles. Most of these nests were located in old poles with an internal diameter of at least 72.5 mm (mean ± SD 83 ± 7.3 mm, range 72.5–105 mm, n = 25). Unused poles had a smaller diameter (mean 63.4 ± 15.2, range 60–70, n = 16) than occupied poles. Nests were located in the upper third of most poles (mean distance from top 35.7 ± 8.0 mm, range 18–60 mm, n = 33). Most nests were attached to projections on the internal surface of the pole; however, in a few cases the birds apparently filled the pole cavity to the desired height. Several poles were reused in successive years, especially poles that were slanted away from vertical.

We followed one active nest in 1983, 10 in 1984 and four in 1985. Nine of the 15 nests ultimately had dead eggs or young, and had no accumulation of fecal material to indicate successful rearing of young. Thus, only 40% of the active nests were possibly successful. We opened several of the abandoned eggs and all appeared to have normally developing young. While most dead nestlings were very young, some were virtually full grown, with primaries and rectrices fully unsheathed and more than half adult size.

In contrast to the pole nests, flycatcher nests in bluebird boxes were highly successful, and virtually all failures were due to predation. From 1984–1987, 22 of 28 (79%) flycatcher nests in boxes successfully fledged young. Predators destroyed four, and possibly five, of the unsuccessful nests. Dead nestlings were not found in any of these nests during 1984–1987.

The most complete record of nest temperatures we collected was for the single nest monitored on 15 Jul. 1985. Nest temperature was elevated between 6.5–13.3 C throughout the day (Fig. 1). Temperature at the surface of the nest peaked at 48.3 C on a day in which the highest recorded ambient temperature was 36.4 C. The clutch of four eggs was later abandoned.

Sampling of temperatures inside other poles also showed nest temperatures elevated above ambient. In 14 nests sampled on 1 Jul. 1984, nest temperatures were elevated an average of 3.5 C (SD 1.9, range 0.4–6.6 C) above ambient, which peaked at 32.9 C. Similarly, in 12 nests monitored on various days in July 1984, and June and July 1985, nest temperature was greater than ambient in all 54 hourly samples. Maximum temperatures inside the poles ranged up to 49.0 C (47.2 C in shaded parts of the nest). Elevated temperatures were also characteristic of poles without nests. Two empty poles included in the hourly sampling on 4 Jul. 1984 had nest temperatures greater than ambient in all samples, averaging 5.0 ± 0.9 C above ambient (range 3.9–6.6 C, n = 10).

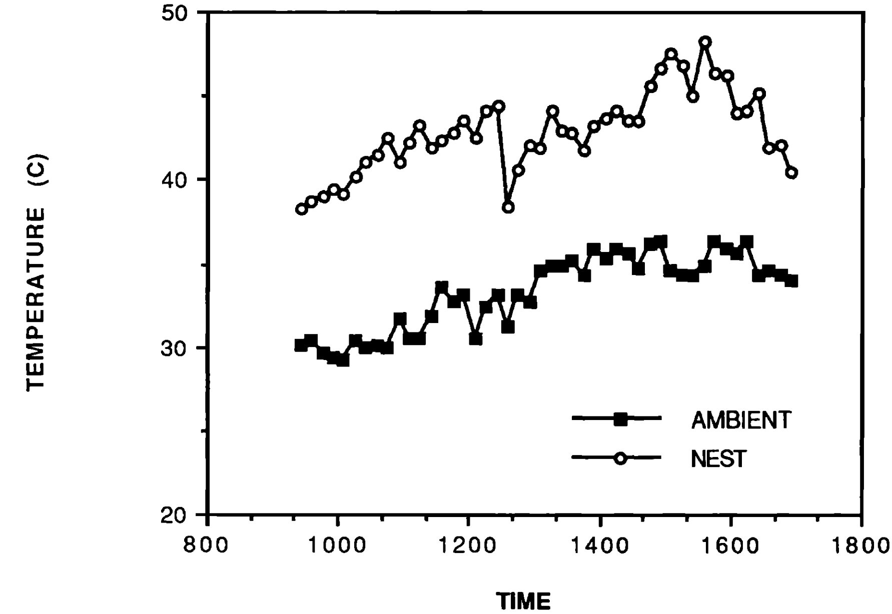

FIGURE 1. Ambient air and nest temperatures at an Ash-throated Flycatcher nest located in a metal fence pole near Hereford, Arizona on 15 Jul. 1985.

In contrast, nests in wooden bluebird boxes were consistently cooler than ambient air temperature (Fig. 2). Nest temperatures of three flycatcher nests in boxes averaged 1.2°, 1.7°, and 0.6 C below ambient during hourly sampling on 3 Jul. 1985. The lower nest temperatures may be due primarily to placement of boxes in shaded sites. One nest box that was in the full sun all afternoon had nest temperatures averaging 3.0 ± 1.4 C above ambient. Similarly, a flycatcher nest located in a natural cavity in a cholla stem fully exposed to the sun had a nest temperature of 37.7 C, 1.9 C above ambient on 9 Jun. 1984.

DISCUSSION

Ash-throated Flycatchers that nested in fence poles routinely experienced nest temperatures highly elevated above ambient air temperature. Temperatures in these nests may approach or exceed lethal levels for a large portion of the afternoon. Avian eggs may be killed by exposure to temperatures of 41.1–48.3 C (Grant 1982, Webb 1987). House Wren eggs failed to hatch when exposed to temperatures between 41–44 C and lethal adult body temperature for passerines has been calculated as 46.8 C (Baldwin and Kendeigh 1932). We recorded temperatures above 41 C in 8 of the 12 pole nests at which we collected sets of hourly temperature samples in 1984 and 1985. Only one of these nests was known to have fledged young.

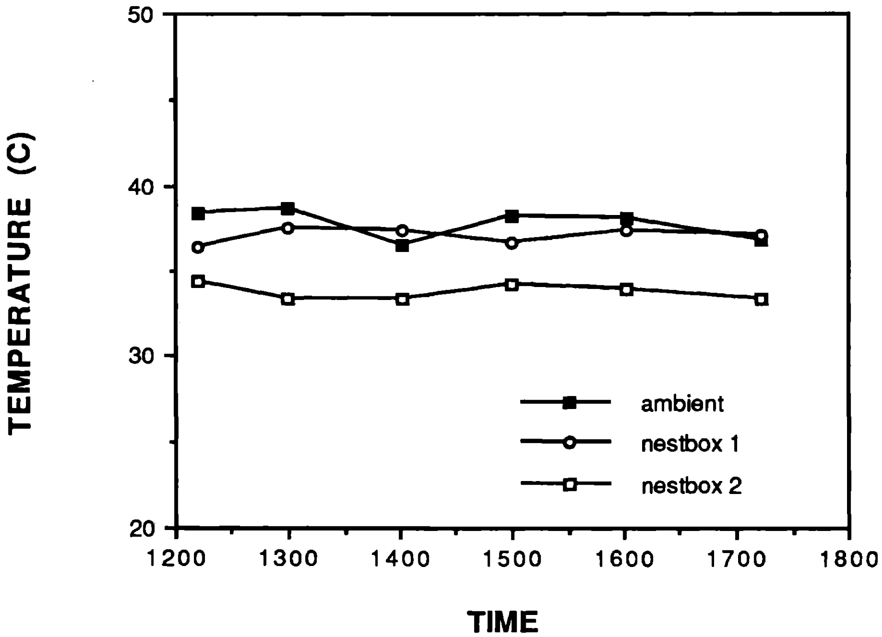

FIGURE 2. Ambient air and nest box temperatures for two flycatcher nests in bluebird boxes in Sonoita, Arizona on 3 Jul. 1985.

Nest failure seemed unusually high for nests in the fence poles. If all nests not known to fail are considered successful, pole-nesting flycatchers in our sample experienced about 40% success. Cavity-nesting species generally have higher fledging success (66%, Nice 1957). In addition, predation and parasitism are usually the most important factors reducing nest success (Ricklefs 1969); however, none of the pole nests were depredated or parasitized. Flycatcher nests in bluebird boxes had a much higher success rate (79%), and only one nest failure in the boxes was not due to predation.

We have no definite proof that high nest temperatures directly killed the eggs or young of unsuccessful pole nests. High nest temperatures could have indirectly caused nest failure by causing the incubating adults to reduce attendance or desert the nest. Temperatures of 46–48 C could be lethal to incubating adults. Data on attendance patterns by adults are necessary to determine if nest temperature has a direct or indirect effect on nest success.

By nesting in man-made structures, Ash-throated Flycatchers in Arizona can breed in areas where no natural cavities exist. Our study suggests that the birds may experience lower fledging success due to lethal nest temperatures as a cost of their opportunistic use of these nest sites. We have noted that certain poles are used repeatedly in subsequent seasons.

A larger study involving banding of adults could determine if these sites are more successful than poles used only once, and whether the same adults are nesting in subsequent attempts.

ACKNOWLEDGMENTS

JBD was supported by a postdoctoral fellowship through the Institute of Ecology, University of Georgia, during the preparation of this manuscript. We thank Jane Church for use of her home and bluebird trail during this study, the University of Arizona for loaning the digital thermometer, and the Tucson Audubon Society for financial support. We also thank the Cochise County Sheriff Department for their tolerance of our "suspicious vehicle" parked along side roads for hours at a time.

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