SYNTOPIC CULVERT NESTING OF CAVE AND BARN SWALLOWS IN TEXAS

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THE Cave Swallow (*Petrochelidon fulva*) previously has been thought to be isolated ecologically from other hirundinids in Texas, narrowly restricted in its breeding sites to sinkholes and the twilight zones of caves (Selander and Baker 1957, Whitaker 1959, Baker 1962, Reddell 1967, see Wauer and Davis 1972 for isolated exceptions). Recently its spatial relationships have changed: *P. fulva* has expanded its breeding niche in the United States to include habitats altered by human activity and has entered into more intimate contact with other swallows. Preliminary to a detailed analysis of distribution, reproductive biology, and interspecific relationships in culvert-nesting Cave and Barn Swallows (*Hirundo rustica*), this report details their extensive synchronous and syntopic reproduction in south central Texas.

STUDY AREA

The primary area of study is a transect coincident with U.S. Highway 90, lying just south of the southern margin of the Edwards Plateau and spanning an east-west distance of approximately 200 km (Fig. 1). In this portion of south central Texas, a steep moisture gradient exists: average yearly rainfall decreases linearly westward from near the transect's initial point (72.3 cm/year) at Hondo to its terminus (41.1 cm/year) near Comstock (Natl. Oceanic and Atmospheric Admin. 1970, 1971a, 1971b, 1971c, 1971d). Land use reflects this gradient: the eastern half of the study area is farmed; the western half grazed.

Tributaries of the Nueces and Rio Grande Rivers flow south and southeast through the area, draining the Edwards Plateau and passing through concrete culverts beneath the highway. Cave and Barn Swallows nest colonially or semi-colonially in these culverts, sometimes isolated by species but usually intermingled in intimate syntopy. Culverts are composed of from one to 12 passageways (tubes) that are rectangular in cross section and range from 12 to 28 m in length, 1 to 2.8 m in height, and 1 to 3 m in width. Substrate conditions in culverts vary with rainfall patterns and topography. Some remain dry throughout most of the breeding season; others possess permanent or semipermanent running or standing water of variable depth; flooding sometimes occurs. Nests are usually located on the most elevated 15% of the walls of the tubes; distances separating them range from less than 0.2 m to over 5 m.

Reproductive data were recorded biweekly from 7 April to 15 September 1973 in 75 culverts along the transect; each traverse of the study area took 2 days. Additional data were gathered in culverts beneath highways north and south of the transect in an attempt to delineate further the extent of nesting syntopy.

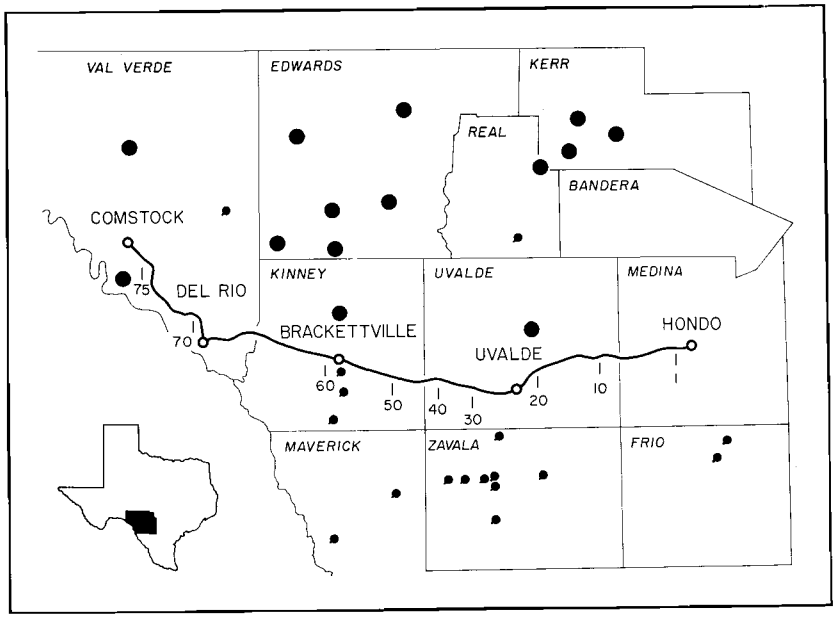

Fig. 1. Distribution of syntopic culvert-nesting Cave and Barn Swallows in central Texas. Counties italicized; cities located by open circles. Initial, terminal, and each tenth culvert of study transect indicated by numbered vertical dashes. Small tagged dots represent off-transect syntopic nesting sites. Large dots represent central Texas cave and sinkhole colonies of Cave Swallows reported to be active recently by Selander and Baker in 1957.

Results

Data on spatial and temporal distribution of breeding adults of both species and total numbers of hatched clutches are summarized in Table 1. Fig. 1 shows locations of initial, terminal, and each tenth culvert of the transect. The earliest data were collected 7 April; at this time *P. fulva* and *H. rustica* were present across the transect and in several places both species were incubating. The frequency of clutch initiation increased through April into May, then decreased through the remainder of the season, ceasing in late August. In both species some nests were active through early September. The latest dates at which young were seen in nests were: *P. fulva*, 8 September; *H. rustica*, 15 September.

Culverts 1 through 7 and 10 through 21 contained only Barn Swallows. The easternmost transect Cave Swallow nest was in culvert 8, 25 km west of Hondo in western Medina County. This culvert and culvert 9 (27 km west of Hondo) displayed syntopy discrete by 32 km from the main body of intermingled nesting (Fig. 1, Table 1); only one nesting

TABLE 1

DISTRIBUTION OF SYNTOPIC CULVERT-NESTING CAVE AND BARN SWALLOWS ALONG U.S. HIGHWAY 90 IN TEXAS[1]

Culvert No.	Date												Total clutches hatched	
	7 Apr.	18 Apr.	2 May	15 May	30 May	15 Jun.	4 Jul.	18 Jul.	1 Aug.	15 Aug.	30 Aug.	15 Sep.	No. C	No. B
1–7	Nonsyntopic (*Hirundo rustica* only)													
8	—	—	CB	CB	CB	CB	CB	CB	CB	B	—	—	2	9
9	—	B	B	B	B	B	CB	CB	CB	B	—	—	1	8
10–21	Nonsyntopic (*Hirundo rustica* only)													
22	—	—	CB	CB	CB	CB	CB	CB	B	B	B	—	3	14
23	CB	CB	CB	CB	CB	CB	CB	B	B	B	B	—	5	39
24	B	B	B	B	B	B	B	B	B	B	—	—	0	10
25	—	—	C	CB	CB	CB	CB	CB	CB	B	—	—	14	3
26	—	—	B	B	B	B	B	B	B	B	B	—	0	16
27	—	C	C	CB	CB	CB	CB	CB	CB	B	B	—	20	9
28	CB	CB	CB	CB	CB	CB	CB	CB	CB	CB	B	—	21	22
29	B	B	CB	CB	CB	CB	CB	CB	CB	—	—	—	3	8
30	—	B	B	B	B	B	B	B	B	B	—	—	0	9
31	—	—	CCB	CCB	CCB	CB	CB	CB	CB	CB	CB	—	20	12
32	CB	CB	CB	CB	CB	CB	CB	CB	CB	CB	CB	—	20	26
33	—	—	—	C	C	CB	CB	CB	CB	B	—	—	2	2
34	B	B	CB	CB	CB	CB	CB	CB	—	—	—	—	9	12
36	B	B	CB	C	C	C	CB	CB	CB	CB	CB	—	27	6
37	C	CB	CB	CB	CB	CB	CB	CB	CB	CB	CB	B	14	13
38	—	—	C	C	C	CB	CB	CB	B	—	—	—	9	2
39	—	—	B	B	B	—	—	—	—	—	—	—	0	3
40	B	CB	CB	CB	CB	CB	CB	CB	CB	CB	CB	—	70	64
41	B	B	CB	CB	CB	B	B	B	—	—	—	—	4	8
42	—	—	CB	CB	CB	CB	CB	CB	B	B	B	—	6	17
43	—	B	CB	CB	CB	CB	CB	CB	B	B	B	—	12	26
44	—	—	CB	CB	CB	CB	CB	CB	CB	CB	CB	—	14	38
45	—	—	B	CB	CB	CB	CB	CB	CB	B	—	—	2	15
46	—	—	B	CB	CB	B	B	B	B	B	B	—	0	10
47	—	—	B	B	B	B	CB	CB	CB	B	B	—	1	9
48	—	—	CB	CB	CB	CB	CB	CB	CB	CB	CB	—	42	54
49	C	C	C	C	C	C	CB	C	—	—	—	—	15	1
50	—	—	B	B	B	B	CB	CB	B	B	B	—	1	4
51	—	C	CB	CB	CB	CB	CB	CB	B	B	B	—	39	3
52	—	—	CB	CB	CB	CB	CB	CB	B	—	—	—	25	7
53	—	—	—	B	B	CB	CB	CB	B	B	—	—	1	6
54	C	C	CB	CB	CB	CB	CB	CB	CB	CB	CB	B	97	15
55	—	—	C	C	C	CB	CB	C	C	C	C	—	26	2
56	—	—	CB	CB	CB	CB	CB	CB	CB	B	B	—	14	19
57	—	—	C	CB	CB	CB	CB	CB	CB	CB	B	—	24	9
58	B	B	CB	CB	CB	CB	CB	CB	B	—	—	—	12	18
60	—	—	B	B	B	B	B	B	B	B	B	—	0	22
61	—	B	CB	CB	CB	CB	CB	CB	CB	B	—	—	4	13
62	B	B	B	B	B	B	B	B	B	B	B	—	0	19
63	—	—	B	B	B	B	B	B	B	B	B	—	0	8
64	—	—	B	CB	CB	B	B	B	B	B	B	—	1	43
65	—	B	B	CB	CB	CB	CB	CB	B	B	B	—	4	18
66	—	—	B	CB	CB	CB	CB	CB	CB	—	—	—	2	15
67	—	—	—	B	B	B	B	B	B	B	B	—	0	25
68	—	—	CB	CB	CB	CB	CB	B	B	B	B	—	2	19
69–75	Nonsyntopic (*Hirundo rustica*; some *P. pyrrhonota*; see text)													

[1] Symbols: C = Cave Swallows nesting, B = Barn Swallows nesting, CC = Cave and Cliff Swallows nesting (Culvert 31).

pair of *P. fulva* was present in each. Essentially contiguous syntopic nesting began at Uvalde and continued westward to just west of the Val Verde County boundary; the culverts of the remainder of the transect contained only Barn Swallows and in one instance syntopic Barn Swallows and Cliff Swallows (*Petrochelidon pyrrhonota*). Culvert 31, in addition to those of *P. fulva* and *H. rustica*, contained one active nest of Cliff Swallows.

Synchronous culvert syntopy also occurred off the transect (Fig. 1); for these situations, only rough estimates of numbers of birds nesting are presented (Table 2). In addition to culverts, both species nested together in a large abandoned grain shed near Brackettville. Two further occurrences of *H. rustica*, *P. fulva*, and *P. pyrrhonota* syntopy were recorded in Frio County. In these culverts, synchrony could not be determined positively. Central Texas Cliff Swallows usually complete breeding much earlier than Cave and Barn Swallows, and on the date visited (22 July) only nests of *P. fulva* and *H. rustica* were active, although many nests of *P. pyrrhonota* appeared recently occupied, judging by the presence of active vermin and fresh fecal piles.

Discussion

In the United States, nesting swallows have in general adapted successfully to environmental conditions disturbed or otherwise modified by human activity (Bent 1942, Allen and Nice 1952, Mayhew 1958, Samuel 1971). Several apparently have benefited by this relationship and become strongly associated with man's activities. Although closely related to the ecologically versatile *P. pyrrhonota*, this has not been the case for *P. fulva* in the U.S. Despite reports of its use of buildings in north central Mexico (Whitaker 1959, Baker 1962), north of the Mexican boundary its breeding appears to have been limited exclusively to caves and sinkholes. In fact some U.S. students have considered it potentially endangered here because of its geographically and ecologically restricted breeding habits: Selander and Baker (1957) reported only 14 active breeding sites on the Edwards Plateau of central Texas; Baker (1962) subsequently published a western Texas location. Later Reddell (1967, 1971) added 14 additional Texas sites. Four of these (Brewster, Culberson, Presidio Counties) significantly increased the known distribution of *P. fulva* in far west Texas; the others increased the range of the central Texas population only slightly. Only two sites are reported from New Mexico (Kincaid and Prasil 1956, Baker 1962).

Although *P. fulva* nests with other swallows in arid parts of north central Mexico (Whitaker 1959, Baker, 1962), in the U.S. it has been

TABLE 2

DISTRIBUTION OF SYNTOPIC CULVERT-NESTING CAVE AND BARN SWALLOWS IN CENTRAL TEXAS (NONTRANSECT)

County	Location	Approximate No. breeding pairs	
		Cave Swallow	Barn Swallow
Frio	Pearsall, 5.0 km N	>10	>20
	" 7.4 km N	>10	>20
Kinney	Brackettville, 0.6 km S	>30	> 3[1]
	" 1.2 km S	> 1	> 1
	" 4.3 km S	>10	> 5
	" 8.0 km S	>20	>20
Maverick	Eagle Pass, 3.1 km NE	2	>10
	" 13.6 km NE	>10	>10[1]
Real	Leakey, 1.2 km S	> 5	> 2
Val Verde	Del Rio, 18.6 km N	> 4	>14
Zavala	La Pryor, 0.6 km W	>10	>10
	" 1.9 km W	> 5	> 5
	" 4.3 km W	> 5	> 5
	" 4.7 km W	> 5	> 5
	" 6.2 km W	>10	>10
	" 6.8 km W	>30	> 5
	" 7.1 km W	> 5	> 5
	" 6.2 km E	>20	> 1
	" 5.6 km N	> 1	> 5[1]
	" 1.9 km S	>10	>10[1]
	" 5.0 km S	> 4	>14

[1] Barn swallows estimated by flying adults only.

strongly isolated from members of its family (Selander and Baker 1957) and only a single instance of its breeding with another hirundinid has been reported (Wauer and Davis 1972).

Presently the situation is altered; not only have the types of nesting sites used (and available) increased significantly, but the range of the species in Texas has expanded to the south and southeast, raising the possibility of continued expansion into flatland non-Karst topography. As a consequence, intimate and relatively widespread breeding syntopy has developed with the Barn Swallow and potentially with the Cliff Swallow.[1] In this situation, the species involved are subjected to potential hazards: increased competition, vulnerability to disease or parasitism, and breakdown of reproductive isolating mechanisms, among others; the danger to populations of *P. fulva* seems to be the greater. Thus the situation presents an excellent opportunity to study the consequences of recent breakdown of ecological segregation. Several pertinent questions

[1] In reponse to discussion of this situation, K. Arnold (pers. comm.) reports he has recently (July 1973) found *P. fulva* nesting syntopically with *H. rustica* in one culvert, and with *P. pyrrhonota* in another near Fort Stockton, Texas.

arise: Are culverts marginal nesting habitat for *P. fulva*—utilized only when "prime" sinkhole-cave habitat is saturated—or are culvert populations self-sustaining? Is syntopy an equilibrium condition or will decrease in numbers or displacement of one species occur? To answer these questions and others, a long-term study of the reproductive biology of both species in altered and original nesting habitat is presently underway.

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SUMMARY

The Cave Swallow recently has expanded its range and breeding niche in central Texas considerably. As in several other swallows, this has been accomplished by entering a man-altered habitat. At present, it has broken its U.S. isolation to caves and sinkholes and also nests syntopically and synchronously in culverts with Barn Swallows in large numbers. Cliff Swallow syntopy also is present and may be considerable. This altered relationship offers several potential hazards to the species involved and provides an excellent opportunity to study competitive equilibria.

LITERATURE CITED

ALLEN, R. W., AND M. M. NICE. 1952. A study of the breeding biology of the Purple Martin (*Progne subis*). Amer. Midl. Naturalist 47: 606–661.

BAKER, J. K. 1962. Associations of Cave Swallows with Cliff and Barn Swallows. Condor 64: 326.

BENT, A. C. 1942. Life histories of North American flycatchers, larks, swallows, and their allies. U.S. Natl. Mus. Bull. 179.

KINCAID, E., AND R. PRASIL. 1956. Cave swallow colony in New Mexico. Condor 58: 452.

MAYHEW, W. W. 1958. The biology of the Cliff Swallow in California. Condor 60: 7–37.

NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION. 1970. Local climatological data: Comstock, Texas. U.S. Dept. Commerce.

NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION. 1971a. Local climatological data: Brackettville, Texas. U.S. Dept. Commerce.

NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION. 1971b. Local climatological data: Del Rio, Texas. U.S. Dept. Commerce.

NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION. 1971c. Local climatological data: Hondo, Texas, U. S. Dept. Commerce.

NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION. 1971d. Local climatological data: Uvalde, Texas. U.S. Dept. Commerce.

REDDELL, J. R. 1967. A checklist of the cave fauna of Texas. 3, Vertebrata. Texas J. Sci. 19: 184–226.

REDDELL, J. R. 1971. A checklist of the cave fauna of Texas. 6, Additional records of Vertebrata. Texas J. Sci. 22: 139–158.

SAMUEL, D. E. 1971. The breeding biology of Barn and Cliff Swallows in West Virginia. Wilson Bull. 83: 284–301.

SELANDER, R. K., AND J. K. BAKER. 1957. The Cave Swallow in Texas. Condor 59: 345–363.

WAUER, R. H., AND D. G. DAVIS. 1972. Cave Swallows in Big Bend National Park, Texas. Condor 74: 482.

WHITAKER, L. M. 1959. Cave Swallow nesting in building near Cuatro Ciénegas, Coahuila, Mexico. Condor 61: 369–370.

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