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Black-Capped Vireo Recovery Plan

Joseph A. Grzybowski
Central State University, Edmond, OK

BLACK-CAPPED VIREO

RECOVERY PLAN



U.S. FISH AND WILDLIFE SERVICE
REGION 2, ALBUQUERQUE, NEW MEXICO

1991

BLACK-CAPPED VIREO
(Vireo atricapillus)
RECOVERY PLAN

Prepared by: Joseph A. Grzybowski, Ph.D.
Department of Biology
Central State University
Edmond, OK 73034-0186

For: U.S. Fish and Wildlife Service
Region 2

Edited by: Alisa M. Shull
U.S. Fish and Wildlife Service
611 East Sixth Street, Fourth Floor
Austin, TX 78701

Approved: 
Regional Director, U.S. Fish and Wildlife Service

Date:

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The cover drawing is by Mary P. Gilroy and was provided compliments of DLS Associates, Austin, Texas.

EXECUTIVE SUMMARY OF THE RECOVERY PLAN FOR THE BLACK-CAPPED VIREO

Current Species Status: This species is listed as endangered. The number of individuals is unknown. However, it has undergone substantial range reduction in Kansas, Oklahoma, and Texas. It is extirpated in Kansas, and the Oklahoma population is below 300 birds. Declines have also been documented over much of the species' range in Texas. Its status is uncertain in Coahuila, Mexico.

Habitat Requirements and Limiting Factors: The black-capped vireo occurs in mixed deciduous/evergreen shrubland. Breeding vireos use shrubby growth of irregular height and distribution with spaces between the small thickets and clumps and with vegetative cover extending to ground level. Habitat losses are occurring through development, overbrowsing, and suppression and alteration of natural disturbance regimes. Cowbird nest parasitism has been drastically reducing vireo reproduction in many areas.

Recovery Objective: Downlisting

Recovery Criteria: All existing populations are to be protected and stabilized; and at least one viable breeding population (of at least 500 to 1,000 breeding pairs each) should exist in each of six regions, including one in Oklahoma, one in Mexico, and four in Texas; and sufficient and sustainable area should exist to support the birds when they are on their winter range; and all of the previously mentioned criteria should have been maintained for at least 5 consecutive years and assurance should exist that they will continue to be maintained. Threats from habitat loss, cowbird parasitism, and other factors will need to be resolved.

Actions Needed:

1. Additional surveys.
2. Clarify population size, area requirements, and location needs for viable populations.
3. Maintain viable populations in target areas.
4. Conduct research on species' biology, habitat needs and management, threats, and winter range.
5. Eliminate threats from cowbird nest parasitism, habitat deterioration, and other agents.
6. Develop and conduct a program for monitoring the vireo's status.

Estimated Cost of Recovery for First Three Years:

FY 1 - \$16,274,000.
FY 2 - \$16,409,000.
FY 3 - \$16,434,000.

Date of Recovery: Current requirements for downlisting to threatened should be met by 2020, assuming full implementation of this plan. However, these populations may not be self-sustaining because of cowbird impacts. More information is needed to determine the potential for complete recovery and delisting. Therefore, time of delisting is uncertain.

DISCLAIMER PAGE

Recovery plans delineate reasonable actions that are believed to be required to recover and/or protect listed species. Plans are published by the U.S. Fish and Wildlife Service, sometimes prepared with the assistance of recovery teams, contractors, State agencies, and others. Objectives will be attained and any necessary funds made available subject to budgetary and other constraints affecting the parties involved, as well as the need to address other priorities. Recovery plans do not necessarily represent the views nor the official positions or approval of any individuals or agencies involved in the plan formulation, other than the U.S. Fish and Wildlife Service. They represent the official position of the U.S. Fish and Wildlife Service only after they have been signed by the Regional Director or Director as approved. Approved recovery plans are subject to modification as dictated by new findings, changes in species' status, and the completion of recovery tasks.

LITERATURE CITATIONS

Literature citations should read as follows:

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Table of Contents

Disclaimer	i
Literature Citation	ii
Acknowledgments	iii
Executive Summary	iv
Table of Contents	v
Tables	vi
Figures	vi
I. Introduction and Background	1
A. Taxonomic and Legal Classification	1
B. Description	2
C. Distribution and Population Estimates	3
D. Life History	17
E. Habitat	20
F. Threats/Reasons for listing	24
G. Conservation Measures Already Initiated	32
H. Recovery Strategy	34
II. Recovery	36
A. Objectives and Criteria	36
B. Recovery Outline	37
C. Narrative Outline for Recovery Actions	39
D. References	47
III. Implementation Schedule	52
IV. Appendix - Comments	61

<u>Tables</u>	<u>Page</u>
Table 1. Black-capped vireo recent (1970-1989) Texas localities.	9
Table 2. Numbers of black-capped vireos counted by state and region (1985 to 1990).	14

<u>Figures</u>	
Figure 1. Probable historic breeding range of the black-capped vireo (Graber 1961).	4
Figure 2. Documented and possible winter ranges of the black-capped vireo (adapted from Graber 1957, Marshall <i>et al.</i> 1985).	5
Figure 3. Current black-capped vireo distribution in Oklahoma.	6
Figure 4. Texas counties known to be occupied by breeding black-capped vireo (Sexton <i>et al.</i> unpubl. MS) in 1990.	8
Figure 5. Locations of some key sites mentioned in the text.	13
Figure 6. Northern Coahuila, Mexico, showing mountain ranges that may provide black-capped vireo habitat. Symbols indicate location of museum records and sightings (Benson and Benson 1990, Marshall <i>et al.</i> 1985).	16
Figure 7. Natural regions and subregions of Texas as modified from Oberholser (1974) and U.S. Fish and Wildlife Service (1979).	35

I. INTRODUCTION AND BACKGROUND

A. TAXONOMIC AND LEGAL CLASSIFICATION:

Family: Vireonidae

Scientific name: Vireo atricapillus Woodhouse

Common name: Black-capped vireo

Original description: Woodhouse (1852)

Type specimen: National Museum Natural History no. 15040 collected 26 May 1851 "on the Rio San Pedro, two hundred and eight miles from San Antonio..." (= Devil's River, near Juno, Val Verde County, Texas (Sexton and Tomer 1991)).

Distinctiveness: Believed most closely related to V. nelsoni, the dwarf vireo of southwestern Mexico, which is similar in plumage (except cap color). A few authors believe that dwarf and black-capped vireos may be conspecific. With Bell's vireo (V. bellii), they may form a superspecies complex (Phillips 1968, Barlow 1980, Barlow pers. comm.).

Listed: Endangered, (Federal Register 52:37420-37423, October 6, 1987); became effective 30 days (November 5, 1987) after publication.

Recovery priority: 2C (According to the Service's criteria this indicates a species with a high degree of threats, high potential for recovery, and in conflict with construction or development projects or other forms of economic activity).

B. DESCRIPTION

General: One of the smallest of the vireos; 9-10 g, 11-12 cm (4.5 in.). Unique among vireos in being sexually dichromatic (sexes are different colorations), and in showing delayed plumage maturation (Rohwer *et al.* 1980) in first-year males.

Plumage and soft parts: Detailed descriptions are provided in Graber (1957) and Oberholser (1974). Adult males (=ASY male, after second calendar year in age) are olive green on the back, white below with flanks tinged yellow to yellowish green. The head is black with prominent spectacles, white on lores, but interrupted over the eye. The bill is black, iris brownish red to red, feet dull gray (plumbeous). The wings and tail are dark olive to blackish. The tertial and secondary coverts are broadly rimmed with pale yellow forming two wing bars. Some adult males show gray rather than black on the lower portions of the nape. The male in the first breeding season (=SY male, male in his second calendar year) is similar to the adult male, but the nape and posterior crown in most birds is extensively gray rather than black.

Adult females generally have a gray head but some look more like the SY male with blackish variably extending around the spectacles and forward portions of the crown. Young of the year in first winter plumage are similar to adult females, but with a brown rather than a reddish brown iris. Some variation occurs in gray on the cap and in the amount of buff on the spectacles and throat. Juveniles are like young in first winter plumage, but generally paler, more whitish underneath, and with less clearly delimited cap and spectacles.

Distinction from other vireos: A black and/or gray cap, and reddish eye separates adults from other vireo species. Most similar is the dwarf vireo, which is identical except for a greenish gray cap. Females and juveniles may be confused with the much larger solitary vireo (*V. solitarius*; at 20 g), but female black-capped vireos show a red eye, and the solitary vireo's spectacles are narrower on the lores and are not interrupted above the eye. Hutton's vireo (*V. huttoni*) can be distinguished by cap color, indistinct spectacle and buffy throat. However, some first winter black-capped vireos may have less distinctive caps, and buffier underparts and spectacles, and appear similar to dwarf vireo and Hutton's vireo.

Molt: The molt sequence is typical of many passerines (see Humphrey and Parkes 1959, Pyle *et al.* 1987). No down plumage occurs in nestlings. The adult molt (prebasic) is complete (all feathers) at the end of the breeding season. The prebasic molt of young of the year (from juvenile into first winter plumage) is incomplete. Juvenile primary coverts, primaries and tail feathers are retained. A partial pre-alternate molt, involving at least the cap of males, was noted by Graber (1957).

C. DISTRIBUTION AND POPULATION ESTIMATES

Historic breeding range: Black-capped vireos are believed to have bred in a strip from south-central Kansas, broadly through central Oklahoma south through central Texas to the Edwards Plateau, then south and west to central Coahuila (Mexico) and Big Bend National Park (Graber 1957, American Ornithologists' Union 1983) (Figure 1). The vireo may also have occasionally bred in Nuevo Leon and Tamaulipas (Marshall *et al.* 1984).

Historic winter range: The vireos' historic winter range is on the Pacific slope of Mexico. It is less well known than the breeding range. Records are primarily from Sinaloa and Nayarit but extend north to southern Sonora, and east to Oaxaca (Graber 1957, Marshall *et al.* 1985) (Figure 2).

Records considered accidental: Reports where vireos were considered to have occurred "accidentally" exist for eastern Nebraska, northeastern Kansas, Louisiana, Arizona, and Nuevo Leon (Mexico) (Marshall *et al.* 1985).

Current breeding range: *Kansas* - No recent breeding records exist. The last sight records of accidentals were noted in the 1950's (Tordoff 1956). Graber (1957) could not locate suitable areas during the early 1950's and believed that drought conditions and land uses in the 1930's eliminated potential habitat.

Oklahoma - Oklahoma has been extensively surveyed (Grzybowski *et al.* 1986, Grzybowski 1989a). Black-capped vireos have been reduced to three focal areas in west-central Oklahoma (Figure 3). Birds in one of these areas (on the border of Canadian and Caddo counties) will likely disappear within the next few years.

Only one bird could be located there in 1990 (Grzybowski 1990a). A group in Blaine County with only six breeding pairs during 1990 (Grzybowski 1990a) is at very high risk. In the Wichita Mountains Wildlife Refuge (WR) and adjacent Fort Sill Military Reservation (MR) (Comanche County), about 225+ adults were observed during 1990. This population, which may approach 300 birds, is currently being monitored (Grzybowski 1990b, Grzybowski and Tazik 1990). The black-capped vireo is believed extirpated from the Arbuckle Mountains (Figure 3) and central Oklahoma where it was noted as recently as 1942 and 1977, respectively (Grzybowski *et al.* 1986), and from intermediary portions of its current range.

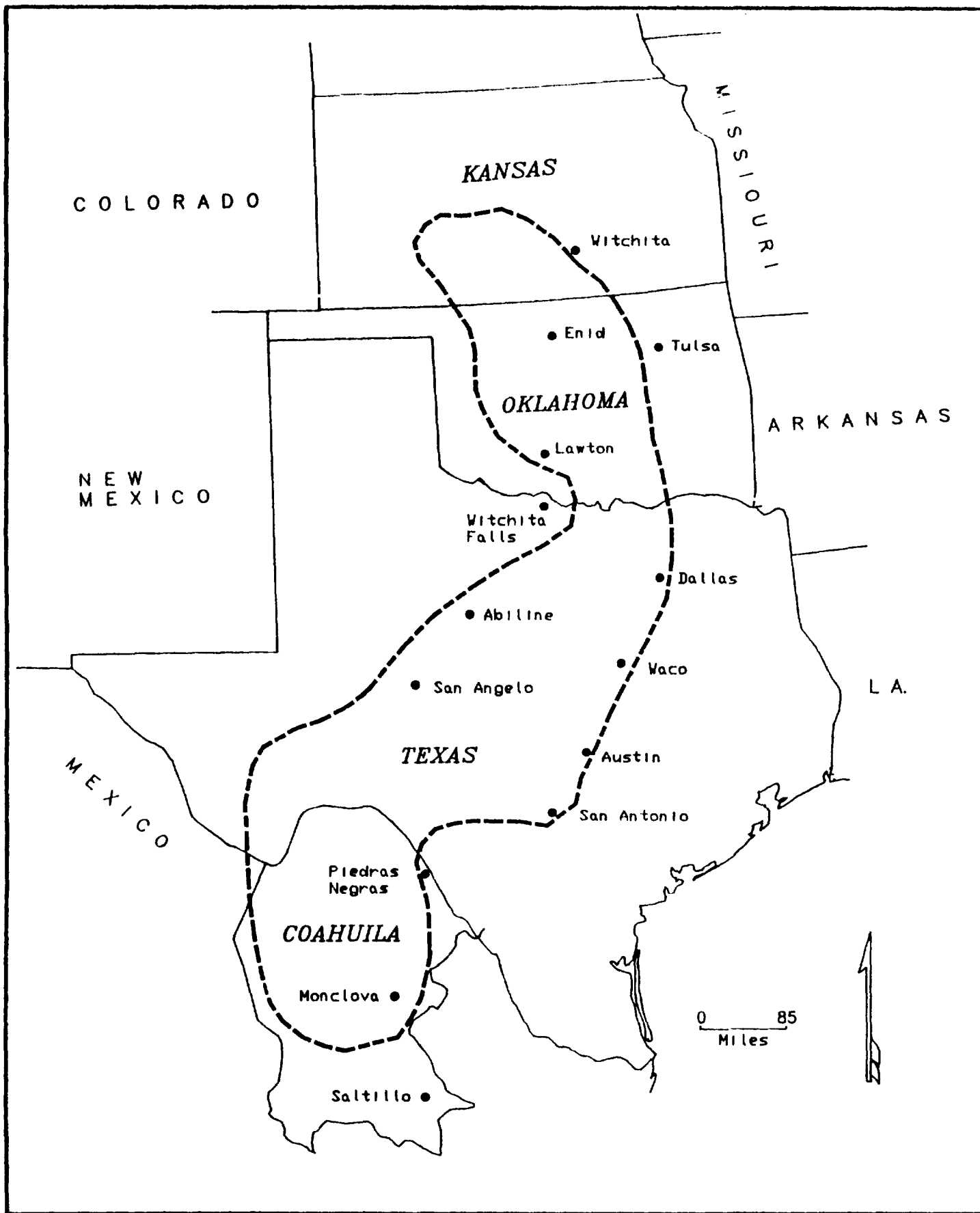


Figure 1. Probable historic breeding range of the black-capped vireo (Graber 1961).



Figure 2. Documented and possible winter ranges of the black-capped vireo (adapted from Graber 1957, Marshall *et al.* 1985).

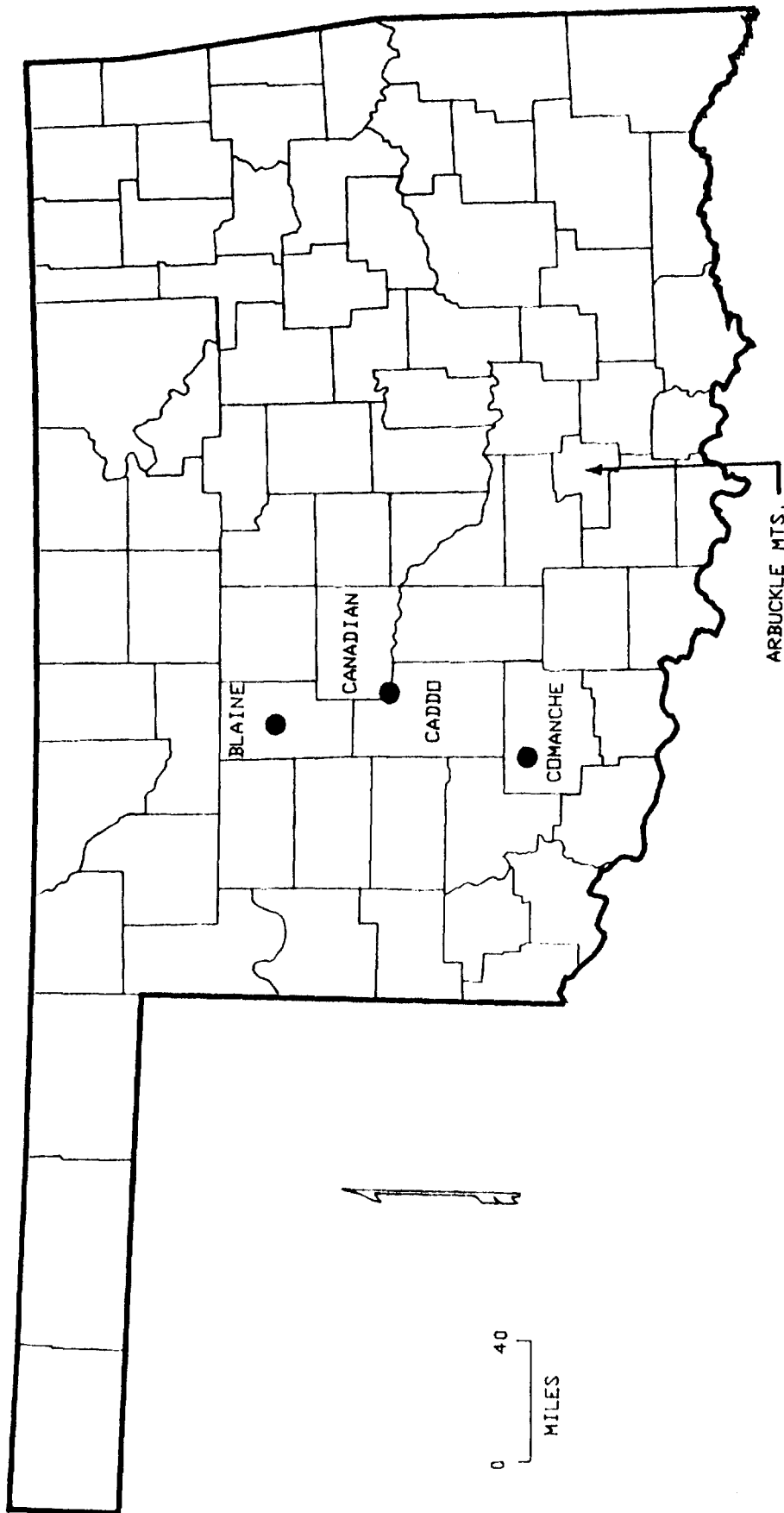


Figure 3. Current black-capped vireo distribution in Oklahoma.

Texas - Populations are still present in a number of localities in Texas, particularly on the Lampasas Cut Plains and Edwards Plateau (Figure 4, Table 1). The eastern and southern edges of the range follow the Balcones Escarpment closely from Waco (McLennan County) to Brackettville (Kinney County). However, the range is likely discontinuous across the Llano Uplift (Sexton *et al.* unpubl. MS), and deterioration of these populations may be extensive, particularly from north-central Texas south broadly to the San Antonio (Bexar County) Region.

Several hundred adults are known breeding on the Fort Hood MR, Bell and Coryell counties (Figures 4 and 5) (Tazik and Cornelius 1989). However, this may be the northernmost substantial group of vireos in Texas. Fewer than 100 adults were found in a detailed survey of the Austin area (Travis County) in 1990 (DLS Associates 1990). An additional 40-50 males were located northwest of Austin in the Post Oak Ridge area in 1989 (Sexton *et al.* unpublished MS).

About 450 adults were estimated in a 290 km² sample area in western Kerr County (Figure 4) during 1990 (Grzybowski 1990c) and probably form part of a larger population in that area. Between 18-26 territories were mapped at Lost Maples State Natural Area (SNA) (Figure 5), Bandera County, from 1989-1990 (Grzybowski 1990d, Bryan and Stuart 1990). Another 100+ males occupied an area focusing on the Kickapoo Caverns State Natural Area (SNA) (Figure 5), Kinney and Edwards counties (Stuart and Bryan, unpubl. data). The latter may form part of a more extensive metapopulation or series of populations south and westward in canyons traversing from the upper bend of the Rio Grande and including canyons of the Devil's River (Val Verde County) where 93 territories were mapped in 1990 (Bryan and Stuart 1990). The status of the vireo in this area is still not well determined, but appears more hopeful than in areas to the east.

The northernmost breeding locality currently known for Texas is in southwestern Dallas County. Three vireos were observed as recently as 1991 (Sexton *et al.* unpubl. MS and Randy Mock, in litt. 1991). They have not been observed along the Red River where they were common in the 1880's (Cooke 1888, Graber 1957), though detailed surveys have not been conducted. They have apparently declined substantially at Meridian State Park (Figure 5), Bosque County, since the 1970's. Although search efforts are very incomplete, few birds have been found in suitable appearing habitat in other areas (not mentioned above) from Bosque and Erath counties on the Lampasas Cut Plains south and west to Bexar and Uvalde counties on the Edwards Plateau (Sexton *et al.* unpubl. MS). Small groups of vireos may still exist in the Concho River Valley and tributaries near San Angelo (Maxwell 1979, Marshall *et al.* 1985, Maxwell in litt. 1991), and small numbers (from 12 to 16 birds) have also been detected in Big Bend National Park (Figure 5) from 1987 to 1990 (McKinney 1987, Barlow and Griffin 1988, Griffin and Barlow 1989, Neighbor 1990).

Population estimates for Texas are difficult to derive because of the variable and incomplete sampling and nature of the information. From 1985 to 1990, about 1,500 adult birds have been observed in Texas, summing only site maximums, or most recent counts for areas with multiple-year data (Sexton *et al.* unpubl. MS) (Table 2). Because the sex ratio is male biased (1 male: 0.73 females; Grzybowski 1988a), this probably corresponds to about 620 pairs.

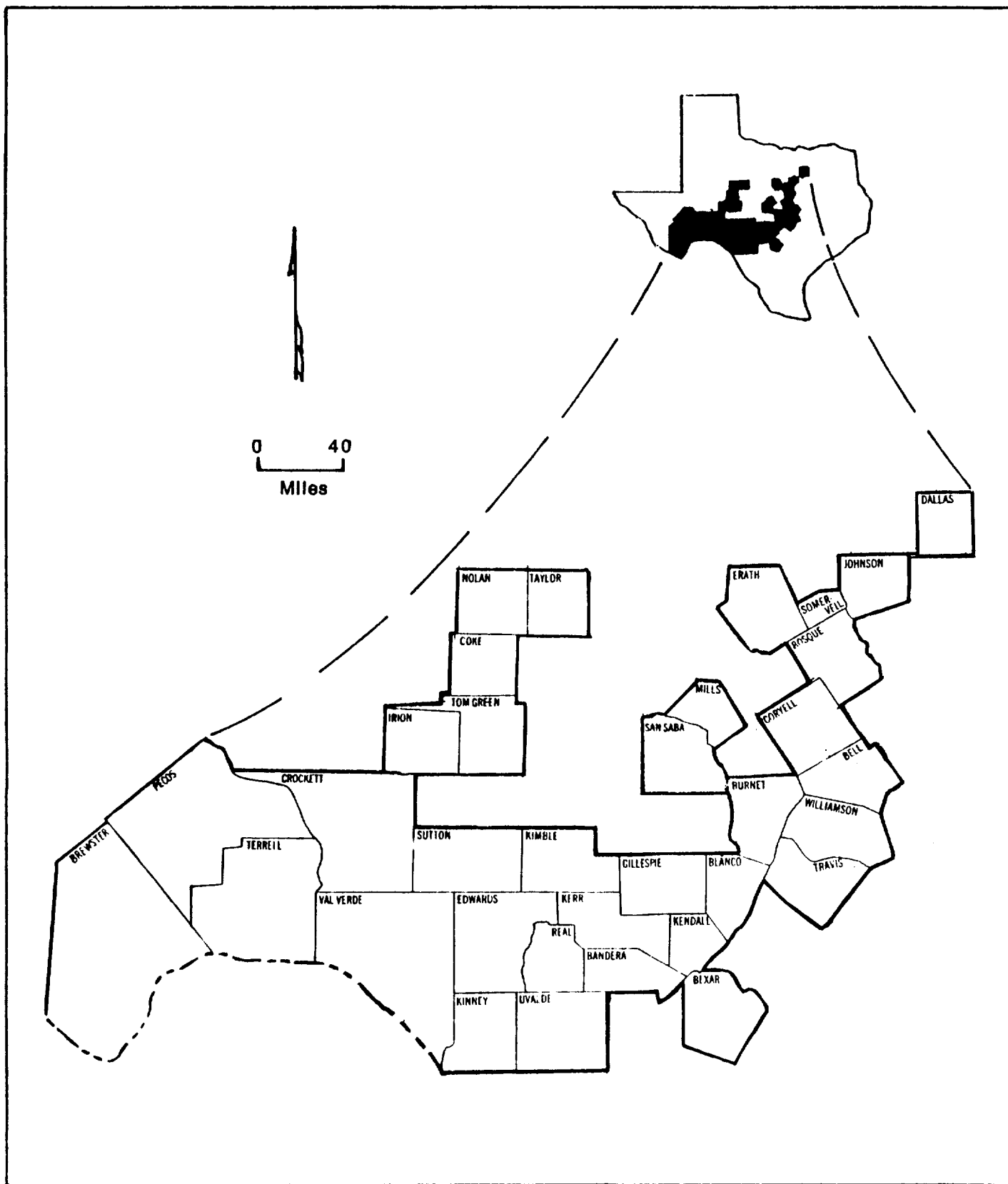


Figure 4. Texas counties known to be occupied by breeding black-capped vireo (Sexton *et al.* unpubl. MS) in 1990.

Table 1. Black-capped vireo recent (1970-1989) Texas localities.
 (from: Marshall *et al.* 1985 and Sexton *et al.* unpubl. MS.)

County	Locality
Bandera	1) Lost Maples State Natural Area 2) Hill Country Natural Area
Bell	1) Fort Hood Military Reservation
Bexar	1) Friedrich Park 2) Camp Bullis
Blanco	1) along RM 2325 2) along Davis-Althaus Road
Bosque	1) Meridian State Park 1) Clayton SW Ranch
Brewster	1) Chisos Mountains 2) Big Brushy Canyon 3) Glass Mountains 4) Big Bend National Park
Burnet	1) Silver Creek Village 2) along RM 1869 3) Marble Falls
Coke	1) W. of Robert Lee 2) along RM 2034 3) along Texas 208 4) Callahan Divide
Crockett	1) Pecos River 2) Ft. Lancaster State Historic Park 3) Howard Draw 4) Fort Lancaster Ruins
Coryell	1) Fort Hood Military Reservation
Dallas	1) Dallas Nature Center
Jeff Davis	1) Davis Mountains
Edwards	1) FM 674 between Rocksprings and Kinney County line 2) Kickapoo Caverns State Park 3) N. of Barksdale 4) FM 2325 N. of Kinney Co. line

Table 1. continued

County	Locality
Erath	1) S. of Bluff Dale
Gillespie	1) NE Doss on HWY 783 2) Reservation Road near Kerr Co. line 3) W of Harper
Hamilton	1) West portion of County
Hays	1) Driftwood
Irion	1) Three localities
Kendall	1) North portion of County
Kerr	1) Auld Ranch 2) Eagle Nest Ranch 3) Elm Pass road 4) Kerr Wildlife Management Area a) Buck Pasture b) Rock Pasture 5) Lazy Hills Guest Ranch 6) Lion's/Shelton Ranch 7) Paradise Ranch 8) Reservation Road and vicinity 9) Rookery site 10) South Fork Ranch 11) Spicer Ranch 12) YO Ranch 13) Priour Ranch 14) Dewberry Hollow
Kimble	1) Junction area 2) Walter Buck Wildlife Management Area 3) S. Llano River State Park 4) along US 290 5 mi E of I-10 5) along RM 479 3 mi E. of I-10
Kinney	1) Kickapoo Caverns State Park
Lampasas	1) no specific location
Midland	1) no specific location
Mills	1) along RR 2005 6 mi E of Goldthwaite

Table 1. continued

County	Locality
Nolan	1) Callahan Divide
Pecos	1) Road side rest stop along US 285 35 mi S. of Ft. Stockton
Real	1) W of Garvin 2) Auld Ranch 3) Eagle Nest Ranch 4) South Fork Ranch
San Saba	1) Colorado Bend State Park
Sommervell	1) Dinosaur Valley State Park 2) Chalk Mountains 3) Picnic area along HWY 67
Sutton	1) 4.3 mi S of Sonora on US 277
Taylor	1) Abilene State Park NW on US 277
Terrell	1) mouth of Independence Creek 2) Sanderson Canyon 5 mi W of Sanderson
Tom Green	1) South Ranch in N Tom Green Co. 2) Near Coke County line
Travis	1) Wild Basin/Davenport Ranch 2) Comanche Trail/Four Points/ Steiner Ranch/Mansfield Dam 3) Gainer Ranch 4) The Parke 5) Hudson Bend/N shore Lake Travis/ S. Jonestown 6) Uplands Development 7) Ball Creek Knolls 8) Nameless Valley Ranch 9) City Park Road 10) Post Oak Ridge
Uvalde	1) along TX 127 2 mi E of Frio River 2) Neal's Lodge at Concan 3) S facing hillside on HWY 1050 W of Utopia
Val Verde	1) Howard Draw N of Pandale 2) TX 163 crossing of Devil's River S of Juno 3) Devil's River State Natural Area

Table 1. continued

County	Locality
Jim Wells	1) as migrant, no specific location
Williamson	1) SW extreme section of Co. near Travis Co. line
	2) Gainer Ranch Travis-Williamson Co. line
Zapata	1) as migrant, no specific location

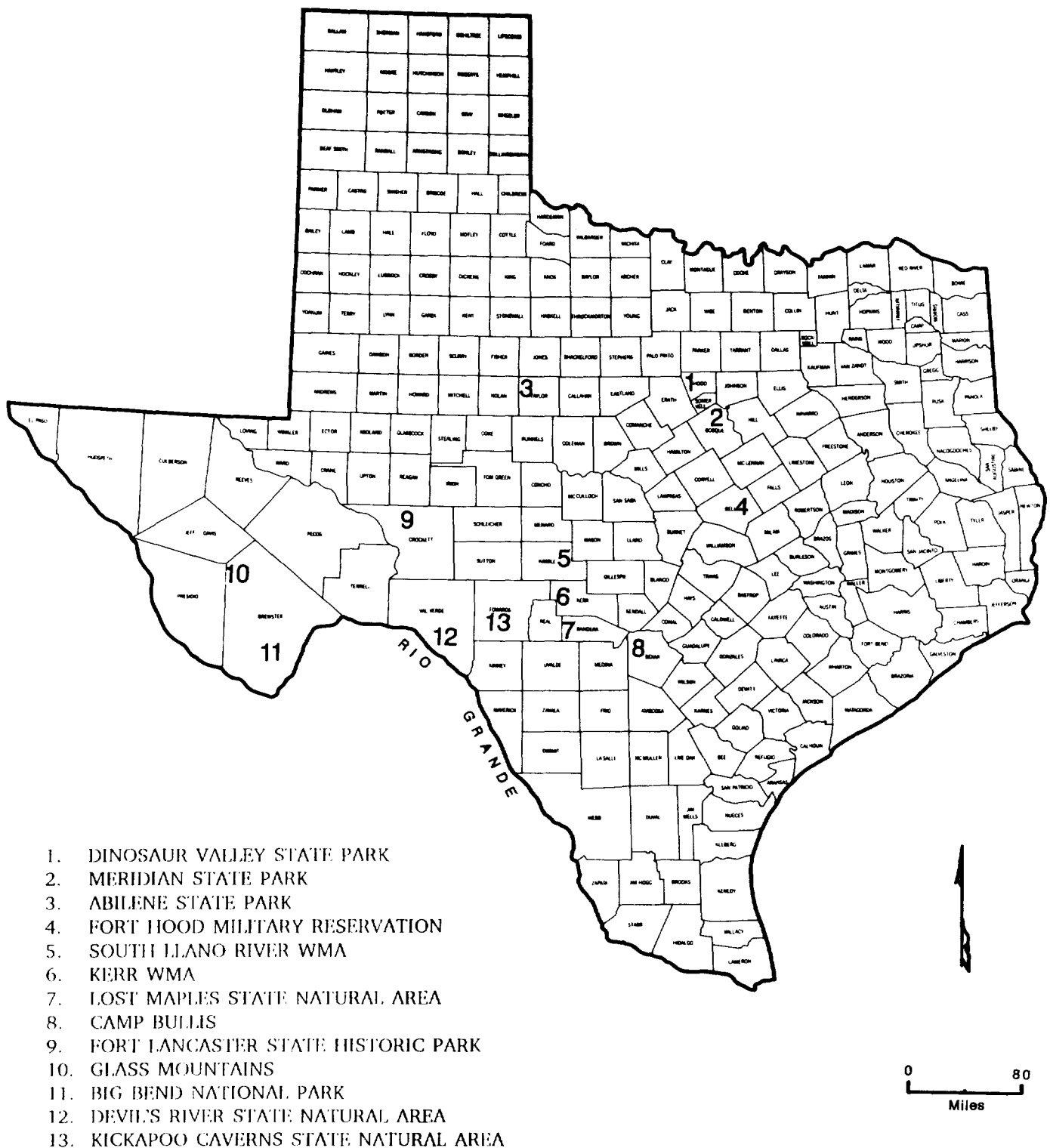


Figure 5. Locations of some key sites mentioned in the text.

**Table 2. Numbers of black-capped vireos counted by state and region
(1985 to 1990).**

State/Region	Numbers counted
Kansas	0
Oklahoma	
Blaine Co.	12
Caddo-Canadian Cos.	1
Wichita Mountains	225
	<u>238</u>
Texas*	
North-central Texas	10
Lampasas Cut Plains	463
Edwards Plateau	771
Concho Valley	22
Southwest Edwards Plateau	192
Trans-Pecos (Brewster Co.)	19
	<u>1,477</u>
Coahuila, Mexico	28+

* from Sexton *et al.* unpubl. MS

Coahuila, Mexico - The vireo is believed to occupy a rich, dense, desert shrub flora at the north base of several mountain ranges, and up a mile or so into the north-flowing canyons in the northern part of the state south to Sierra San Marcos (Marshall, in litt. 1991) (Figure 6). Extensive habitat has been noted in some areas of northern Coahuila, and substantial population(s) may exist in these areas. Marshall *et al.* (1985) observed 21 male vireos in incomplete surveys of areas that could support more. Marshall (in litt. 1991) also believes that this population extends along the north base of the Encantada range throughout a mining area, which is fenced off from livestock (cattle, sheep, and goats). He believes that this population could contain several hundred pairs. Benson and Benson (1990) recently published an estimate for northern Coahuila of 3,139-9,463 pairs ($P < 0.1$). They assumed that all canyons in that area contained some suitable habitat and were occupied. However, few (28) birds were actually observed by Benson and Benson. For discussions on the accuracy of their estimates see Scott and Garton (1991) and Benson and Benson (1991).

Current wintering range: Few observations have been reported for wintering areas in Mexico. Most recent observations have come from Durango, Sinaloa, Nayarit and Jalisco (Graber 1957, Marshall *et al.* 1985, Harden pers. comm., Hutto pers. comm., Rowlett pers. comm.) (Figure 2). None of these observers found many individual vireos, even though Graber and Marshall specifically searched for them. Marshall (in litt. 1991) comments that the "winter birds are extremely shy of taped breeding season songs."

A few scattered winter records exist for Guerrero and Oaxaca, and one for southern Sonora (Marshall *et al.* 1985). The relations between populations on the wintering and summering grounds are not known.

Migration routes: Few records exist. Those that do imply northward migration through southern Coahuila, Nuevo Leon, and western Tamaulipas. Marshall *et al.* (1985) mapped all known migration records, which indicate migration around the Mexican Plateau -- clockwise in the fall; counter-clockwise in the spring.

Observations during the fall migration period overlap the wintering or breeding areas, and may indicate birds that have not departed or already arrived on summering and wintering areas, respectively.

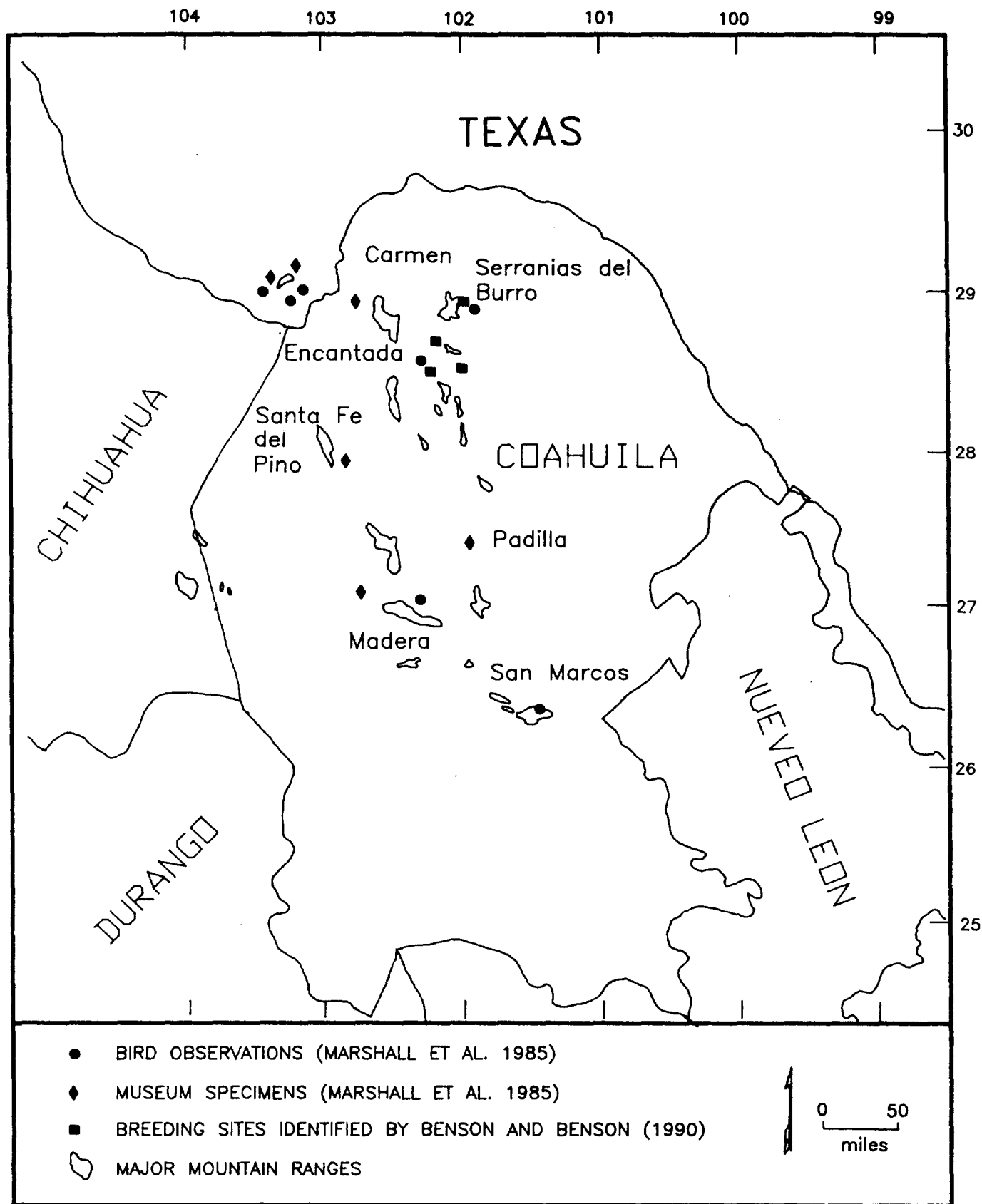


Figure 6. Northern Coahuila, Mexico, showing mountain ranges that may provide black-capped vireo habitat. Symbols indicate location of museum records and sightings (Benson and Benson 1990, Marshall *et al.* 1985).

D. LIFE HISTORY

Migration Phenology: Black-capped vireos arrive in Texas from late March to mid-April (late April in dry years). They arrive in Oklahoma from mid-April to early May (mid-May in dry years) (Graber 1957, Grzybowski pers. obs.). The vireo usually migrates southward from Oklahoma by late August-September and from Texas by mid-September. Adult males arrive before females and first-year males, and depart after females and young in fall (Graber 1957, Oberholser 1974, Grzybowski pers. obs, O'Donnell pers. obs.).

Distribution pattern: Vireos' territories are often clustered in patches of suitable habitat. Larger groupings of 15 or more territories in Kerr County, Texas, and in the Wichita Mountains, Oklahoma, contained proportionately more ASY (after second calendar year) males than smaller groupings. Conversely, the smaller groupings (usually fewer than 10 territories) contained proportionately more SY (in second calendar year) males (Grzybowski 1990d, unpubl data). Reproductive success is greater in the larger than the smaller groupings. Males from the smaller groupings have been observed moving to the larger groupings within and between seasons, but none have been noted moving in the opposite directions (Grzybowski 1989a, 1990b,d). This pattern may cluster birds non-randomly in some areas.

Clusters of 20 or more territories have been observed at Kerr WMA, in the Austin area, and in the Wichita Mountains (Grzybowski 1988a, 1989a, 1990b,c). The clusters of territories were smaller on Fort Hood MR (Tazik and Cornelius 1989) and Kickapoo Caverns SP (Stuart and Bryan unpubl. data) although these areas have relatively large populations, perhaps indicating that patches of suitable habitat were smaller in these areas.

Territory size: Documented at between 1 and 10 acres, mostly 2-4 acres (Graber 1957, Tazik and Cornelius 1989).

Nesting (sources include Graber 1957, Grzybowski 1985a, 1986, 1988a, 1989a, 1990d, pers. obs., O'Donnell pers. comm.): Nesting begins when the females arrive and continues through August. Nest-building requires 2-5 days; usually 2-3. Male and female start the nest; the female finishes. Bachelor males build nest platforms. The platform function is unclear, but it may help attract females. Complete clutches have been found as early as April 4 in Texas (Austin) and April 30 in Oklahoma. The latest known nesting start (i.e., beginning of nest construction) is July 21.

The clutch contains 3-4 white eggs. Four eggs are usually laid in the first two nesting attempts, but only three eggs may be laid in later clutches. Seasonal clutch size is unknown but is likely between 12-20 eggs (as in many other passerines) allowing for up to six nesting attempts per nesting season. One egg is normally laid per day. The first egg is usually laid one day after completion of the nest. The male vireo guards the nest considerably during this period.

Incubation requires 14-19 days, usually 15-16 days. Incubation is lengthy; most small passerines with open-cup nests incubate 10-14 days. Incubation usually begins with the second or third egg and is shared by male and female (female incubates at night).

The nestling stage lasts 9-12 days, but is usually 11 days. The young born naked and blind, are fed by both adults. Females brood the young for 4-6 days after hatching and do most of the nest sanitation and removal of ectoparasites. Fledgling stage (when young have left the nest but are attended by adults) is 30-45 days (occasionally to 52 days). This stage is longer than in most other passerines. The young may leave the nest 1-2 days before they can fly. They may be attended by the male alone, the female alone, or both parents. The parents may split the brood, and each care for several young. The female may leave care of the young to the male and attempt another nesting effort or she may desert the male to remate with another male. Females may also desert a male after an unsuccessful nesting attempt and remate with another male. Males will often keep the young within the confines of their territories, but females attending young often wander off the male's territory.

Vocalizations: Primary songs of males are a complicated series of modestly melodious phrases. Seasonal variation is likely in repertoire selection. Some males have individually recognizable notes in their phrases. Variation in repertoire is greater than that in most other vireos, except the dwarf vireo (Barlow 1981, Marshall *et al.* 1985).

Males begin developing rudimentary songs when 20-30 days out of nest. One male about 55 days out of nest was heard countersinging with a territory-holding adult and could not be readily distinguished from this adult male (Grzybowski pers. obs.).

Other vocalizations include more complex whisper-songs of males, muttering notes (both males and females), distinctive alarm calls described as "shradding" by Graber (1957), and also a light chatter call very similar to that of a ruby-crowned kinglet (*Regulus calendula*).

Band returns (as indicators of survivorship): Annual returns of males in the larger groupings have been documented between 60 and 70% and indicate relatively high survival for a small passerine. Returns of adult females and males in smaller groupings, however, is lower, about 39-61% (Grzybowski 1989a, 1990a,b,c). Survival of females may be lower. More males are detected than females, and about 69-76% of males are mated (Grzybowski 1988a, 1989a, Tazik and Cornelius 1989). However, site fidelity is also greatest for males in the larger groupings, and the differences in return percentages may reflect off-site dispersal, particularly for SY males in the smaller groupings (Grzybowski 1989a, 1990a,b,c). Dispersing birds, however, may place themselves at higher risk, and thus have lower survivorship.

Limited data are available for return of hatch-year birds. Only about 14-23% of the young are detected the following season (Grzybowski 1990b,c). However, this group is the primary dispersal component of vireo populations and is the most

likely to disperse off-site and thus evade detection. A preliminary estimate of juvenile returns at the Kerr WMA, generated from a broad scale search of adjacent ranches, was 35-52% and approached that of females (Grzybowski 1990c). However, more data on survivorship, particularly for females and young, are needed to establish more useful estimates.

Dispersal: Adult males breeding in the larger groupings exhibit the greatest site fidelity, returning to virtually the same territory, and have never been detected moving to another location in subsequent years. Females in the larger groupings exhibit the next greatest site fidelity, more frequently moving among territories both within and between seasons (Grzybowski 1989a, 1990d, unpubl. data). Males and females breeding in the smaller groupings have been detected at new localities in subsequent years. Tazik and Cornelius (1989) observed 4 of 85 returning males (4.7%) and 4 of 21 females (19%) undergo dispersals of 5.7 to 24 and 1.2 to 28 km, respectively, on Fort Hood. One female in Travis County moved 10 km (DLS Associates 1989a). Grzybowski (1989b) has detected males moving up to 8 km in the Wichita Mountains. Hatch-year birds have been detected between 0.15 and 21 km distant from their natal territory the following or subsequent seasons. Mean dispersal distance for returns at Kerr WMA (3.72 km, S.D.=4.15, Grzybowski 1990c) is an underestimate because some dispersing birds are undetected. More data and additional analyses are needed.

Behavior on wintering grounds: Little is known about behavior on the wintering grounds. Marshall et al. (1985) found the bird very secretive, retreating very quickly after an initial approach to taped calls. Encounters by other individuals have been equally brief (Arvin pers. comm.; Hutto pers. comm; Rowlett pers. comm.).

E. HABITAT

General characteristics of breeding habitat: The black-capped vireo breeds in shrubby growth of a forest-grassland ecotone from Kansas (formerly) to Coahuila, Mexico. Breeding vireos use shrubby growth of irregular height and distribution, with spaces between the small thickets and clumps, and with vegetation cover extending to ground level (Graber 1961). From Oklahoma through most of Texas, this type of vegetational configuration occurs most frequently on rocky substrates with shallow soils, in rocky gullies, on edges of ravines, and on eroded slopes.

Shrubland habitat can be successional and pass through periods of suitability and unsuitability for the vireo. How long it can remain suitable will likely depend on a number of factors affecting vegetation structure, including underlying geology, soil type, slope, and species composition. The extent and height of this habitat may also be determined by secondary factors such as fire, grazing, or other forms of periodic site disturbance (Graber 1961). This process, however, is not well studied.

Structural characteristics of breeding habitat: While restricted to essentially shrubland areas, habitats occupied by vireos nonetheless vary considerably in vegetational characteristics. Vireo territories and non-vireo shrubland plots were sampled from the Wichita Mountains, Lampasas Cut Plains, and the central Edwards Plateau. Analysis revealed that a factor common to the vireo territories, and distinguishing them from non-vireo plots, was a high density of deciduous vegetation from 0 to 3 m (Grzybowski *et al.* unpubl. MS).

The analysis sampled a habitat gradient ranging from maturing shrubland habitats to more open areas. The vireos occupied semi-open habitats in the middle of the gradient (established by a first Principal Component) indicating the analysis had accurately identified the range of suitable habitats. The average amounts of deciduous cover among three regions varied from 30 to 50%. Total woody cover (including junipers) was about 36 to 53%.

Low deciduous cover was the key element in vireo habitat, but three other characters or suites of characters were of secondary importance and related to maintaining this primary component. One secondary character was greater within-territory heterogeneity in vegetation structure than on non-vireo plots. The primary component of this heterogeneity was the number of changes between woody vegetation and openings or separations between bushes, as well as within-territory variance in other deciduous variables. This characteristic occurs where bushes in an irregular matrix become more closely spaced, but still separated, and can thus have the best light penetration, and provide dense deciduous cover in the lower height zones. This heterogeneity may also set the upper limits of acceptable total woody cover.

Juniper cover (another secondary character) averaged from 3 to 6% in the different regions. On the portion of the gradient with greater deciduous and juniper cover, vireos occupied habitats with fewer junipers (regional averages of 3 and 5% juniper cover compared to 6 and 11%, respectively, in non-vireo plots for these regions). At least three other independent analyses have also indicated that junipers are underrepresented in vireo territories relative to non-vireo plots,

and that vireos use junipers for nesting much less frequently than they occur in their territories (Grzybowski 1986, Tazik and Cornelius 1989, Tazik *et al.* 1989). Vireos may be indifferent to the presence of junipers, but the presence of junipers may reduce the key element—deciduous vegetation in the lower height zones. In Travis County, Texas, some "poorer" quality vireo territories with noticeably more juniper were larger in area (DLS Associates 1989a) than higher quality vireo territories elsewhere with fewer junipers.

The third character of secondary importance was openness. Deciduous vegetation in the lower height zones appears to be maximized where total woody cover is between 35 and 55%, leaving 45 to 65% open. However, the form of this openness was heterogeneous and related to maintaining spacing between individual bushes.

Floristic components of breeding habitat: Though the vireo's range is relatively small compared to many other passerine species, a wide diversity of plant species can provide suitable vegetational structure. No single plant species dominated most of the localities containing vireos, though oak was the most frequently encountered taxon.

In Oklahoma, blackjack oak (*Quercus marilandica*) was the most abundant plant species. Post oak (*Q. stellata*) was also an important component in this area. In contrast, however, oaks were entirely absent at one eroded site (Blaine County). A diversity of non-oak taxa replaced the oaks (Grzybowski 1986, unpubl. data).

On Fort Hood, Texas, shin oak (*Q. sinuata* var. *breviloba*) occurred more commonly in vireo territories than in non-vireo plots (Tazik *et al.* 1989). At Kerr WMA, Texas, shin oak was the most common species in vireo territories (Grzybowski 1986). Plateau live oak (*Q. fusiformis*) was of secondary importance. Various oak species figure importantly in the southwestern portion of the range. *Quercus mohriana* is reported to be a key indicator of black-capped vireo habitat in the Concho Valley region (Terry Maxwell, Professor, Angelo State University, in litt. 1991). A dwarf form of wavy-leaf oak (*Quercus undulata*) and evergreen sumac (*Rhus virens*) were the most common woody plants in black-capped vireo habitat in Coahuila (Grabner 1961).

Nest sites: Nests are placed in small forks of bushes. Different species are used in different areas, but the frequently used species are deciduous. Blackjack oak was the most frequently used species in Oklahoma, shin oak on the Kerr WMA in Texas, sumac (*Rhus* spp.) species in the Austin area (Grzybowski 1986), shin oak and Texas oak (*Q. buckleyi*) on Fort Hood MR (Tazik and Cornelius 1989), Texas persimmon (*Diospyros texana*) on Kickapoo Caverns SP (Bryan and Stuart 1990), and Texas mountain laurel (*Sophora secundiflora*) at Devils River SNA and Lost Maples SNA (Bryan and Stuart 1990). Most nests were between heights of 40 and 120 cm in the zone of densest deciduous vegetation.

Habitat distribution: There are no estimates of the historical or recent amount and distribution of vireo habitat. Several studies employing LANDSAT imagery and attempting to obtain these estimates have met with disappointing results (Shaw *et*

al. 1989a,b, Shaw 1989). Geographic Information Systems (GIS) have been used by the BCCP (Balcones Canyonlands Conservation Plan) Committees (Butler/EH&A Team 1991) to delimit areas potentially capable of maintaining vireo habitat on the basis of geologic substrate, slope, aspect, and soil depth. However, areas with habitat could not be extracted, and this process is untested. Aerial photographs have been used to subjectively assess areas with potential vireo habitat and may prove more useful if information can be digitized.

Fire: In areas that undergo relatively rapid succession, fire may play a role in maintaining black-capped vireo habitat. The time from previous fire disturbance to initial re-occupancy by vireos has not been well documented and likely depends on location and site. Occupied areas that had been substantially burned in the Wichita Mountains were fully recolonized the second year after the burn.

In areas that may generate vireo habitat, fire appears to retard invading junipers and enhance regrowth of fire-adapted *Quercus* and *Rhus* species. Vireos were commonly found on sites subjected to burns (Graber 1957). The largest population groupings in the Wichita Mountains, Fort Hood MR, Kerr WMA, and Austin occur in areas recovering from significant burning. Benson and Benson (pers. comm.) noted that suitable areas in Coahuila were subject to regular wild fires, creating dense low oak growth. Other forms of disturbance may provide adequate substitutes for burning, but fire may be an important management tool in some areas.

However, some areas of black-capped vireo habitat are relatively stable. Fire will not be an appropriate tool in all black-capped vireo areas. Determinations will have to be made on a site-by-site basis. Additional study is needed for use in making these determinations.

Geology and soil: The appropriate vegetational configuration appears to occur most frequently in areas with eroded gullies, poor soils, or rocky substrates. Sexton et al. (unpubl. MS) appears to have found a link between occurrence of black-capped vireos and Fredricksburg limestone in Texas. Graber (1961) comments that vireos in the Sierra Madera in Coahuila were found only on dry limestone hillsides. This association with limestone does not persist in Oklahoma where the vireo has been found on a variety of soil types and other geologic substrates (Grzybowski, pers. obs.).

Although geology and soil are a step removed from the most proximate feature of vireo habitat--namely vegetational configuration--certain geologic substrates, soil, and features of topography are more likely to maintain suitable vegetational configuration and structure. This association needs to be investigated more thoroughly.

Wintering habitat: Very little is known of the vireos' winter habitat on the Pacific slope of Mexico. Graber (1961) describes two somewhat disparate habitat types used by wintering vireos--arid scrub 1-3 m tall and an incredibly diverse, luxuriant and more mesic cut-over second growth forest. Both habitats, however, contained low deciduous growth. Marshall et al. (1985) found the vireos on higher, drier

slopes. Hutto (pers. comm.) located his only bird in the more luxuriant subtropical forest. Harden (pers. comm.) found a bird in an area of cane.

F. THREATS/REASONS FOR LISTING

Population decline: The black-capped vireo has undergone a substantial reduction in range since documentable times. Fragmentation and reduction of numbers within the current range has also occurred. The black-capped vireo no longer nests in Kansas. Its range has been reduced to three locales in Oklahoma, and it will likely occur in only two, possibly one, of those shortly; it is secure in none of these areas. This vireo is likely extirpated from much of its former range in north-central Texas and soon may become extirpated on the southeastern edge of the Edwards Plateau (i.e., Bexar, Comal, and adjacent counties) (Graber 1961, Marshall *et al.* 1985, Grzybowski *et al.* 1986, Sexton *et al.* unpubl. MS). These areas with extirpated or declining populations comprise over 50% of the historical range.

To the west, it is not well studied, but numbers are more encouraging at several localities in the southwestern portions of the Edwards Plateau (Stuart and Bryan unpubl. data). Few have been observed in Coahuila, Mexico, but large areas of suitable-appearing habitat have been reported (Graber 1961, Marshall *et al.* 1985, Benson and Benson 1990). However, numbers observed in Big Bend and in the Concho Valley area near San Angelo are small (Maxwell 1979, Marshall *et al.* 1985, McKinney 1987, Barlow and Griffin 1988, Neighbor 1990). There the vireo appears to be at the western limits of its potential range, and birds in those areas may be the outliers of current viable populations, parts of deteriorating populations, or parts of larger populations still undetected.

Reproductive success: Reproductive success is low at sites investigated in Oklahoma and on the central Edwards Plateau. No young were produced by the vireos monitored in Caddo and Canadian counties, Oklahoma, from 1984 to 1989 where cowbird parasitism was not controlled (Grzybowski 1985b, 1989a,b). Adult numbers were already very low in 1985 (13), and only one male could be found in 1990 (Grzybowski 1990a). No young were produced during two of three years of monitoring in Blaine County, Oklahoma without human intervention (in the form of removal of cowbirds and/or their eggs). In the third year, 8-10 young were produced by four females (Grzybowski 1989c). Reproductive success without human intervention in the Wichita Mountains averaged 0.94 young/female from 1986-1990 (Grzybowski 1990b). At the Kerr WMA, Texas, reproductive success without human intervention was 0.66 young/female from 1985-1988 (Grzybowski 1988a, 1990d).

Annual population change (R), growth rate, can be estimated by the formula: $R = fj + a$, where "f" is annual fecundity (number of female young produced/adult female/year), "j" is annual juvenile survivorship rate, and "a" is annual adult female survivorship rate. For stable populations, $R = 1$. Pooling band returns of adult females (Grzybowski 1990a,b,c) provides an estimate of minimum female survivorship of 0.47. Using values 0.2 (approximate observed juvenile survivorship) and 0.44 (possible juvenile survivorship; Grzybowski 1990c), a stable population would have to maintain a fecundity of 2.65 and 1.20 female young produced/adult female/year, respectively (5.3 and 2.4 total young, respectively) to maintain a stable population. Although only minimum adult female survivorship is estimated from band returns, the reproductive success observed

without human intervention is far below that required for population stability. At productions of one young produced/adult female/year (0.5 female young), female survivorship would need to be 0.90 or 0.78 if juvenile survivorships were 0.2 and 0.44, respectively. The calculated female survivorship rates are much higher than those observed among wild females, and also higher than those observed in wild males. Thus, natural production in these areas was clearly deficient.

Low recruitment (number of young entering the breeding population): Estimates of reproductive success and survivorship are subject to biases, including the potential depressing influence of investigators on reproductive success, difficulty in counting young already fledged, and the inability to detect individual banded birds dispersing off study sites (which will lower estimates of survivorship). However, the proportion of SY males (pSY), which are males in their first potential breeding season, to total number of SY plus ASY males can be used as an estimate of recruitment (i.e., $PSY = SY/(SY + ASY)$ = an estimate of recruitment). It is not a perfect estimate because many SY males are unmated. In stable populations, adult male survivorship plus pSY should equal one. Using the higher (and perhaps optimistic) estimates of adult male survivorship from the Wichita Mountains and the larger grouping at Kerr WMA (0.71) (Grzybowski 1990b,c), the expected pSY in a stable population should approximate at least 0.29.

Observed pSY for populations or groups without or before management have been lower, much lower in some instances. No SY males have been detected in the Caddo-Canadian counties area in Oklahoma during the monitoring period from 1984-1990 (Grzybowski 1989a, 1990a). In the Wichita Mountains, pSY was 0.19 (from a sample of 42 birds) in 1987, a year after initial management actions were begun (Grzybowski 1989a). Initial estimates for the Davenport Ranch site in Austin showed only 0.05 pSY males; for the Kerr WMA, 0.21 pSY males; for the South Fork Ranch in Kerr County, 0.19 pSY males (Grzybowski 1988a, 1990d). On Fort Hood MR, pSY was 0.11 during a period of management (Cornelius, pers. comm.). An estimate from Devils River State Natural Area, Val Verde County, Texas, was 0.31 in 1990; from Kickapoo Cavern State Park was 0.36 in 1990 (0.14 in 1989); and from Lost Maples State Natural Area was 0.17 in 1990 (Bryan and Stuart 1990).

In west-central Oklahoma and the Austin, Texas, area, where vireo numbers are seriously declining, pSY was very low (0, and 0.05, respectively). On Fort Hood MR, the estimate was also low. For the Wichita Mountains and Kerr County, where natural reproductive success was about one young/female/year, pSY was higher -- 0.19-0.21 -- but still below that expected for a stable population. Only in Val Verde, Kinney, and Edwards Counties did the estimated pSY achieve that expected for a stable population. Thus, in data collected from a substantial portion of the range, recruitment did not achieve levels expected for a stable population and is generally consistent with conclusions from reproductive success.

However, according to Tazik (in litt., 1991), on Fort Hood more SY males were located during 1991, in conjunction with surveys for the golden-cheeked warbler. They were found in areas where the vireos had not ordinarily been searched for in the past. Thus, Tazik believes the pSY of 0.11 observed on Fort

Hood during 1987-1989 is undoubtedly low. The usefulness of pSY as an index of population status and stability needs to be further evaluated.

Nest parasitism by Cowbirds: In recent times, three cowbird (*Molothrus* spp.) species have shown dramatic increases in numbers and range across this hemisphere (Friedmann 1929, Grinnel and Miller 1944, Mayfield 1965, Post and Wiley 1977a, Dolbeer and Stehn 1979, Brittingham and Temple 1983, Cruz *et al.* 1985). Breeding bird surveys conducted by the U.S. Fish and Wildlife Service show that brown-headed cowbirds (*M. ater*) are more abundant in mid-continent areas (which includes the southern Great Plains) and their numbers are increasing (Robbins *et al.* 1986). The brown-headed cowbird has expanded its range and numbers north, east, and west of its traditional mid-continental range (Snyder 1957, Friedmann 1963, Mayfield 1965, Hanka 1985) and is now breeding south into peninsular Florida (Paul 1989).

The bronzed cowbird (*M. aeneus*) has also been increasing and expanding its range from Texas into Louisiana and Florida and west in California (Grzybowski 1987, Paul 1989). The shiny cowbird (*M. bonariensis*), since its arrival as an exotic in 1860 (Newton 1860), also has spread across the Antilles (Cruz *et al.* 1985) and is now invading the southeastern United States (Langridge 1989, LeGrand 1990, Jackson 1990). Shiny cowbirds were observed in Texas and Oklahoma in 1990 (Grzybowski and Fazio 1991).

A number of factors may be involved in the increase in cowbirds. These factors range from an increase in suitable cowbird habitat beginning in colonial times with the opening of the forests (Friedmann 1929, Mayfield 1965) to increased urban development, grazing impacts, and a speculated higher overwinter survival caused by favorable habitat conditions during winter due to rice fields, feed lots, etc. (Brittingham and Temple 1983). Whatever the causes, the impacts are being felt by the black-capped vireo and other species such as the Kirtland's warbler (*Dendroica kirtlandi*) (Mayfield 1960, Walkinshaw 1983), least Bell's vireo (*V. bellii pusillus*) (Goldwasser *et al.* 1980, Franzreb 1989), and yellow-shouldered blackbird (*Agelaius xanthomus*) (Post and Wiley 1977b).

Early this century, Bunker (1910) commented that black-capped vireos were frequent victims of nest parasitism by brown-headed cowbirds (*M. ater*). Graber (1957), the first to quantify cowbird impacts on the vireo, found that 50% of the eggs, (49% of the nests; Graber unpubl. data) were affected by cowbird parasitism in Caddo County, Oklahoma during the mid-1950's. In the 1980's, more than 70% of the nests were parasitized across the range examined. At some localities in some years, parasitism exceeded 90% for fairly large samples (Grzybowski 1990c, Tazik and Cornelius 1989). This parasitism has been credited for the alarmingly low annual pair success, which has been much less than one young per pair at a number of sites studied in Texas and less than 0.5 young per pair for areas in Oklahoma (Grzybowski 1985b, 1988a, 1989a,b,c, 1990b,d).

The bronzed cowbird has been recorded only once as a parasite in black-capped vireo nests (Bryan pers. comm.). However, the first shiny cowbirds detected in Texas and Oklahoma appeared in black-capped vireo nesting areas (Grzybowski and Fazio 1991, Lasley and Sexton 1990).

Nest parasitism shows annual variation. Even at sites with high parasitism, parasitism may drop to 50 or 60% some years (Grzybowski 1990c). This variation may allow for higher production in those years, but it may simply slow the rates of decline in vireo populations. Average annual parasitism is still relatively high, and average reproductive success is still less than that needed to maintain populations in many areas even assuming optimistic survival rates (Grzybowski 1986, Pease and Gingerich 1989).

Cowbirds have been noted laying from 1-4 eggs in vireo nests (Grzybowski 1985a, Tazik and Cornelius 1989). One egg is optimal for cowbird survival because the vireo nests (with few exceptions) are too small to accommodate more than one cowbird beyond age 5 days. Where cowbirds are more numerous, however, the number of nests with multiple cowbird eggs in them increases.

Cowbird egg incubation time is 10-12 days, usually 11. Time from hatching to fledging is 10-11 days. Cowbird young leave their foster parents 14-20 days after fledging (Friedmann 1929).

Cowbirds interfere with vireo nesting in one or more of the following ways:

- a) Cowbirds lay an egg in the vireo nest. Because incubation time of the cowbird egg is 4-5 days less than that of the vireo, the cowbird young is much larger than the vireo young (if the vireo eggs even hatch). Thus, no vireo young can be produced from a parasitized nest unless the cowbird egg is infertile or laid late in the vireo's incubation period.
- b) Cowbirds often remove a vireo egg for every cowbird egg they lay.
- c) Vireos may attempt to complete a full clutch of four vireo eggs (although laying more than four) despite the presence of a cowbird egg(s). The remaining vireo eggs may be spaced farther apart in time than in a normal egg-laying sequence. If cowbird eggs are infertile, or are removed, the most recently laid vireo eggs may not be incubated long enough to hatch, thus reducing brood size (Grzybowski pers. obs.).
- d) Cowbirds may poke tiny holes in the vireo eggs they do not remove (intentionally, or in attempts to remove them).

The black-capped vireo's small size precludes several options, including physically deterring the cowbirds or ejecting cowbird eggs. Defense from parasitism is limited and includes the following:

- a) Vireos may abandon parasitized nests. Tazik and Cornelius (1989) recorded 37% of nests were abandoned and credited 28% to parasitism. Abandoning nests may reduce the impact of parasitism, as a portion of the renesting will be unparasitized.
- b) Vireos may bury the cowbird egg with nesting material. This has been observed on several occasions and can occur when the cowbird egg is laid before completion of the nest lining (Grzybowski pers. obs, Rothstein 1990).
- c) Nest concealment may offer some protection from parasitism. However, cowbirds often watch adults building nests, and many vireos build in pendulent nests which tend to be more visible than nests of other species.

The impact of cowbirds on the southwestern vireo populations needs further investigation to evaluate the ability of vireo populations in these areas to maintain

themselves with cowbird nest parasitism without human intervention. Trapping is not recommended until such background data are collected over at least 2 years (unless cowbird parasitism is demonstrated to be very extreme in the first year). This step may significantly reduce costs of recovery if parasitism is not a serious threat in a given area.

The following are methods that have been used for local cowbird removal:

- a) Use of cowbird decoy traps (USDI 1973) at or near breeding sites. This method has been the most commonly employed and has generated some level of success at all sites used (see Conservation Measures section). Some refinements in their use may need attention, both from the perspective of their design (to prevent escapes and predation) and perhaps more importantly in their placement in ways that substantially improve their influence zones. Information from current and past and proposed trapping efforts should be used to address this issue.
- b) Trapping at cowbird feeding sites may help enhance influence zones of the traps, or reduce local numbers of female cowbirds, thus reducing their overall impact. Significantly more females have been captured near cattle or buffalo than in traps away from these animals (Grzybowski 1990b). Rotational grazing at the Kerr WMA placed cattle adjacent to vireo nesting areas at the beginning of the nesting season (Grzybowski 1990c). In both of these studies, parasitism was substantially reduced, and vireo reproductive success enhanced. Where cattle are present in the landscape near vireo breeding areas, this trap placement may be a useful strategy.
- c) Shooting at breeding sites: Tazik and Cornelius (1989) have demonstrated some success using this method with the aid of cowbird recordings which attract cowbirds to the gunmen. (Note: This technique may be disruptive to nesting vireos.)

Direct habitat destruction: Conversion of potential vireo habitat to urban and suburban development may threaten the vireo in some areas. Such development has been a factor in western Travis County, Texas, where road construction and subdivision development have impacted or threatened vireo nesting areas (Espey, Huston & Associates 1988, DLS Associates 1989b).

A significant "colony" on the Davenport Ranch has declined dramatically from 27 pairs in 1985 to 4 pairs in 1990 (Grzybowski 1990c). This site is now surrounded by suburban development and has become isolated from other vireo breeding areas by 10 km. The problem may be further compounded by the addition of several predators (i.e., house cats and dogs) and an increase in numbers of other predators (eg. raccoons, skunks, jays, squirrels, etc.). This form of development may have been or be impacting vireos in Dallas, Bexar, and Kerr counties, but it has not been studied in these areas.

Range management that removes low woody vegetation is widespread across the vireo's range, but may be most extensive on the Edwards Plateau (Marshall *et al.* 1985). This process destroys vireo habitat and can substantially impair recovery of these areas; however, in some instances it provides a disturbance regime which creates vireo habitat. Many areas cleared by ranchers are then grazed by cattle, goats, and sheep, and thus restrained from again becoming vireo habitat. However, some sites bulldozed in Kerr County and on the Fort Hood MR have grown into vireo habitat.

Overbrowsing, particularly by goats (but also deer and some exotic animals), can remove vegetation in the lower height zones required by vireos for nesting. The substantial Angora goat enterprise and proliferation of browsing exotic game animals on the Edwards Plateau have removed large areas of vireo habitat (Marshall *et al.* 1985). If the root structures of deciduous plants can still support growth, the results of overbrowsing may be reversed if the animals are removed. Regrowth of browsed vegetation may develop into vireo habitat, as has occurred on the South Fork Ranch in Kerr County (Fuchs, pers. comm., Grzybowski pers.obs.).

Habitat loss or deterioration through control of natural processes: Some areas of black-capped vireo habitat appear to be relatively stable, but in other areas vireos occupy a successional habitat which passes through a period of suitability. Control of natural processes may prevent the creation and maintenance of vireo habitat in certain areas. The expectation under natural conditions is that a mosaic of habitats exist with differing histories of disturbance and thus a certain proportion of land will likely be in the successional stage suitable for vireos.

Fire was likely responsible for maintaining or periodically returning some areas to vireo habitat in the past. Fires still occur, but are suppressed in many areas, so the probability of an area being in the appropriate successional stage is probably lower than in the past. Lands in public ownership may not be large enough (or may be in multiple use settings) to depend on random disturbance events, such as fire, to maintain adequate amounts of vireo habitat.

Habitat deterioration due to control of natural processes may result in (a) decreasing amounts of suitable habitat as the habitat matures (b) increased fragmentation of what may historically have been large patches or series of patches of suitable habitat, (c) increasing isolation between vireos in occupied patches, (d) decreasing probabilities of young vireos dispersing successfully between these patches, (e) increased potential for nest predators such as jays and squirrels from the surrounding, more mature habitat to invade and impact nesting success of black-capped vireos in the remaining smaller patches, and (f) increased potential for extinction as probabilities for successful dispersal and reproductive success decline.

The circumstances in this scenario appear relevant to much of the range from Oklahoma to the southeastern edge of the Edwards Plateau. These conditions may currently exist in most of west-central and central Oklahoma outside of the Wichita Mountains. A number of formerly occupied sites have matured substantially (to heights over 40 feet), and west-central and central Oklahoma now contain significant numbers of junipers. More suitable patches were observed than occupied, but these patches were often relatively small (< 50 ha) and isolated by distances measured in kilometers from each other (Grzybowski *et al.* 1986, pers. obs.). The trend of this influence in Texas is uncertain, but may be impacting significant areas of the Lampasas Cut Plains and Balcones Canyonlands as represented in southern Dallas County, western Travis County, and Bexar and Uvalde counties. Additional research is needed to determine which areas of vireo habitat are relatively stable and which will need periodic disturbance to maintain.

Indirect effects of land uses: Some land uses or habitat modifications that do not necessarily directly impact vireo habitat may indirectly impact vireos. For example, in a broad sense, the threat of cowbird nest parasitism results from changes in the habitat that increase cowbird abundances in vireo nesting areas. The cause(s) of these increases can be local, as in increasing suitability of habitat for cowbirds in or adjacent to suitable vireo habitat, and/or it can be remote, as in increasing suitability or availability of cowbird wintering habitat enhancing overwinter survival and thus increasing cowbird numbers. Land uses may also increase suitable environments for certain predators (i.e., raccoons, skunks, house cats, jays).

Increased effects from predators and nest parasites are sometimes attributed to "edge effects". Patch size is sometimes used to evaluate edge effects. Studies have indicated that both cowbird nest parasitism and nest predation on open-cup nesting passerines decreases with distance from edge (Gates and Gysel 1978, Brittingham and Temple 1983, Andren and Angelstam 1988). A few studies, however, have indicated that the dispersal potential of cowbirds is high (Rothstein *et al.* 1984), and that parasitism rates may be more species-specific and not as closely linked to edge as other studies indicate (Robinson pers. comm.). However, edge effects can still occur as specified below.

Cattle in or near vireo habitats can attract cowbirds. On Fort Hood MR, where cattle numbers were over 3500 animal units during 1987 and 1988, parasitism rates were 90% (even with cowbird trapping (Tazik, in litt 1991)). A reduction in cattle numbers on Fort Hood to 1500-2000 during 1989 and 1990 resulted in a decrease in parasitism to 60 to 65 percent and a dramatic increase in vireo production (Tazik, in litt 1991).

However, cattle have been used effectively to significantly increase cowbird capture on the Kerr WMA (Grzybowski 1990c). Where cowbirds are not being removed however, cattle grazing in or near vireo nesting areas may pose a substantial local threat to vireo nesting success. Cattle may also create disturbances if concentrated in vireo nesting areas at the beginning of the nesting period and may cause vireos to abandon the site. Data supporting this contention are limited and subjective.

Species such as scrub jays (*Aphelocoma coerulescens*), squirrels, raccoons, and skunks may increase vireo nest predation where food sources for these species (which are often omnivorous) allow their populations to be maintained at artificially high levels. This may be a particular problem where urbanization is occurring. In urban settings, these predators have had a demonstrated influence (Wilcove 1985). The longer incubation time in vireos may make them more sensitive to increases in predator numbers than other passerines. Thus, in some situations, these predators may need to be controlled.

Comparative data on nest predation are limited. However, significantly fewer ($P < 0.05$) vireo nests were predated (Grzybowski unpubl. data) in areas where cowbirds were trapped at Kerr WMA than in areas where cowbirds were trapped in the Austin area (DLS Associates 1990) (24% of 134, and 54% of 102 nests, respectively). This higher number in the Austin area may be related to an increase in scrub jays benefiting from urbanization and/or to the increased successional maturity of the habitat (Grzybowski *et al.* MS). Very few nests were predated by mammals. However, as the incidence of parasitism declines, predation may become limiting to production.

Fire ants may create local problems. They tend to invade habitats along corridors of disturbance. Fire ants may have caused vireos to abandon their nests and eggs on a few territories in Travis County (O'Donnell pers. obs.). They may be a local problem in other urbanized areas, but have not been noted as a general problem rangewide. According to Tazik (in litt, 1991) few if any problems have been observed on Fort Hood.

Direct human disturbances: Human disturbance near and in nesting areas during the breeding season, particularly at the onset, may alter vireo behavior and/or cause vireos to abandon nests or territories. Use of taped songs may also have adverse effects (Marshall *et al.* 1985). Excessive use of tapes may have adversely affected the birds' behavior in some areas.

Pesticides: Pesticides, particularly systemics, may be a problem on vireo breeding and wintering areas.

G. CONSERVATION MEASURES ALREADY INITIATED

Cowbird removal at vireo nesting locations: Grzybowski (1985a,b) observed high nest parasitism by cowbirds at several sites in Oklahoma and Texas at an early date. Subsequent work confirmed generally high parasitism at other localities (Grzybowski 1989a, 1990c, Tazik and Cornelius 1989). Thus, cowbird control was perceived as an early management need to enhance vireo reproductive success.

Control occurs by trapping and removing cowbirds (including shooting) from vireo breeding sites and by removing cowbird eggs and young from vireo nests. Cowbirds are being removed from sites across Oklahoma and Texas including Blaine County, Oklahoma (Oklahoma Nature Conservancy; Hamilton 1991); the Wichita Mountains WR, Oklahoma (Grzybowski 1990b); Fort Hood MR, Texas (Tazik and Cornelius 1989); western Travis County and adjacent Burnet and Williamson counties, Texas (Texas Animal Damage Control Service 1990); the Kerr WMA, Kerr County, Texas and the Walter Buck WMA, Kimble County, Texas (Grzybowski 1990c); Lost Maples SNA, Bandera County, Texas (Bryan and Stuart 1990); and Big Bend NP, Brewster County, Texas (Mike Fleming, Big Bend NP, pers. comm.). A cowbird trap was operated at the Methodist Canyon Camp in Canadian County, Oklahoma from 1985 to 1987, but was moved in 1987 to protect greater numbers of vireos in the Wichita Mountains (Grzybowski 1989a). Additionally, traps were constructed and operated during 1986 in Texas at the Hill Country SNA, Bandera County; Meridian SP, Bosque County; and Dinosaur Valley SP, Somervell County (Wahl 1986).

Cowbird removal has substantially decreased parasitism of vireo nests at most of these sites and increased vireo reproductive success. The most dramatic results have been obtained at the Kerr WMA where trapping has reduced parasitism from 77% to 15%. Reproductive success in trapped areas exceeded 2.5 young per female for three consecutive years (Grzybowski 1990c). In western Travis County, parasitism was reduced to 15% in 1989, when production of young/female was 3.15-3.30 (DLS Associates 1989b).

However, trapping at Fort Hood has been less successful. From 1987 to 1989, 86% of vireo nests were parasitized in areas without trapping compared to 76% in areas with trapping. Females on Fort Hood fledged only 0.91 young per year in this period. Cowbird numbers are apparently high, and the primary effect of the trapping has been to reduce the number of cowbird eggs laid in vireo nests (Tazik and Cornelius 1989).

Cowbird eggs and young are being removed from vireo nests at some sites in conjunction with studies and monitoring of vireos. The benefit of this action, however, is limited to specific nests.

National Wildlife Refuge: A National Wildlife Refuge is being established by the U.S. Fish and Wildlife Service and will be managed significantly for the black-capped vireo and protecting extant vireo groupings in the Post Oak Ridge area near Austin, Texas.

Balcones Canyonlands Conservation Plan: The Endangered Species Act authorizes the U.S. Fish and Wildlife Service (Service) to permit the taking of federally listed wildlife species if such taking is "incidental to, and not the purpose of carrying out otherwise lawful activities (16 U.S.C. Section 1539)." This process is intended to reduce conflicts between listed species and private development and to encourage "creative partnerships" between the private sector and local, State, and Federal agencies in the interests of endangered species and habitat conservation. Before issuing a permit, the Service must be assured that the applicant will implement certain conservation measures. These measures are detailed in a conservation plan that the applicant is required to develop and submit with their application for an incidental take permit.

Development of such a plan is currently underway in the Austin, Texas, area and is being called the Balcones Canyonlands Conservation Plan (BCCP) (formerly called the Balcones Canyonlands Habitat Conservation Plan and before that the Austin Regional Habitat Conservation Plan). Under this plan, the population of black-capped vireos in this area would be protected and enhanced. Several preserves would be created under the BCCP, along with other conservation measures. It is hoped that a sustainable population of vireos can be maintained in this area under the BCCP in conjunction with the new National Wildlife Refuge. The BCCP is still developing and has not yet been submitted to the U.S. Fish and Wildlife Service for approval.

H. RECOVERY STRATEGY

The plan is designed to preserve, protect, and enhance (in some cases) the vireo populations that we now have until we can obtain a better understanding of whether full recovery is possible and, if so, what it will take to fully recover this species.

As part of recovery, these goals need to be further evaluated and refined, especially regarding population numbers, area, and habitat configurations needed to maintain viable populations. It is also desirable that populations maintain the capability for gene flow between regions. This genetic exchange should be considered as part of the design in their selection.

To further refine these goals, additional surveys should be conducted and various other information collected for use in population viability analyses. However, until this refinement occurs, all existing populations should be protected and maintained.

In addition, at least one viable population should be maintained in each of six regions throughout the vireos current breeding range. These six regions include Oklahoma, Mexico, and four of the six regions in Texas (see Figure 7).

Within the target regions, recovery activities may include the development of cowbird removal programs, habitat protection (including land acquisition, easements, and cooperative land management practices with private landowners), habitat management, and considerations for local threats (possibly including control of nest predators [such as scrub jays], browsers [such as deer and goats], and cattle [which attract cowbirds]) where necessary. Results of these activities should be monitored relative to changes in black-capped vireo numbers and other parameters deemed useful from recommended analyses. It is important to understand that populations transcend individual property boundaries, except where these property holdings are very large (> 10,000 hectares). Implementation will require focus on populations.

Regarding the cowbird threat, the current practice of site-specific cowbird removal, by itself, will not provide for long-term recovery of specific populations. Additional methods of reducing the threat from cowbirds need to be investigated.

Human-caused losses to any individual vireos or groups of vireos, whether they are in or outside of target regions or populations, would be considered "take" under provisions of the Endangered Species Act (Act) unless appropriate permits have been issued. ("Take" as defined by the Act means "to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, to attempt to engage in any such conduct.")

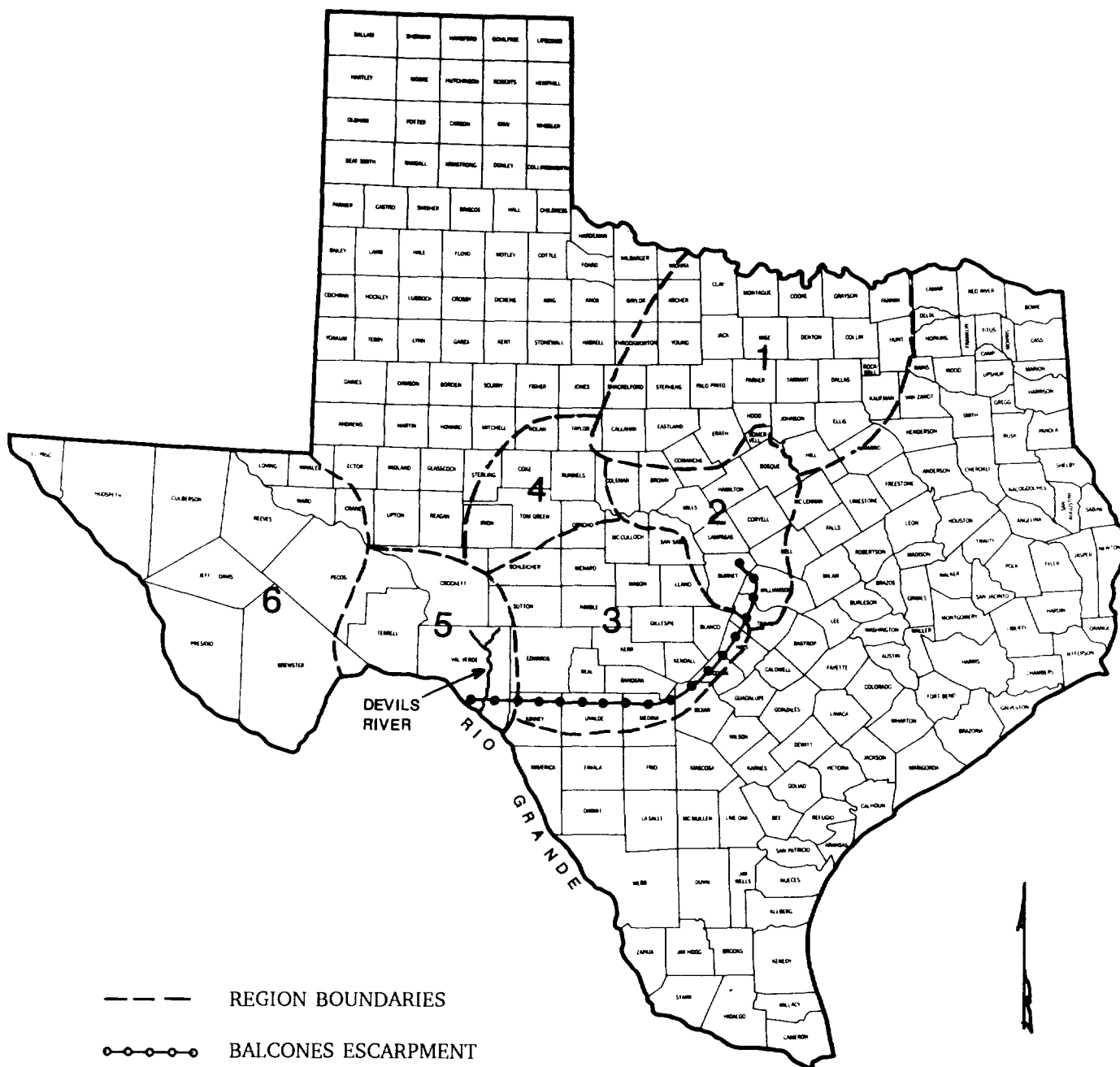


Figure 7. Natural regions and subregions of Texas as modified from Oberholser (1974) and U.S. Fish and Wildlife Service (1979).

II. RECOVERY

A. OBJECTIVES AND CRITERIA

Objective: The prospects for complete recovery and delisting of this species are uncertain. Therefore, an interim recovery objective is being identified for this plan. The interim objective is downlisting the black-capped vireo to threatened status. Criteria for this interim objective are given below.

Criteria: The black-capped vireo will be considered for reclassification from endangered to threatened when:

- (1) all existing populations are protected and maintained,
- (2) at least one viable breeding population exists in each of the following six locations:
 - Oklahoma
 - Mexico
 - four of the six Texas regions (designated in Figure 7),
- (3) sufficient and sustainable area and habitat on the winter range exists to support the breeding populations outlined in (1) and (2) above, and
- (4) all of the above have been maintained for at least 5 consecutive years and available data indicate that they will continue to be maintained.

Pease and Gingerich (1989) conducted some viability analyses for this species, and their approximations are similar to general estimates (i.e., not specific to the black-capped vireo) by Franklin (1980) and Frankel and Soulé (1981). Using the Pease and Gingerich (1989) estimate, a viable population should comprise at least 500 to 1,000 breeding pairs. The median value of 750 pairs should be achieved for at least 50% of the target viable populations. This viable population estimate may change with additional analyses (called for in this plan) and may differ from region-to-region.

This recovery plan is intended to preserve, protect, and enhance (in some cases) the vireo populations that now occur until we can obtain a better understanding of whether full recovery is possible and, if so, what it will take to fully recover this species. The feasibility of total recovery and delisting will be examined as part of this plan. If found to be feasible, criteria for determining when delisting could occur, in terms of viable populations (including population sizes, locations, and configurations), will be developed as part of this plan, and the plan will be revised to incorporate these new objectives and criteria.

These reclassification criteria are preliminary and may be revised based on new information (including research specified as recovery tasks in this plan). The estimated date for attaining the objective of this plan (downlisting to threatened) is the year 2020.

B. RECOVERY OUTLINE

The following is an outline of the recovery tasks needed to attain the objective of this plan. The following section (C.) includes more detailed information on the tasks.

1. Specific research and information needs

1.1 Surveys

- 1.11 Regional surveys
- 1.12 Supplemental surveys

1.2 Determine population configurations needed for long-term species survival and viability

- 1.21 Obtain information necessary to develop viability model
- 1.22 Develop viability model and recommend areas where viable populations exist and should be maintained and areas that have potential for development of viable populations

1.3 Cowbird threat

- 1.31 Determine where cowbirds are a serious threat
- 1.32 Determine the role of cattle in cowbird threat
- 1.33 Determine if feasible, and if so how, to manage cattle so they will not negatively impact vireo viability
- 1.34 Develop a long-term solution to the threat

1.4 Habitat

- 1.41 Determine habitat use throughout the range
- 1.42 Develop methods for identifying probable habitat
- 1.43 Determine how to manage habitat for the vireo
- 1.44 Identify areas where vireo habitat can be most easily created and maintained
 - 1.441 Habitat substrates
 - 1.442 Successional changes in habitat
- 1.45 Determine if habitat management techniques for deer (and exotic ungulates) and black-capped vireos are compatible

1.5 Determine extent of other threats

1.6 Winter range

- 1.61 Distribution and threats
- 1.62 Habitat

1.7 Determine usefulness of age structure data as an index to population health of the vireo

2. Maintain existing populations and assure at least six viable populations as called for in the recovery criteria

2.1 Habitat management

2.11 Vegetation manipulation

2.12 Manage browsers as needed

2.2 Protection of areas

2.21 Acquisition and lease

2.22 Work cooperatively with private landowners

2.23 Work with other agencies and organizations

2.24 Regulatory

2.3 Address cowbird threat

2.31 Site-specific/local cowbird control

2.32 Long-term solution to cowbird problem/threat

2.4 Manage for other threats where necessary and warranted

3. Monitoring

3.1 Develop monitoring techniques

3.2 Monitor populations within areas deemed necessary for recovery

3.3 Monitor habitat within areas deemed necessary for recovery

3.4 Monitor threats

4. Winter range

C. NARRATIVE OUTLINE FOR RECOVERY ACTIONS

1. Specific research and information needs

1.1 Surveys

1.11 Regional surveys. From the regional perspective, additional assessments of population status are still needed in (a) north-central Texas, (b) the southeastern portion of the Edwards Plateau (Austin/San Antonio/ Kerrville triangle), (c) the Concho Valley area near San Angelo, (d) the Devils's River and adjacent drainages in western Texas, and (e) the mountains of Coahuila, Mexico. In north-central Texas, these surveys should include areas along the Red River, Dallas and Ellis counties, and Palo Pinto and Parker counties. The first priority for status surveys should be those areas where the potential contribution to or role in the recovery of the species is greatest (for example areas that may have sizeable populations of vireos that have not yet been discovered).

1.12 Supplemental surveys. These may still be needed in the Big Bend region, in Travis and adjacent counties, in Lampasas, Hamilton, and Mills counties, Texas and in Blaine and Dewey counties, Oklahoma. The mentioned areas may have potential for development of viable populations. The first priority for these surveys should be areas on the Lampasas Cut Plains.

1.2 Determine population configurations needed for long-term species survival and viability

The concept of viable populations is an important part of the recovery plan. Data and analyses are needed to better refine population sizes, amount of area, and necessary configuration between specific habitat patches, including corridors, needed to meet recovery objectives with a reasonable probability of success. Data analyses will also disclose what levels of reproductive success are needed. Analysis may need to be conducted individually for different regions. These analyses should also evaluate whether full recovery of this species is possible and, if so, what would be required in terms of viable populations, including population sizes, locations, and configurations.

1.21 Obtain information necessary to develop viability model. While Pease and Gingerich (1989) have conducted some viability analyses for this species, and their approximations are similar to general estimates by Franklin (1980) and Frankel and Soulé (1981), this analysis can be improved by refining or developing empirical estimates of various population parameters. In particular, better estimates of the survivorships, dispersal, and movement of females and juveniles, and the coefficients of variation of fecundity and survivorship, are needed. Accommodations for dispersal also need to be considered. Better information is needed on dispersal distances of young and females so one can better identify the required area and configuration of viable populations.

Some of the information needed for viability models can be obtained by using existing data. Some empirical data are still needed for these

models, particularly for survivorship of females and juveniles. Females determine reproductive potential and are key components of population dynamics models. The young are the primary dispersing component in vireo populations and determine the area encompassing gene flow.

Banding studies that assess survivorship, dispersal, and movement should continue. These studies are best pursued where dispersal can be accurately assessed. Three sites currently offer the highest value for intensive banding studies: the Wichita Mountains WR and adjacent Fort Sill MR, Oklahoma; Fort Hood MR, Texas; and the area encompassed by the Balcones Canyonlands Conservation Plan, Texas.

- 1.22 Develop viability model and recommend areas where viable populations exist and should be maintained and areas that have potential for development of viable populations. The model should include necessary population configurations and corridors needed, as well as population sizes and areas needed.

A consideration in positioning potential populations is the relations between them, particularly the potential for gene flow and enhancement of adaptive genetic variation. This positioning should be evaluated from a theoretical perspective, but the proposed population areas and corridors need to be designed with existing populations and habitat in mind.

Specific locations, within the target regions, for the viable populations need to be further evaluated. Many can currently be identified, but other sites should be assessed. These sites should be selected to retain a diversity of habitats. Site selection should also be influenced by the distance to and location of other viable sites. Priority should also be given to those areas with the best currently existing populations, those in gaps or unique areas, and those requiring the least management.

Information obtained from surveys called for in task 1.1 and habitat research called for in 1.4 of this plan should play an important part in completing this task.

1.3 Cowbird threat

To date, the threat of cowbird parasitism on black-capped vireos has been addressed by attempting to remove cowbirds from select black-capped vireo nesting areas. However, this human intervention is labor intensive and will not result in a long-term, permanent solution to this threat. A long-term approach needs to be considered in terms of recovery and eventual delisting of the black-capped vireo. Cowbird removal should continue, in the interim, wherever parasitism poses a serious threat to the vireo.

- 1.31 Determine where cowbirds are a serious threat. Black-capped vireos do not appear to be as seriously impacted by cowbirds in some parts of their range. Cowbird removal should not be initiated in any new areas (i.e., areas not trapped, etc. in the last 5 years) until at least 2

years of data indicate cowbird control is warranted (unless cowbird parasitism is demonstrated to be very extreme in the first year).

- 1.32 Determine the role of cattle in cowbird threat. Cattle in or near vireo habitats can attract cowbirds and increase vireo nest parasitism. This task should identify the extent that cattle influence cowbird populations and thereby affect nest parasitism, and determine the extent this relationship is influenced by site.
- 1.33 Determine if feasible, and if so how, to manage cattle so they will not negatively impact vireo viability.
Cattle are widespread throughout the vireo's range. This task should endeavor to identify livestock management methods that will not negatively impact the vireo.
- 1.34 Develop a long-term solution to the threat.
The cowbird threat is currently being addressed by cowbird removal in specific black-capped vireo breeding sites. This approach may temporarily stabilize some vireo populations. However, it will not provide for long-term recovery because when cowbird removal is stopped, the threat increases again. Therefore, a long-term solution to the cowbird threat needs to be developed. In developing a solution, one needs to consider the cause of the threat. Various possibilities should be explored to determine which are feasible, ecologically sound, and most likely to be effective.

One particular alternative that should be considered is trying to control/reduce cowbirds with various management strategies, including management of land, habitat, and cattle. The long-term solution may involve a wide variety and combination of strategies, and may involve additional research on cowbird ecology. Among the possible strategies are habitat protection (through a variety of means discussed elsewhere in this plan) in particular configurations that are less advantageous for cowbirds -- perhaps contiguous, unfragmented tracts, located away from major cowbird food sources or feeding areas. Another strategy that may be investigated is land use practices that can be used to discourage high numbers of cowbirds. Management strategies may include removal of cowbirds and/or cattle in some cases, particularly on public lands. However, an attempt should be made to find management strategies that would not require continual cowbird removal or removal of cattle where cattle are desired on private lands.

1.4 Habitat

- 1.41 Determine habitat use throughout the range. The black-capped vireos' habitat varies in different parts of its range. Grzybowski *et al.* (unpubl. MS) have conducted a study of vireo habitat in parts of the range. However, additional work is needed to clarify important habitat components rangewide and to develop the information in ways more directly useful to managers and landowners.

Identifying important habitat components is important in understanding limitations on populations, effects of future development, and application of recovery strategies.

- 1.42 Develop methods for identifying probable habitat. There are no mechanisms for assessing amount and distribution of habitat other than on-site inspection. Various remote sensing methods should be further investigated. Methods may include looking at various factors besides vegetation, such as soils, aspect, etc. (see task 1.441).

Information on habitat distribution may prove useful in developing proposed configurations of habitat, in monitoring habitat changes, in identifying areas that may contain previously unknown black-capped vireo locations, and in evaluating particular activities which may impact vireos.

- 1.43 Determine how to manage habitat for the vireo. Techniques for managing vireo habitat should be developed for: (1) converting an area into vireo habitat and (2) keeping an area in vireo habitat. The best techniques may vary from site-to-site. In other areas, vireo habitat may be fairly stable and require little to no management. In other areas, where succession would result in conversion of the area out of vireo habitat, management may be necessary. This task is to determine the best methods to manage habitat for vireos in various locations.

- 1.44 Identify areas where vireo habitat can be most easily created and maintained, where it does not currently exist, but is needed for recovery.

- 1.441 Habitat substrates. Slope, aspect, and soil depth have been used in the Austin area to delimit areas with potential for vireo habitat (Butler/EH&A Team 1991). Sexton *et al.* (unpubl. MS) has found some relationship between occupied vireo habitats and Fredricksburg limestones. These databases and information should be tested. If useful, they can be exploited rangewide to determine the breadths and combinations of conditions conducive to producing vireo habitat. Substrates that maintain vireo habitats for an extended time should be identified. Knowledge of these substrates will help identify and choose sites for vireo habitat development.

- 1.442 Successional changes in habitat. Some black-capped vireo habitat undergoes successional changes. An assessment should be made of areas which have relatively stable habitat and areas undergoing succession that will result in loss of black-capped vireo habitat. This assessment should also include estimates of the rates of these changes and life expectancies of vireo habitat under various conditions. This knowledge will be important in developing specific habitat planning and management.

Several possible approaches to answering these questions include:

- a) Assemble and evaluate information on histories of occupied sites.
- b) Assemble or collect data on vegetational changes occurring in shrubland habitats. Much of this may be available through various rangeland monitoring databases.
- c) Investigate application of some remote but high resolution approaches, such as using high resolution imagery from aerial photos.

1.45 Determine if habitat management techniques for deer (and exotic ungulates) and black-capped vireos are compatible. Many landowners on the Edwards Plateau and elsewhere generate substantial income from hunting leases. Many of these landowners actively manage for deer (and exotic game ungulates). Deer are browsers and vireos seem to occupy habitats that provide good browse. This task should examine the compatibility of management practices for these two species. Recommendations should be made for maximizing compatibility and avoiding any adverse impacts to vireos from incompatible practices. This information could be used by a variety of federal and state extension service programs.

1.5 Determine extent of other threats

Where warranted (i.e., where threat, possibly on site-by-site basis, may be seriously impacting the vireo population). In some areas, vireos may be seriously impacted by threats that are not a problem rangewide. These other threats may include such things as fire ants, predation by scrub jays or other predators, unusual human disturbance, pesticides, etc.

If predators are seriously impacting a vireo population, other contributing factors such as habitat quality and proximity to humans should also be assessed.

1.6 Winter range

1.61 Distribution and threats. Determine black-capped vireo distribution and the extent and types of threats to the vireo and the habitat in the winter range.

1.62 Habitat. Determine habitat use, habitat condition, and the extent of probable vireo habitat on the winter range.

1.7 Determine usefulness of age structure data as an index to population health of the vireo

Age-structure data can, with survivorship, provide an index to population growth rate in stable populations. Age-structure data are easier to obtain than fecundity, consequently the reliability of this index should be explored. This index may greatly benefit the efficiency of current monitoring activities of reproductive success and future monitoring of the effects of conservation efforts.

2. Maintain existing populations and assure at least six viable populations as called for in the recovery criteria

2.1 Habitat management

Management will be necessary to create or maintain vireo habitat in certain areas. This management should consider other resource values, such as other species like the golden-cheeked warbler, and avoid or minimize negative impacts to these resources.

- 2.11 Vegetation manipulation. Recommendations for habitat management should be assembled into a series of guidelines useful for managers. These guidelines will be needed for site-specific management of public lands, and for consulting with private landowners.

These recommendations may vary from region-to-region. Information obtained in task 1.43 should be used to develop the guidelines; however, preliminary guidelines should be developed before that task is completed. Guidelines will be updated as new information becomes available. Habitat manipulation should proceed cautiously for the first few years until the preliminary guidelines are proven effective. All habitat manipulation should be preceded by collection of baseline data and followed by monitoring to evaluate results. Consideration should also be given to effects of management on other ecological values.

- 2.12 Manage browsers as needed. Management of browsing animals, such as deer and goats, should be considered where these species are negatively impacting vireo habitat.

2.2 Protection of areas

Vireo habitat and corridors can be protected in a number of ways. This protection will involve working with various landowners and other agencies and organizations.

- 2.21 Acquisition and lease. Habitat acquisition and easements will be needed in some areas to maintain target groupings of vireos. Various lease arrangements are appropriate for encouraging management on private lands.

The U.S. Fish and Wildlife Service has identified land in the Post Oak Ridge area west of Austin, Texas, for potential acquisition as a National Wildlife Refuge. The Texas Parks and Wildlife Department recently purchased lands containing vireos, including Kickapoo Caverns SP and Devils River SNA. Land acquisition is also one of the options being recommended by the BCCP (Butler/EH&A Team 1991).

Potential sites available for purchase should be identified within designated population areas, and prime sites obtained. U.S. Fish and Wildlife Service policy stipulates the agency will only acquire land from a willing seller.

- 2.22 Work cooperatively with private landowners. Use various methods to protect vireos and their habitat on private lands. This should be a major part of recovery because little public land occurs in the vireo's range.

Identify beneficial management practices and convey this information to landowners and managers through the various federal and state programs and extension services such as those of the Soil Conservation Service, state wildlife agencies, and the Fish and Wildlife Service. This process will be essential to recovery because private lands are a key component of areas needed to retain viable populations. Habitat management guidelines to be developed under task 2.11 will be useful to implement this task.

- 2.23 Work with other agencies and organizations. Some vireo habitat occurs on public land. Several agencies and organizations have roles or activities that could influence vireo recovery. The Service should work with these various agencies and organizations to aid in the conservation and recovery of the black-capped vireo.

- 2.24 Regulatory. The protective provisions in the Endangered Species Act and regulations should be enforced. These provisions include "take" prohibitions, among others. Enforcement of these provisions involves such things as Fish and Wildlife Service law enforcement, Section 7 consultations with Federal agencies, and review of permit applications.

2.3 Address cowbird threat

- 2.31 Site-specific/local cowbird control. Cowbird removal will be necessary at vireo breeding localities where cowbirds are a threat to reproductive success (see task 1.31). In those areas where cowbirds will be removed, removal should begin about 2 weeks prior to the arrival time of vireos at the breeding area.

- 2.32 Long-term solution to cowbird problem/threat. Use techniques identified under task 1.3. This solution will require cooperative work with private landowners and other agencies and organizations.

2.4 Manage for other threats where necessary and warranted

Localized threats may have to be addressed at some sites where they are seriously impacting the vireo population (see task 1.5). These determinations will be made on a site-by-site basis. Other threats may include fire ants, predation by scrub jays and other predators, unusual human disturbance, and pesticides. **Note:** If predator control is contemplated, careful consideration should be given to determining its necessity and ecological impact prior to any implementation. Other alternatives should be investigated.

3. Monitoring

Monitoring should occur across the range to determine the success of conservation actions and/or status of vireo populations. A number of items should be addressed in such monitoring.

3.1 Develop monitoring techniques

A general techniques should be established for each type of monitoring (habitat, vireos). These techniques should describe standardized data collection procedures so that results will be comparable. These techniques should be designed to minimize observer or other biases.

3.2 Monitor populations within areas deemed necessary for recovery

Monitor numbers, some measure of reproductive success and/or recruitment at designated sites within all targeted populations. This monitoring should include vireos in small and large groups because the large groups may be more stable. The small groups may be more sensitive to change and allow rapid detection of changes in local populations.

The percent of first year males may be a very useful indicator of the health and status of a population, and may be much more efficient than measuring reproductive success. The usefulness of this indicator is to be evaluated as part of task 1.7.

3.3 Monitor habitat within areas deemed necessary for recovery

Monitor habitat loss and gain within each population area. Such monitoring should also accompany management.

3.4 Monitor threats

The degree of vireo nest parasitism by cowbirds should be monitored to determine the level of threat and the potential benefit of cowbird removal. Monitor other threats which may be impacting vireo populations and the benefit of efforts to reduce these threats.

4. Winter range

Various cooperative international activities should be used to work with Mexico to address threats and to protect black-capped vireo wintering and breeding habitat. Activities that may provide opportunities for cooperative management include the U.S./Mexico Agreement, the International Affairs office of the Fish and Wildlife Service, and debt-for-nature swap programs.

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III. RECOVERY PLAN IMPLEMENTATION SCHEDULE

Priorities in column one of the following implementation schedule are assigned using the following guidelines:

- Priority 1 - An action that must be taken to prevent extinction or to prevent the species from declining irreversibly in the foreseeable future.
- Priority 2 - An action that must be taken to prevent a significant decline in species population/habitat quality, or some other significant negative impact short of extinction.
- Priority 3 - All other actions necessary to meet the recovery objectives.

Key to Acronyms used in Implementation Schedule

BCCP - Balcones Canyonlands Conservation Plan
DOD - Department of Defense
FWS - U.S. Fish and Wildlife Service
 FWE - Fish and Wildlife Enhancement
 IA - International Affairs
 LE - Law Enforcement
 RF - Refuges
NPS - National Park Service
SCS - Soil Conservation Service
TPWD - Texas Parks and Wildlife Department
TNC - The Nature Conservancy
USDA - U.S. Department of Agriculture

RECOVERY PLAN IMPLEMENTATION SCHEDULE

PRI-ORITY #	TASK #	TASK DESCRIPTION	TASK DURATION (YRS)	RESPONSIBLE PARTY			COST ESTIMATES (\$000)			COMMENTS
				REG	FWS PROGRAM	OTHER	FY 1	FY 2	FY 3	
1	1.31	Determine where cowbirds are serious threat	5	2	FWE		30 ✓	30 ✓	30 ✓	
						TPWD	10 ✓	10 ✓	10 ✓	
1	1.43	Determine how to manage habitat for vireo	10	2	FWE Refuges		30 ✓ 80 ✓ 10 ✓	30 ✓ 80 ✓ 10 ✓	30 ✓ 80 ✓ 10 ✓	
						TPWD				
1	1.61	Winter range-distribution and threats	3	2,8	FWE Research		50 ✓ 25 ✓	50 ✓ 25 ✓	50 ✓ 25 ✓	
1	2.22	Work cooperatively with private landowners	Ongoing		FWE Refuges		40 ✓ 40 ✓	40 ✓ 40 ✓	40 ✓ 40 ✓	*Extension service
						USDA*	10 ✓	10 ✓	10 ✓	
						SCS TPWD	10 ✓ 10 ✓	10 ✓ 10 ✓	10 ✓ 10 ✓	
1	2.23	Work with other agencies and organizations	Ongoing	2	FWE	* Various	20 ✓	20 ✓	20	*includes a large number including TPWD, NPS, DOD, SCS, USDA, BCCP, TNC

RECOVERY PLAN IMPLEMENTATION SCHEDULE

PRI- ORITY #	TASK #	TASK DESCRIPTION	TASK DURATION (YRS)	RESPONSIBLE PARTY			COST ESTIMATES (\$000)			COMMENTS
				REG	PROGRAM	OTHER	FY 1	FY 2	FY 3	
1	2.24	Regulatory	Ongoing	2	FWE LE Refuges		30 ✓ 10 ✓	30 ✓ 10 ✓	30 10 ✓	
1	2.31	Site-specific/local cowbird control	Ongoing	2	FWE Refuges		15 ✓ 20 ✓	15 ✓ 20 ✓	15 ✓ 20 ✓	*Animal Damage Control
						USDA* TPWD DOD	20 ✓ 10 ✓ 30 ✓	20 ✓ 10 ✓ 30 ✓	20 ✓ 10 ✓ 30 ✓	
1	4.	Winter range	Ongoing	2,9	FWE I.A.	NPS	5 ✓ 100 ✓	5 ✓ 100 ✓	5 ✓ 100 ✓	
2	1.11	Regional surveys	10	2	FWE	TPWD	37.5 ✓ 12.5 ✓	56.25 ✓ 18.75 ✓	56.25 ✓ 18.75 ✓	
2	1.21	Obtain information for viability models	4	2,8	FWE Refuges Research		20 ✓	20 ✓	20 ✓	
						DOD BCCP	20 ✓ 20 ✓	20 ✓ 20 ✓	20 ✓ 20 ✓	

78 240 240

RECOVERY PLAN IMPLEMENTATION SCHEDULE

PRI- ORITY #	TASK #	TASK DESCRIPTION	TASK DURATION (YRS)	RESPONSIBLE PARTY			COST ESTIMATES (\$000)			COMMENTS
				REG	PROGRAM	OTHER	FY 1	FY 2	FY 3	
2	1.22	Develop viability model and recommend areas for viable populations	1	2,8	FWE Research					This task will depend on tasks 1.1, 1.21, and 1.4
2	1.32	Determine role of cattle in cowbird threat	5	2	FWE Refuges		30 ✓	30 ✓	30 ✓	
						DOD TPWD	20 ✓ 10 ✓	20 ✓ 10 ✓	20 ✓ 10 ✓	
2	1.33	Determine if feasible and if so how, to manage cattle so they will not negatively impact vireo viability	3	2	FWE Refuges			15 ✓ 20 ✓	15 20	
						DOD TPWD		20 ✓ 5 ✓	20 5	
2	1.34	Develop long-term solution to cowbird threat	15	2	FWE Research Refuges		100 ✓	100 ✓	100 ✓	
2	1.41	Determine habitat use throughout range	10	2	FWE		50 ✓	50 ✓	50 ✓	

RECOVERY PLAN IMPLEMENTATION SCHEDULE

PRI- ORITY #	TASK #	TASK DESCRIPTION	TASK DURATION (YRS)	RESPONSIBLE PARTY			COST ESTIMATES (\$000)			COMMENTS
				REG	PROGRAM	OTHER	FY 1	FY 2	FY 3	
2	1.42	Develop methods for identifying probable habitat	3	2	FWE			25 ✓	25	
2	1.45	Determine compatibility between habitat management for deer and black-capped vireos	3	2	FWE		15	15 ✓	15	
						SCS USDA TPWD	5 ✓	5 ✓	5	
2	1.5	Determine extent of other threats	3	2	FWE Refuges		15 ✓	15 ✓	15	
						BCCP TPWD USDA	20 ✓ 10 ✓ 20 ✓	20 ✓ 10 ✓ 20 ✓	20 10 20	
2	1.62	Winter range-habitat	3	2,8	FWE Refuges		35 ✓	35 ✓	35 ✓	
2	2.11	Vegetation manipulation	Ongoing	2	FWE Refuges	TPWD		15 ✓ 30 ✓ 5 ✓	15 ✓ 30 ✓ 5	

1205 ✓ 205

RECOVERY PLAN IMPLEMENTATION SCHEDULE

PRI- ORITY #	TASK #	TASK DESCRIPTION	TASK DURATION (YRS)	RESPONSIBLE PARTY			COST ESTIMATES (\$000)			COMMENTS
				REG	PROGRAM	OTHER	FY 1	FY 2	FY 3	
2	2.12	Manage browsers as needed	Ongoing	2	FWE Refuges		10 ✓	10 ✓	10 x	
						SCS TPWD DOD USDA				
2	2.21	Aquisition and lease	10 years	2	Refuges, Realty		5,000 ✓	5,000 ✓	5,000 ✓	Service costs are for Balcones National Wildlife Refuge
						BCCP	10,000 ✓	10,000 ✓	10,000 x	
2	2.32	Long-term solution to cowbird threat/pro- blem	Undeter- minable at this time	2, 8	FWE, Research					Costs unknown at this time
						USDA				
2	2.4	Manage for other threats where necess- ary and warranted	Ongoing	2	FWE Refuges				10 x	
						BCCP			15 x	

16215 ✓ 16240 ✓

RECOVERY PLAN IMPLEMENTATION SCHEDULE

PRI- ORITY #	TASK #	TASK DESCRIPTION	TASK DURATION (YRS)	RESPONSIBLE PARTY			COST ESTIMATES (\$000)			COMMENTS
				REG	PROGRAM	OTHER	FY 1	FY 2	FY 3	
2	3.1	Develop monitoring techniques	1	2,8	FWE Refuges Research		20 ✓			
2	3.2	Monitor populations within areas deemed necessary for recovery	Ongoing	2	FWE Refuges		10 ✓ 5 ✓	10 ✓ 5 ✓	10 ✓ 5 ✓	
						DOD NPS TPWD BCCP	7 ✓ 4 ✓ 5 ✓ 10 ✓	7 ✓ 4 ✓ 5 ✓ 10 ✓	7 ✓ 4 ✓ 5 ✓ 10 ✓	
2	3.3	Monitor habitat within areas deemed necessary for recovery	Ongoing	2	FWE Refuges		10 ✓ 5 ✓	10 ✓ 5 ✓	10 ✓ 5 ✓	
						DOD NPS TPWD BCCP	7 ✓ 4 ✓ 5 ✓ 10 ✓	7 ✓ 4 ✓ 5 ✓ 10 ✓	7 ✓ 4 ✓ 5 ✓ 10 ✓	

16293 ✓

1622

RECOVERY PLAN IMPLEMENTATION SCHEDULE

PRIORITY #	TASK #	TASK DESCRIPTION	TASK DURATION (YRS)	RESPONSIBLE PARTY			COST ESTIMATES (\$000)			COMMENTS
				REG	PROGRAM	OTHER	FY 1	FY 2	FY 3	
2	3.4	Monitor threats	Ongoing	2	FWE Refuges		5 ✓ 3 ✓	5 ✓ 3 ✓	5 ✓ 3 ✓	
						DOD NPS TPWD BCCP TPWD	4 ✓ 2 ✓ 3 ✓ 5 ✓	4 ✓ 2 ✓ 3 ✓ 5 ✓	4 ✓ 2 ✓ 3 ✓ 5 ✓ 10	
3	1.12	Supplemental surveys	2	2	FWE		10 ✓	10 ✓		
						NPS	5 ✓			
3	1.441	Habitat substrates	3	2	FWE Refuges		15 ✓	15 ✓	15 ✓	
3	1.442	Successional changes in habitat	3	2	FWE Refuges		30 ✓	30 ✓	30 ✓	
						DOD TPWD	15 ✓ 10 ✓	15 ✓ 10 ✓	15 ✓ 10 ✓	

RECOVERY PLAN IMPLEMENTATION SCHEDULE

PRI- ORITY #	TASK #	TASK DESCRIPTION	TASK DURATION (YRS)	RESPONSIBLE PARTY			COST ESTIMATES (\$000)			COMMENTS
				REG	PROGRAM	OTHER	FY 1	FY 2	FY 3	
3	1.7	Determine usefulness of age structure data as index to vireo population health	6	2,8	FWE Research		10	10 ✓	10 ✓	

✓ 164574

164574 ✓

164574 ✓

IV. Appendix

List of Commenters	62
Summary of Comments and Service Response	66

**INDIVIDUALS AND AGENCIES PROVIDING COMMENTS ON THE
DRAFT BLACK-CAPPED VIREO RECOVERY PLAN**

ADAMS, THADDEUS H., 1803 Lawyer Place, College Station, TX 77840

**AULT, CHARLIE, U.S. Fish and Wildlife Service, Land Acquisition Planning, Division
of Realty, Albuquerque, NM 87103**

**BARLOW, JON C., Curator of Ornithology, University of Toronto, Robarts Library,
Toronto, Canada M5S 1A1**

BAUGHN, CYNTHIA, 603 Oak, Sweetwater, TX 79556

**BENSON, ROBERT H., Bioacoustics Laboratory, Texas A&M University,
College Station, TX 77843-3367**

BOTES, CINDY, 1803 Country Club Dr., Midland, TX 79701

**BRISENO, ALEXANDER E., City Manager, City of San Antonio, P.O. Box
839966, San Antonio, TX 78283-3966**

**BRUNS, DUSTY, Land Manager, Camp Bullis Training Site, Fort Sam Houston, TX
78234**

**CLAPP, ROGER B., Fish and Wildlife Service, National Museum of Natural History,
Washington, DC 20568**

**COOK, JOHN, Regional Director, National Park Service, Big Bend National Park, Big
Bend National Park, TX 79834**

CRANE, GEORGE, Lockhart, TX

DARLING, LYNN, 1317 S. 19th #2, Lincoln, NE 68502

**DENTON, LLOYD A., JR., Greater San Antonio Builders Association,
8925 N.W. Interstate 10, San Antonio, TX 78230**

**DIAMOND, DAVID D., Coordinator, Texas Natural Heritage Program,
Resource Protection Division, Texas Parks and Wildlife Dept., 4200 Smith School
Rd., Austin, TX 78744**

EVANS, PHIL, 6902 One Oak Road, Austin, TX 78749

**FISH AND WILDLIFE SERVICE, Acting Regional Director, Research and
Development, Washington, D.C. 20240**

**FISH AND WILDLIFE ENHANCEMENT, Field Supervisor, 608 East Cherry
Street, Columbia, MO 65201**

FOGERTY, JOHN K., 4426 Greystone, San Antonio, TX 78233

FORSYTHE, STEVE, Field Supervisor, U.S. Fish and Wildlife Service,
222 S. Houston, Ste. A, Tulsa, OK 74127

GRZYBOWSKI, JOSEPH A., 1701 Lenox, Norman, OK 73069

HENSON, PAT, Assistant State Conservationist, Soil Conservation Service, 101 South
Main Street, Temple, TX 76501

HILL, SHARON D., Acting Chief, Environmental Compliance Team, Dept. of the
Army, Headquarters III Corps and Ft. Hood, Ft. Hood, TX 76544-50

JAHRSDOERFER, SONJA, U.S. Fish and Wildlife Service, 222 S. Houston, Ste. A,
Tulsa, OK 74127

JETER-EDWARDS, JULIE, 4934 Furman, San Antonio, TX 78249

KEDDY-HECTOR, D. P., Texas Parks and Wildlife Dept., 4200 Smith School Rd.,
Austin, TX 78744

KEYES, CONRAD G., JR., Principal Engineer, Planning, International Boundary and
Water Commission, United States and Mexico, The Commons, Bldg. C, Suite
310, 4171 N. Mesa Street, El Paso, TX 79902

KIGHT, JOHN C., 744 W. San Antonio, Boerne, TX 78006

LADD, CLIFF, Senior Staff Ecologist, Espey, Huston & Associates, Inc., 916 Capital
of Texas Highway South, P.O. Box 519, Austin, TX 78767

MANNCHEN, BRANDT, 627 Euclid, Houston, TX 77009

MARSHALL, BARBARA, Star Route Box 152, Poteet, TX 78065

MARSHALL, JOE T., Zoologist (Research Ret.) Biological Survey, National Museum
of Natural History, Washington, DC 20560

MATCHEN, PAULA, 1008 James Street, Sweetwater, TX 79556

MAXWELL, TERRY C., Professor, Department of Biology, Angelo State University,
San Angelo, TX 76909

MCKINNEY, LARRY D., Director, Resource Protection Division, Texas Parks and
Wildlife Dept., 4200 Smith School Rd., Austin, TX 78744

MEISTER, NED, Regulatory Affairs Director, Texas Farm Bureau, State Office, P.O.
Box 2689, Waco, TX 76702

MOCK, R., Executive Director, Dallas Nature Center, 7171 Mountain Creek Pkwy.,
Dallas, TX 75249

MORRILL, WILLIAM I., Wildlife Management Inc., P.O. Box 880, Boerne, TX
78006

NICHOLS, JAMES D., Fish and Wildlife Service, Patuxent Wildlife Research Center,
Laurel, MD 20708

PARKER, PAUL J., 2707 Barton Point Drive, Austin, TX 78733

PEREZ, ROY T., Ecological Services, Fish and Wildlife Service, Corpus Christi, TX
78412

PHINNEY, MARY, Administrator, Dallas County Park and Open Space Program,
Dallas County Commissioner's Court, Dallas, TX 75202

PROBANDT, CHARLES, President, Texas Sheep and Goat Raisers' Association, P.O.
Box 2290, San Angelo, TX 76902

RUSSELL, KATHRYN, RT 2, Box 51B, Liberty Hill, TX 78642

RUSSELL, KEN, Fish and Wildlife Service, P.O. Box 1306, Albuquerque, NM 87103

RUSSELL, KERRY, of LLOYD, GOSSELINK, FOWLER, BLEVINS, AND
MATTHEWS, P.C., Attorneys at Law, P.O. Box 1725, Austin, TX 78767

RUSSELL, PHILLIP, 4722 Concord Dr., Garland, TX 75042

RUST, SUSAN, Stewardship Services, 168 Chevy Chase, San Antonio, TX
78209

SCHATZMAN, MARK, 348 Westview Terrace, Arlington, TX 76013

SCHULTZ, STEVE, Vice President - Urban Affairs, The Greater San Antonio Chamber
of Commerce, P.O. Box 1628, San Antonio, TX 78296

SCOTT, J. MICHAEL, Leader, Idaho Cooperative Fish and Wildlife Research Unit,
University of Idaho, Moscow, ID 83843

SEXTON, CHARLES W., Environmental Specialist, Environmental and Conservation
Services Dept., City of Austin, P.O. Box 1088, Austin, TX 78767

SHANNON, LARRY, Acting Assistant Director, Fish and Wildlife Enhancement, Fish
and Wildlife Service, Washington, D.C. 20240

STATON, BETH, P.O. Box 33, Ottine, TX 78658

TAZIK, DAVID D., U.S. Army, Construction Engineering Research Laboratory, Corps
of Engineers, P.O. Box 4005, Champaign, IL 61824-4005

TEXAS AND SOUTHWESTERN CATTLE RAISERS ASSOCIATION, 1301 West
Seventh, Fort Worth, TX 76102

THACKER, ROGER, Division of Laboratory Animal Resources, University of Kentucky
- Chandler Medical Center, H41A, Lexington, KY 40536-0084

**THOMAS, STANLEY E., Colonel, U.S. Army Commanding, Dept. of The Army,
Hdq., United States Army Garrison, Fort Sam Houston, Ft. Sam Houston, TX
78234-6000**

**WAHL, REX, Manager, Texas Coastal Sanctuaries, National Audubon Society, 3765 S.
Alameda St., Suite 415, Corpus Christi, TX 78411**

**PRINCIPAL COMMENTS RECEIVED ON THE
BLACK-CAPPED VIREO TECHNICAL/AGENCY DRAFT
RECOVERY PLAN**

Comments were received from 57 individuals or agencies. Some groups or individuals submitted more than one comment letter. All comments were considered when revising the draft plan. Many relevant and helpful comments were submitted on the draft recovery plan. The Service appreciates the time that each of the commenters took to review the draft and to submit their comments.

The comments discussed below represent a composite of those received. Comments of similar content are combined into general groups. Only critical comments, those raising a question, or suggestions are included in this discussion. Many favorable, supportive comments were also received.

Comment 1. Not enough emphasis has been given to winter range and population viability analysis of the black-capped vireo in Mexico.

Service Response: We agree that additional emphasis on winter habitat and population studies and conservation of the vireo in Mexico are needed and have endeavored to incorporate such tasks in the final recovery plan.

Comment 2. The feasibility and effectiveness of cowbird reduction efforts was questioned. Such control efforts are overemphasized in the recovery plan.

Service Response: Preliminary studies have shown increased vireo reproductive success in most areas where cowbird control has occurred. We agree that baseline information on the level of parasitism and vireo reproductive success should be collected prior to initiation of cowbird removal at any new sites. The Service does not anticipate broadscale reduction or eradication of cowbirds in the nation, state, or even in large subunits of a state. Past control efforts by the Animal Damage Control section that formerly was part of U.S. Fish and Wildlife Service, and more recently by the U.S. Department of Agriculture, indicate widespread efforts to eradicate or seriously reduce the numbers of the species would be too costly, unsuccessful, and probably ecologically unwise. The Service does anticipate continued use of localized control of cowbirds wherever it appears essential to maintain nesting populations of vireos. Appropriate balance is needed between cowbird control measures and other types of management techniques which may be less temporal and more cost effective.

Comment 3. Cowbird reduction sites need to be compared against "control" sites to assess the effectiveness of the cowbird reduction efforts.

Service Response: As noted in the response to Comment 2, baseline data on the level of parasitism and vireo reproductive success should be collected prior to initiation of cowbird removal on any new sites. In addition, monitoring to assess the effectiveness of cowbird reduction efforts is called for in the plan.

Comment 4. The cowbird reduction program is flawed because compensatory cowbird recruitment was not considered. Also, cowbird population size estimates are unrealistic.

Service Response: Cowbird removal activities in black-capped vireo nesting areas have not been designed to eliminate the species from an area. Control activities have been designed to reduce vireo nest parasitism in a localized area and the control efforts appear to have been successful in meeting this objective in most areas where cowbirds have been removed. Compensatory recruitment by cowbirds is a distinct possibility. Cowbirds definitely number in the millions nationwide, but the term billions cannot be documented.

Comment 5. A blackbird hunting season was proposed along with a cowbird management program in cooperation with Agricultural organizations.

Service Response: A special blackbird hunting season might accomplish little more than removal of the annual population surplus. Traditional fall hunting activities would not coincide with timing of the vireo nesting season when cowbird removal is beneficial to the vireo. Hunting activities would not be acceptable in the immediate vicinity of nesting vireos because of the associated disturbance and possible nest abandonment. Cowbird management programs in cooperation with Agricultural organizations have definite potential for benefiting vireos. Such opportunities will be investigated.

Comment 6. It may be unwise to shoot cowbirds in nesting areas of black-capped vireo because of the associated harassment, injury, or accidental killings of vireos which may result.

Service Response: We agree that such shooting must be permitted only on the periphery of nesting areas and at a great enough distance from any individual vireo nest to ensure that vireo nesting success will not be affected detrimentally. Shooters would need sufficient training and experience to ensure they only shot at cowbirds. Some assurance would also be necessary that the cowbirds being killed were those that potentially, because of such things as distance from the nesting area, might parasitize vireo nesting areas.

Comment 7. When implemented, the plan may violate the rights of private landowners if it regulates land clearing, burning, planting, etc. on private property.

Service Response: The Service has no intention of infringing on the rights of private landowners. The plan is intended to be a guide for recovery of the black-capped vireo. Implementation of any task is subject to national and international law.

Comment 8. Land acquisition should involve a willing seller relationship and should not be acquired through eminent domain.

Service Response: U.S. Fish and Wildlife Service policy stipulates the agency will only acquire land from a willing seller. Various conservation easements, cooperative agreements, or lease arrangements are also possible options to outright purchase.

Comment 9. Evaluation is needed of the plan's implications on other flora and fauna. What are the implications to the endangered golden-cheeked warbler?

Service Response: We agree that the management activities for vireos must be carefully planned and monitored to ensure that other scarce flora or fauna are not being detrimentally impacted by efforts to recover the vireo.

Comment 10. How feasible are management aspects of this plan?

Service Response: We believe it is feasible to attain the management (recovery) goals of the revised plan.

Comment 11. There appear to be some oversights on cost figures to implement the recovery plan. The total cost was not listed. Costs of browser/grazer control are not included. Predator control costs were not included.

Service Response: The total cost for each of the first three years is estimated. Future costs will likely be lower, but they are difficult to predict until we evaluate the success of the early efforts. At this time we are unable to predict the costs of browser/grazer control because the extent of use of this management technique is unknown. The need for predator control has not been determined, but has been identified as an area for further study. Therefore, because we do not know if this management technique will ever be called for or to what extent, we cannot estimate costs.

Comment 12. Are the baseline data, on which the plan is based, valid when one considers the small sample sizes, inadequate habitat descriptions, biased reproductive success data which only compared large versus small groupings, nesting habitat descriptions potentially biased toward studied sites, and drier portions of present vireo range were not included in vegetational analyses.

Service Response: A frequent difficulty in working with endangered species is that of small sample sizes, limited information, few studies, and incomplete information rangewide. Recovery actions must often be initiated with the best information available even though it is less than ideal. Delay of recovery action might ensure loss of the species. Therefore, recovery activities are initiated cautiously while additional baseline data gathering continues.

Comment 13. Will the proposed prescribed burning conflict with provisions of the Clean Air Act.

Service Response: Prescribed burning need not conflict with the Clean Air Act. The timing, location, and type of burning, however, is important. Prescribed burning will not be initiated if it violates State or Federal air quality standards.

Comment 14. Evapotranspiration was not addressed in the recovery plan as a secondary habitat factor.

Service Response: The statement is correct. A number of secondary habitat factors have not been considered in the research to date. These factors may deserve consideration in future research.

Comment 15. Short-term and long-term recovery goals should be delineated.

Service Response: Short-term goals are identified for downlisting the vireo to the Threatened category. We have insufficient information at this time to justify setting goals for delisting the species. Current policy requires that recovery plans be revised every 5 years as new information becomes available. A future revision will be an appropriate time to consider setting the long-term goals for delisting.

Comment 16. Climatic change is a definite factor and global warming may be beneficial for the vireo.

Service Response: Climatic change certainly influences the vireo. What effect (positive or negative) global warming would have on the vireo is unknown.

Comment 17. Habitat loss and modification were not addressed in the plan.

Service Response: Habitat loss and modification is discussed in the plan to the extent that it is known. Precise historical habitat acreages and distribution of the vireo are unknown so the loss and changes in distribution are discussed in general terms.

Comment 18. Land acquisition and preserve creation is not the solution. The U.S. Fish and Wildlife Service should work with landowners to create cost share incentive programs for conservation of the vireo. Why not develop incentives such as paying the private landowner \$200 for each successful vireo nesting effort on his property?

Service Response: Some types of management are best implemented on large units of land owned by the public. However, conservation on private lands is also essential to recovery of the vireo and is discussed and called for in the plan. Cost share and other incentive programs have the potential for significantly benefiting the vireo and we agree they should be evaluated as a recovery measure.

Comment 19. A 90 day extension is needed for the period permitting comments on the plan because there was insufficient public notice.

Service Response: Public notice was published in local newspapers and in the Federal Register. Letters inviting review of the draft plan were mailed to key agencies and individuals. An extension was granted but it was less than 30 days. The extension was less than the requested 90 days because the Service had to comply with other deadline dates established for plan completion. Notification of the extension was sent to all people who had requested a copy of the draft plan from us prior to reopening of the comment period. In addition, notification of the extension was published in the Federal Register.

Comment 20. The expertise of a plant ecologist is needed to develop an unbiased sample analysis of vireo habitat.

Service Response: We agree that plant ecologists have an important role in helping design habitat research. Plant ecologists were involved in review and revision of the plan.

Comment 21. Wildfire suppression could be considered take.

Service Response: Wildfire is not always synonymous with good management of vireo habitat. Prescribed burning differs from wildfire in the choice of time, fire intensity, fire duration, soil moisture conditions, location and other factors which may make wildfire detrimental. A judgement about whether wildfire suppression constitutes take (as defined by the Endangered Species Act) would appropriately be determined by the courts.

Comment 22. The downlisting and recovery criteria are arbitrary and too stringent.

Service Response: Downlisting and recovery criteria may appear arbitrary when one is dealing with an endangered species about which biological information is incomplete. For example, we do not know what population size is necessary to ensure long-term viability. Small population dynamics differ from that of large populations and they are influenced more by stochastic events. The endangered species biologist is forced to make

a "best estimate" of what constitutes sufficient recovery for downlisting. Fortunately, the revision of the recovery plan at 5 year intervals provides an opportunity for reevaluating the previously stated goals on the basis of new information. Current downlisting goals may be modified in the future if warranted by new information.

Comment 23. Developing habitat and/or captive breeding and reintroduction into historic range of the vireo should be considered in the plan.

Service Response: This recovery plan concentrates on actions necessary to stop population decline and to preserve existing population units. Development of habitat in areas within the historic range, but where it does not currently exist, may be necessary and is discussed in the plan. Captive propagation has an important role in recovery of some endangered species, but we do not currently believe it is necessary or justified for recovery of the black-capped vireo.

Comment 24. Critical habitat designation needs to be very specific.

Service Response: Critical habitat (as defined by the Endangered Species Act) has not been designated for the black-capped vireo. If such habitat is designated in the future it will be as specific as possible and will go through the required procedural rulemaking process.

Comment 25. More emphasis should be given to fire ant control within black-capped vireo habitat.

Service Response: At the present time we have no information suggesting that fire ants are an important factor limiting the populations of vireos. We will continue to be alert to their possible significance as biological studies of the vireo continue.

Comment 26. Enforcement actions were not described in detail.

Service Response: The statement is correct. Copies of the appropriate Federal and State laws are available from the agencies responsible for enforcing these laws. Interpretation of some aspects of the law may vary with unique individual circumstances which require interpretation by solicitors or legal experts. Recovery plans deal primarily with biological aspects of recovery. However, in the final plan we have included more detail on the general kinds of actions referred to as "enforcement".

Comment 27. Cost estimates appear to be underestimates.

Service Response: As estimates they may vary in their accuracy, depending on the number of unknowns involved. Some estimates may be overestimates. Some adjustments have been made in the final plan.

Comment 28. Status surveys, habitat distribution, and cowbird research should be given priority 1 on the implementation schedule.

Service Response: Priority 1 is an action absolutely essential to prevent extinction or to prevent the species from declining irreversibly in the foreseeable future. We believe that status surveys, habitat distribution, and most cowbird research is more appropriately assigned a priority 2, which is "an action that must be taken to prevent a significant

decline in species population/habitat quality, or some other significant negative impact short of extinction."

Comment 29. A recovery team should be formed for the vireo.

Service Response: Recovery teams are optional and when used are usually involved in drafting recovery plans. The Service has no plans to appoint a recovery team for the black-capped vireo. However, input from various biologists, agencies, etc. involved in vireo recovery have been considered in finalizing this plan and will be important in implementing this plan.

Comment 30. The dogmatic assumptions of rapid dynamics and successional nature of vireo habitat are erroneous. Some vireo populations like those in west Texas are in rather stable habitats.

Service Response: It is possible that some vireo habitats are fairly stable over time and other vireo habitats in other geographic locations exhibit rather rapid successional changes. It is not the intent of the Service to imply that all vireo habitats experience rapid successional changes, and revisions to the draft have been made to try to clarify this point.

Comment 31. Black-capped vireo population estimates of Benson and Benson (1990) are as good as many vireo population estimates from other regions.

Service Response: The statement is generally correct because census of small populations is usually fraught with the potential for error.

Comment 32. The reproductive ecology of black-capped vireo should be compared with that of other vireos and small passerines in the region.

Service Response: The comparison seems worthwhile in those species where sufficient information is available on their ecology. Unfortunately, we know even less about the biology and ecology of some other vireos and small passerines.

Comment 33. Areas with livestock and heavy human use have high cowbird densities. The most effective way to control cowbird parasitism is to remove the reason the cowbirds are there. This should be a management principle.

Service Response: There may be instances where it will be practical to regulate livestock use and human activities to benefit the vireo. In those circumstances these practices will be implemented.

Comment 34. The distribution of these vireos is not discussed in detail (ie., in Big Bend National Park, Camp Bullis, etc.).

Service Response: The statement is correct. Such detail is not a component of recovery plans. The interested reader/scientist is expected to refer to references listed for such detailed information.

Comment 35. Inadequate emphasis was placed on additional status and distribution surveys.

Service Response: Such additional surveys are important on the wintering grounds and in breeding habitat in Mexico and southwestern Texas. These should be accomplished as funds and priorities permit. The first priority is to protect known populations while simultaneously learning more about distribution and status at other sites.

Comment 36. The plan should be delayed several years and only written when information on the bird and its ecology is sufficient to implement better designated recovery actions.

Service Response: Under the Endangered Species Act recovery actions are to be implemented with the best available biological information. A plan with known limitations is better than no plan. Recovery actions that cautiously follow a plan and appropriate priorities are more likely to be successful than actions implemented without a plan. In addition, the plan identifies needs for and includes additional research as tasks in the plan. Future revisions to the plan will consider results of this research.

Comment 37. There are conflicting data about whether grazing by sheep and goats is detrimental or beneficial.

Service Response: Overbrowsing, particularly by goats, can be detrimental to black-capped vireos' habitat. However, in some cases, negative effects can be reversed if the animals are removed. Individual situations require onsite evaluation by a wildlife ecologist.

Comment 38. Recovery costs per bird are excessive.

Service Response: Recovery of endangered species is often expensive. However, rarely are recovery plans fully funded in any given year. How much is actually spent depends on annual budgets and appropriations. Perhaps this is one reason why so few species have ever been recovered.

Comment 39. There seems to be reasonable doubt the species is recoverable.

Service Response: The objectives of the plan have been revised. Delisting criteria are not given, pending further evaluation of whether total recovery is possible. Downlisting criteria are included in this final plan and the Service believes there is a high probability that these criteria can be met if sufficient funds are available to implement the recovery plan. There is always some element of uncertainty about success. The Endangered Species Act requires the development of recovery plans for the conservation and survival of listed species.

Comment 40. There is evidence the vireo has coexisted for centuries with cowbirds. The plan should concentrate on habitat acquisition and maintenance, not cowbird control.

Service Response: The vireo has coexisted for centuries with cowbirds. However, when man introduced large numbers of livestock, and altered habitat by his other activities, it appears he promoted an increase in numbers and distribution of cowbirds. Before man's intervention, the cowbird may not have been a factor limiting vireo populations. Man's intervention, however, may have changed the situation sufficiently to make the cowbird a significantly more effective nest parasite and, thus, a key factor limiting vireo populations. The draft plan may have overemphasized the role of cowbird control.

Habitat management and acquisition will be important parts of recovery. The draft plan was revised accordingly.

Comment 41. The plan places too much emphasis on research and not enough on application of current management knowledge.

Service Response: We do hope to fully use our current management knowledge. There is much to learn by refining our management techniques, by ascertaining that our techniques will accomplish what preliminary results suggest, and by researching new innovative recovery actions. Perhaps the wording of recovery implementation gave the impression that research is overemphasized.

Comment 42. The preferred citation (pg. ii) should be Grzybowski, J.A. 1991. He wrote it and should get credit as author.

Service Response: When contractors are hired to develop a draft plan, the Service retains the option of modifying the plan. The final published plan may not resemble the draft product provided by the contractor. The Service may include in the final plan some features that the original author opposes. For those reasons, the Service takes full responsibility as the final author but indicates in the plan the role of the contractor (in this case, on the title page).

Comment 43. Few studies of vireos on private lands were mentioned, but over 90 percent of the land base in Texas is privately owned. The land use and habitat structure on public lands is diverse and may not be similar to that of private lands.

Service Response: Some private lands have not been accessible because of trespass restrictions. Public ownership is also conducive to long-term studies. We are aware of the limitations of extant research and expect to be cautious in extrapolating them to all types of habitat in private ownership.

Comment 44. A reasonably accurate total population estimate, with appropriate estimates of standard deviation, is needed. Some individuals believe the vireo is more abundant than originally thought.

Service Response: The statement is correct. As time and funds permit, we hope to derive a total population estimate with appropriate statistical confidences.

Comment 45. No mention was made of the types of feeding areas needed during pre-nesting, nesting, and post-nesting periods.

Service Response: Information is lacking on food habits and the precise habitat needs for the periods mentioned.

Comment 46. Could artificial vireo nests with artificial eggs be placed in vireo nesting habitat to reduce the reproductive effectiveness of the cowbird? Why not develop sterilization techniques for cowbirds as an alternative to costly, eternal eradication programs?

Service Response: Yes, artificial vireo nests may prove to be a useful management technique aiding in reducing the detrimental impact of nest parasitism by cowbirds.

Sterilization techniques also have potential for minimizing the cost and efforts currently needed to control cowbirds in localized areas.

Comment 47. The plan should include a means of monitoring the cost effectiveness of recovery techniques.

Service Response: Management costs in relation to the resulting recovery benefits are the typical way in which we assess cost effectiveness.