CURVE-BILLED THRASHER REPRODUCTIVE SUCCESS AFTER A WET WINTER IN THE SONORAN DESERT OF ARIZONA

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Studies of avian reproductive success provide important clues about the relationship between a species' populations and its habitats. Although many species are hard to study because their nests are difficult to locate and assess, the Curve-billed Thrasher (*Toxostoma curvirostre*) is an ideal subject. Its open-cup stick nests are easy to find and often at a height convenient for observing nest contents. For the subspecies in southeastern Arizona (*T. c. palmeri*), the breeding season can begin in late January, but generally nesting does not increase sharply until late March, with a distinct peak from mid-April through mid-May (Corman 2005), The initiation of breeding, however, seems (in part) correlated with the amount of winter precipitation. Two or more wet months in succession lead to food resources sufficient to elicit early nesting (Smith 1971), but earlier clutches may be smaller than those laid later, as early in the season food supplies may be limited (Stahlecker 2003). As food supplies increase, clutch sizes increase (Smith 1971). On the other hand, the success rate of earlier nests may be greater, as important predators of eggs and nestlings, such as snakes, are less active early in the season (Tweit 1996). To assess the Curve-billed Thrasher's nesting chronology and reproductive success after a period of abundant autumn–winter rainfall, I began a study of its nesting near Tucson, Pima County, Arizona, in late January 1979.

The 130-ha study site, within the Sonoran Desert ecoregion (Ricketts et al. 1999), was on the east slope of the Tucson Mountains 3.2 km east-northeast of Gates Pass (111° 06′ N, 32° 13′ W) at an elevation of 793 m. The dominant overstory vegetation consisted of Saguaro cacti (*Carnegiea gigantea*), wolfberry (*Lycium* sp.), mesquite (*Prosopis* spp.), Chainfruit Cholla (*Cylindropuntia fulgida*), and palo verde (*Cercidium* sp.), with an understory predominantly of bursage (*Ambrosia* sp.) and annual forbs. All thrasher nests were easily located during nest building, egg laying, or early incubation, as all were in cholla and usually visible from a distance. I assessed nests' contents weekly by using a bicycle mirror attached to a rib from a decomposed Saguaro. At the Tucson weather station, ~11 km east-southeast of the study site, mean precipitation for October through January 1971–2000 was 9.0 cm, but for October 1978–January 1979 total precipitation was 23.13 cm; October had 4.72 cm, November 4.01 cm, December 6.93 cm, and January 7.47 cm, but February precipitation was below normal (1.07 versus 2.24 cm, respectively). Maximum temperatures from October 1978 through January 1979 averaged 16° C, lower than the 30-year mean of 19° C, perhaps because of increased cloud cover.

In 1979, laying of the first egg by 38 pairs of thrashers ranged from 14 February to 14 March; most laying was in mid-to late February. All 38 nests were in Chainfruit Cholla and averaged 154.9 cm (standard deviation ±27.32 cm) above ground (range 108–212 cm). Mean clutch size was generally smaller (2.53 eggs, standard deviation ±0.56) than reported in other studies of the Curve-billed Thrasher in southeastern Arizona, in which clutch sizes ranged from 2.5 to 3.2 eggs (Tweit 1996). For example, from 1963 to 1968 at nearby Saguaro National Monument, Anderson and Anderson (1973) found a mean clutch size in 86 Curve-billed Thrasher nests of 2.7 eggs. During my study, 19 of 38 clutches (50%) had two eggs, 18 (47%) had three eggs, and one (3%) had four eggs. Nesting success was high; among 38 clutches, at least one egg hatched in 36, for an apparent nest-success rate of 95%. Three other studies of the Curve-billed Thrasher in southeast Arizona during the late 1960s and early 1970s

reported apparent success rates ranging from 58.1 to 63.1% (Tweit 1996). Of the nests I studied, the one with four eggs was destroyed when strong winds displaced it (at 212 cm above ground it was the highest nest), and another clutch was destroyed when the three eggs were punctured. Five eggs from five nests were infertile, for a fertility rate of 94% in 89 eggs. Of the 84 young that hatched, two died when their nest was blown from a cholla, five disappeared from four nests, and 77 fledged. Thus of 96 eggs laid, 80% fledged young, a rate higher than the 44% reported for 54 eggs during an earlier study near Tucson (Edwards and Stacy 1968, in Tweit 1996).

Predation has been identified as the most important factor in mortality of Curve-billed Thrasher eggs and nestlings (Tweit 1996). The vicious spines on the Chainfruit Cholla generally deter mammalian predators, but some local snakes, such as the Red Racer (*Masticophis flagellum*), Common Kingsnake (*Lampropeltis getulus*), and Gopher Snake (*Pituophis catenifer*), are capable of climbing into chollas and are known consumers of eggs and young birds. Predation by snakes, however, has not been reported early in the Curve-billed Thrasher's nesting cycle (Tweit 1996). In the clutch whose three eggs were punctured the punctures were small, suggesting destruction by either a neighboring Cactus Wren (*Campylorhynchus brunneicapillus*) or another Curve-billed Thrasher.

Precipitation above normal from October 1978 through January 1979 was likely responsible for early nesting of the Curve-billed Thrasher in late winter 1979. Temperature did not seem as important, but Edwards and Stacy (1968) reported the species laying as early as 26 January after a mild winter. As reptiles have been implicated as important predators of Curve-billed Thrasher eggs and nestlings, the high success rates in 1979 were perhaps related to the first nesting cycle of the year being completed before snakes emerged. Smith (1971) and Edwards and Stacy (1968) reported rates of nesting and fledging success higher when pairs nested early. Early nesting can be risky, however; 41 mm of a cold rain near Tucson in March 1968 resulted in death for several nestlings 3–6 days old (Anderson and Anderson 1973, Edwards and Stacy 1968).

At the time of this study in 1979, global warming had received little attention, but global climate change and its effect on ecosystem survival are currently at the forefront of numerous biological investigations. If the desert Southwest becomes drier and warmer as predicted, years of early nesting and high nest success, such as I observed in 1979, will become ever less frequent. Much will depend on vegetation changes. Cholla is the principal component of the Curve-billed Thrasher's nesting habitat at least in Arizona, with prickly pear, thorny shrubs, and other species used to a lesser extent. Corman (2005) reported that of 87 nests noted during research for the Arizona Breeding Bird Atlas, 90% were constructed in six species of cholla and that Curve-billed Thrashers avoided the Sonoran Desert where vegetation was sparse and cholla lacking. If a decrease in rainfall eliminates cholla, the thrasher's populations would be affected severely, except perhaps in irrigated urban settings.

My study's original objective was to assess the Curve-billed Thrasher's breeding success after a wet winter followed usually by a cooling trend in March; the winter was wet, but the March cooling did not occur. Stephen Russell suggested the study, and to him I am most grateful. I thank Robert Scholes for reviewing an early draft of the manuscript, and also thank reviewers Mathew Johnson and Robert Tweit, and editors Thomas Gardali and Philip Unitt who provided suggestions for improving a later draft.

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