

Reproductive failure of endangered southwestern willow flycatchers on the Rio Grande,
New Mexico

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REPRODUCTIVE FAILURE OF ENDANGERED SOUTHWESTERN WILLOW FLYCATCHERS ON THE RIO GRANDE, NEW MEXICO

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The willow flycatcher (*Empidonax traillii*) is widely distributed across southern Canada and the United States. The southwestern subspecies (*Empidonax traillii extimus*) breeds primarily in Arizona, New Mexico, and southern California and was listed as federally endangered in 1995 (United States Fish and Wildlife Service, 1995). Southwestern willow flycatchers

are obligate riparian breeders, preferring dense streamside habitat containing tree willow (*Salix gooddingii*), coyote willow (*Salix exigua*), seepwillow (*Baccharis salicifolia*), Fremont cottonwood (*Populus fremontii*), Russian olive (*Elaeagnus angustifolia*), salt cedar (*Tamarix chinensis*), Arizona alder (*Alnus oblongifolia*), or boxelder (*Acer negundo*—Hubbard, 1987).

When found in willow habitats, willow flycatchers appear to prefer nest sites and song perches in larger, denser willow patches and to avoid narrow riparian zones (Sedgwick and Knopf, 1992). Willow flycatcher nests typically are found near rivers (Brown, 1988) or over wet soil (Flett and Sanders, 1987; Harris et al., 1987; Harris, 1991).

Willow flycatcher populations are thought to be threatened primarily by loss of breeding habitat due to livestock grazing (Taylor and Carroll, 1986); invasion by salt cedar; water diversion, impoundment, and channelization; agricultural development; and recreation. Breeding success also is impacted severely by nest parasitism by the brown-headed cowbird (*Molothrus ater*—Sedgwick and Knopf, 1989; Harris, 1991; Brown, 1994; Uyehara and Narins, 1995).

In addition to long-term impacts on young willow stands favored by flycatchers, increased human interference with natural flooding cycles in riparian areas has the potential to affect short-term nesting success. Although willow flycatchers are reported to prefer to nest in flooded areas (Flett and Sanders, 1987; Harris et al., 1987; Harris 1991), the effect of variable river flow rates on nesting success of willow flycatchers has not been documented. In this paper we report several incidents of reproductive failure in two southwestern willow flycatcher populations in New Mexico, focusing on effects of zero flow rates in the Rio Grande during the 1996 breeding season. We suggest a new hypothesis for reproductive failure in southwestern willow flycatchers: that willow flycatchers will not attempt to nest in the absence of flowing water.

We monitored nesting efforts and success in two populations of southwestern willow flycatchers from May to August, 1996. We studied two areas of the Rio Grande River, San Marcial, Socorro Co.; and Velarde, Rio Arriba Co.; New Mexico. The San Marcial area, which is about 335 km south of Velarde, comprises approximately 22 km of riparian habitat along the Rio Grande at the upper end of Elephant Butte Reservoir. This reach is characterized by a high sediment load, low banks, and high flooding probability. Flows are regulated by several upstream dams used for flood control and irrigation supply, and a network of levees reduces the tendency of the river to meander. During

periods of high volume, the river overflows its banks and is contained within levees the length of the study area. The dominant native tree species in the San Marcial area is the tree willow. The area also supports stands of exotic salt cedar, Russian olive, and mixed stands. The majority of flycatcher nesting territories are typically in riverside vegetation between the west bank of the river and the levee.

All four Velarde sites are located in riparian vegetation within 50 m of the Rio Grande and are from 0.5 to 4 km apart. Flow in the river is controlled by upstream dams and irrigation use. Location of three sites between the river and the levee subjects them to flooding when river levels are high. None of the sites was inundated when surveyed in 1996, although in 1995 the three that were surveyed were flooded to a depth of up to 1.5 m (Bureau of Reclamation, in litt.). In 1996, the nearest water to any Velarde territory was in the river or in an irrigation ditch adjacent to the territory edge. The dominant tree species at all Velarde sites is the coyote willow, with lower incidence of cottonwood and Russian olive.

Sites that had been occupied in 1995 were surveyed at least twice in 1996. We used a tape playback method after we received our United States Fish and Wildlife Service (USFWS) Endangered Species Permit on 20 June 1996. Before 20 June we checked previously-occupied territories by listening for willow flycatcher vocalizations, but without playing tapes. Birds were singing as early as late May and so were easily detectable by ear. Second surveys were conducted at least 8 days after the first surveys. For 10 sites, four at Velarde and six at San Marcial, at least one survey was conducted in late May or June and one in early July. Birds were first discovered in three new, southern sites at San Marcial during July and August, and these sites were not visited in June.

Surveying and nest monitoring were conducted according to protocol prescribed by the United States Fish and Wildlife Service. Both were conducted between 0530 and 1100 h MDT. Late-morning surveys were discontinued when it became warm and birds stopped singing. Surveyors approached sites to be surveyed on foot and stopped to listen for flycatcher vocalizations. If willow flycatcher vocalizations were heard, the location of the bird was noted. If no willow flycatcher was detected, taped wil-

low flycatcher song was broadcast for 15–30 sec. After listening for a response for 1–2 min, the tape was again played. This procedure was repeated about every 25 m as surveyors walked through habitat.

Observers sat or stood outside territories inhabited by flycatchers and watched for interactions between males and females. We listened for “whitt” and “creet” calls between pair-mates. If focal areas of activity within territories could be identified, those areas were searched for nests. This technique worked well at Velarde where there were several active nests. However, at San Marcial larger areas had to be searched for the presence of nests. We followed United States Fish and Wildlife Service protocols for nest monitoring, to avoid inducing nest predation. Nests were checked no more than twice weekly, and surveyors left nests by a route different than that used to approach nests.

A mirror mounted on a telescoping pole was used to view nest contents and results were recorded. Presence of cowbirds, water, insects, and livestock was also recorded. A territory was defined as any site where a singing male was detected at least three times over a period of 2 weeks or more, or where a pair was detected at least twice. Territories were spot mapped by noting areas within which a male sang repeatedly. Flow data were obtained from United States Geological Survey (USGS) databases accessed by the Automatic Data Processing system (ADAPS). Flow rates for the 1997 season are still provisional; all other flow data are final (ADAPS).

Compared with previous years at San Marcial, the incidence of willow flycatcher nesting was greatly reduced in 1996. Although nine flycatcher territories were thoroughly searched (first detected 26 May to 1 August), and at least four males were paired, only one nest was detected. That nest was empty when checked on 23 July, and willow flycatcher eggshell fragments were found on the ground under the nest. During 12 visits to the territory (27 June–13 August) no fledglings were detected with the parents, suggesting that the nesting attempt failed. In contrast, flycatchers nested in at least five territories in 1994 and all five territories in 1995 (New Mexico Natural Heritage Program, in litt.). In 1997, there were two successful nests at San Marcial; five territorial males remained unpaired. Three males were heard singing at a site that traditionally held

TABLE 1—Mean monthly flow rates, cubic feet per second (cfs) in the Rio Grande at San Marcial (station 0835840) and Velarde (station 08279500), New Mexico, 1994–1997. Data were obtained from United States Geological Survey (USGS) databases accessed by the Automatic Data Processing System (ADAPS) of the USGS National Water Information System. Data for 1997 are provisional; data from all other years have been finalized by the USGS.

	May	June	July	August
San Marcial				
1994	3,745	3,684	343	514
1995	3,656	4,007	3,851	419
1996	0	78	339	193
1997	2,575	3,277	498	868
Velarde				
1994	3,438	2,378	427	288
1995	2,141	3,958	3,540	538
1996	406	268	244	245
1997	2,380	3,038	846	891

three breeding pairs, but because Bureau of Reclamation investigators were denied access by landowners, it is not known whether nesting occurred on those three territories in 1997 (A. Coykendall, pers. comm.).

In 1996, the Rio Grande at San Marcial was completely dry during the early part of the flycatcher breeding season. This period of zero flow lasted from 10 April to 29 June 1996. Once water was present in the river, it remained for only about three weeks. By 22 July, water flow at San Marcial was again at zero cubic feet per sec (cfs) and remained there until the end of the breeding season in mid-August, resulting in a total of 100 dry days from April to August (ADAPS).

By contrast, in 1994, when five nests were detected, water was present for most of the nesting season and mean flows were appreciably higher than in 1996 (Table 1). Flow fell to zero for only 15 days in July, 1994 (ADAPS). In 1995, when all five territorial pairs nested, mean flows were similar to those in 1994 (Table 1). Eight days in 1995 showed estimated flows of zero. They occurred after 12 August, too late for willow flycatcher nest starts. Mean monthly flow rates were again normal in 1997 (Table 1), but political tensions prevented researchers from acquiring complete nesting data.

In 1996 and 1997 five territorial males remained unpaired at San Marcial, suggesting that

TABLE 2—Impacts on willow flycatcher nesting attempts on the Rio Grande, New Mexico, 1996. Note that some nests suffered more than one impact; e.g., Velarde nest 2 was both parasitized and predated, but the cowbird egg disappeared from the nest. It is not known whether San Marcial nest 1 was parasitized, because we discovered it after it had been predated.

	Detection date	Parasitized	Predated	Abandoned
Nest				
San Marcial 1	7/23/96	?	X	
Velarde 1	7/1/96		X	
Velarde 2	6/28/96	X	X	
		(cowbird egg disapp.)		
Velarde 3	7/15/96	X		X
Velarde 4	6/28/96		X	
Proportion		2/4	4/5	1/5

a shortage of females may be another cause for low reproductive rates at that location. The inability of males to acquire mates may be symptomatic of a larger threat such as a male-biased sex ratio or a senescing population.

Flycatchers had been detected at three Velarde sites in 1995 (25 May to 15 June, Bureau of Reclamation, in litt.). In 1996, we found two of these sites again occupied, with another pair at a fourth Velarde site. Four nests were located between 12 June and 1 July. Two were parasitized; three were predated, and one parasitized nest was abandoned (Table 2).

No nest monitoring data exist from Velarde in 1994–1995, but apparently-territorial flycatchers were detected during two surveys each in 1994 (one male, New Mexico Department of Game and Fish, in litt.) and 1995 (six males, Bureau of Reclamation, in litt.). The 1995 number is similar to the number of territorial males we found at Velarde in 1996 (five). Nesting was attempted on five territories again in 1997. Due to concern over the possibility that observers were inducing predation or parasitism, the monitoring procedure was changed in 1997. Observers did not visit nests during construction or laying stages in 1997, and duration and number of nest checks were minimized. In spite of these precautions, failure rate was similar to that in 1996 (A. Coykendall, pers. comm.).

In contrast to San Marcial, water remained in the river at Velarde throughout the 1996 nesting season. Flow ranged from 404 cfs on May 15 to 210 cfs on 22 July 1996. These flow rates were low compared to 1994, 1995, and 1997 (Table 1); however, rates never reached

zero and all three mated pairs at Velarde attempted nests in 1996.

In this study, reproductive failure in 1996 was absolute at both study areas, but causes for failure at the two locations were quite different. At Velarde in 1996, where water flowed in the river throughout the nesting season, three of four nesting attempts apparently were predated and one was abandoned, possibly due to cowbird parasitism (Table 2). Two of those four nests contained a cowbird egg. Because the cowbird egg disappeared from one nest, cowbird parasitism appeared to be a potential cause of nest failure for only one nest, although cowbirds cannot be ruled out as predators. In 1997, failures at Velarde were again apparently due to predation (three nests) or parasitism (two nests—A. Coykendall, pers. comm.).

At San Marcial, the near absence of nesting attempts on the nine 1996 territories was striking. We suggest that paired males may have failed to nest in 1996 because there was no water in the Rio Grande for most of the breeding season. Land use, including grazing, did not change appreciably between 1995 and 1996. The lack of water could be a direct cue itself or it may be the ultimate cause of more proximate factors such as reduced humidity or low insect availability. The absence of water may also explain why three birds established territories at one traditional San Marcial site in May, 1996, but abandoned those territories in mid-June (two) and early July (one).

Both within-year comparison of Velarde and San Marcial results for 1996, and between-year comparison of sites at San Marcial suggest that

presence of water in the river channel could be a minimal requirement for nesting. Over-bank inundation of willow flycatcher territories may also be important to encourage nesting. Flow rates are typically lower during the months of July and August than in May and June, even in good nesting years. Thus, presence of water in the river during May and June may be most crucial.

Flow rates in the Rio Grande result from several factors. The drought of 1996 was one cause of reduced flow rates. However, human use patterns also contributed to the total absence of water in the Rio Grande for much of the summer of 1996. This study suggests that in a year of winter drought such as 1996, water management practices could have significant impacts on reproductive success of the endangered southwestern willow flycatcher.

It is unusual to find the Rio Grande riverbed completely dry for weeks at a time. The 100-day dry period in 1996 is the only one in the 4 years that willow flycatchers have been monitored on the Rio Grande in New Mexico. For this reason, and because population sizes of willow flycatchers on the Rio Grande are perpetually small, it is not possible to rigorously test our hypothesis. However, it is likely that changing global climate patterns and current water management practices in the southwestern United States may provide future opportunities to examine this hypothesis more closely.

In summary, southwestern willow flycatchers on the Rio Grande, New Mexico, apparently experience multiple threats to successful reproduction, including cowbird parasitism, predation, and the inability of paired males to acquire mates. We suggest that weather patterns, along with water management practices, may also impact southwestern willow flycatcher reproduction. The number of different potential impacts, variation in their importance between locations and among years, and land ownership issues, present a complex and challenging conservation problem.

Resumen—Resumimos las causas del fracaso de anidar en el ave papamoscas sauce del sudoeste en dos lugares distintos cerca del Río Grande, en Nuevo México, entre los años 1994 y 1997. Nos enfocamos en los efectos del flujo bajo del Río Grande durante la temporada de anidar en 1996. En Velarde, donde el agua se

mantuvo en el río durante 1996 y 1997, todos los intentos de anidar fracasaron debido a la depredación o al parasitismo. En San Marcial, las aves papamoscas anidaron en por lo menos cinco territorios en 1994 y 1995, pero sólo un par intentó anidar en 1996. Sugerimos que las aves papamoscas no intentaron anidar en San Marcial en 1996 porque no había agua en el río durante la mayoría de la temporada de anidar. También, cinco machos territoriales se mantuvieron desparejados en 1996 y en 1997, indicando que la inhabilidad de los machos por adquirir parejas puede ser otro factor que afecta el éxito de reproducción en San Marcial. Las múltiples amenazas al éxito reproductivo, y la variación en su importancia entre sitios y años, presentan un problema de preservación complejo y desafiante.

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NOTEWORTHY RECORDS OF MAMMALS FROM MICHOACÁN, MÉXICO

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Michoacán is located in west-central México, where there is extreme topographic variation. Thus, the state has a high diversity of climatic regions and vegetation types, and there is considerable interface or interdigitation between Nearctic and Neotropical biota. Of the ca. 450 species of terrestrial mammals recorded from México, Michoacán has 170 (38 percent, including the records cited herein), of which 23 percent are endemic to México. This state has received considerable attention from mammalogists (Hall and Villa R., 1950; Álvarez, 1968; Uribe et al., 1981; Sánchez Hernández et al., 1985; Polaco and Muñoz-Martínez, 1987; Huerta M., 1989; Sánchez Hernández et al., 1992; Núñez-Garduño et al., 1996), but knowledge about the distributions, habitat preferences, and reproduction for mammals from this state is still limited. In 1992 three of us (RDO, RLW, CSH) developed a plan to survey the small mammals of Michoacán. Preliminary collections had been made by CSH and some of his students since 1977, but intensive work did not begin until 1994 and 1995, when we made comprehensive field collections and examined specimens deposited at several museums in México and the United States. In this preliminary report we document seven new species for the state and provide additional records for

four other species. The new state records represent an increase of 4.3 percent above the previous number of 163 terrestrial species, indicating that the mammalian fauna for this region still deserves further investigation.

Specimens from existing museum collections are indicated by their catalog numbers and museum initials, as follows: FMNH, Field Museum of Natural History; KU, Museum of Natural History, University of Kansas; UMSNH, Universidad Michoacana de San Nicolás de Hidalgo; IBUN-AM, Instituto de Biología, Universidad Nacional Autónoma de México. Uncataloged specimens are listed by field catalog number, using the following initials for collector: AERM, Alberto Enrique Rojas-Martínez; ANG, Arturo Núñez-Garduño; CBCT, Catalina Beatriz Chávez-Tapia; CSH, Cornelio Sánchez-Hernández; DGR, David Garrido; MLRA, María de Lourdes Romero-Almaraz; RHM, René Hinojosa-Mercado. External, embryo, and testis measurements are in millimeters and mass is in grams.

Peropteryx macrotis macrotis (Wagner, 1843). Tancítaro, 19°20'45"N, 102°22'14"W. 1 female (FMNH 51431). This adult, lactating female was collected on 19 August 1940. This is the first record of *P. macrotis* from Michoacán, and the locality is 365 km NW of the nearest reported locality (5 km S Agua de Obispo, Guer-