Section 6 (Texas Traditional) Report Review

FEB 2 4 2006

Attachment to letter dated _____

Project Title: Breeding Habitat, Distribution and Population Status of the Black-capped Vireo in Northern Mexico

Final or Interim Report? Final

Job #: WER 65 **Grant #:** E- 17

Reviewer Station: Arlington ESFO, Austin ESFO

Lead station was contacted and concurs with the following comments:
☐ Yes ☐ No ☒ Not applicable (reviewer is from lead station)

Interim Report (check one):

☐ is acceptable as is

☐ is acceptable as is, but comments below need to be addressed in the next report

☐ needs revision (see comments below)

Final Report (check one):

☐ is acceptable as is

☒ is acceptable, but needs minor revision (see comments below)

☐ needs major revision (see comments below)

Comments

This study significantly adds to the knowledge of the vireo's range outside of the U.S. We only have a few comments for finalizing this report.

In addition to addressing our comments on the previous draft of the final report, we note that 2004 survey information, which was not part of this grant, was submitted. We appreciate the submission of this additional information. However, for the purposes of finalizing this grant, we would like to have a report that includes all data collected and summarized, so that the report can stand alone. The data can be appended rather than included within the report, if that is easier. As part of the data submitted, please include latitude and longitude for all sightings. Finally, for Attachment A, which is in color, please either separate the routes out by year or submit the figure electronically, so that we are able to reproduce it.

FINAL REPORT

As Required by

THE ENDANGERED SPECIES PROGRAM

TEXAS

Grant No. E - 17

Endangered and Threatened Species Conservation

Project WER 65: Breeding Habitat, Distribution And Population Status of the Black-capped Vireo in Northern Mexico

Prepared by:

C. Craig Farquhar, Ph. D.

Robert Cook
Executive Director

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February 24, 2005

PERFORMANCE REPORT

STATE: Texas **GRANT NUMBER:** E-17

GRANT TITLE: Endangered and Threatened Species Conservation

REPORTING PERIOD: 1 September 2001 – 31 August 2004

PROJECT NUMBER: WER 65

PROJECT TITLE:

Breeding Habitat, Distribution And Population Status Of The Black-capped Vireo in Northern Mexico

OBJECTIVE(S):

1. To census breeding populations and characterize habitat of BCVI in northern Mexico.
2. To identify key land use threats, and develop management strategies.

Segment Objectives:

1. Populations of BCVIs will be located and mapped using previously published information and information from landowner and agency contacts. To the extent possible, territories will be mapped and reproductive activity will be monitored by locating and observing individuals. The number, sex ratio, and parasitism rates of brood parasites (Brown-headed Cowbirds and/or Bronzed Cowbirds, *M. aeneus)* will be recorded. The presence of potential predators will also be noted.

2. BCVI populations will be censused with the distance sampling method (Thomas et al., 2001) from randomly assigned line transects or point counts (depending upon habitat) within potential habitat.

3. Principal vegetative components will be identified and tabulated following USFWS guidelines (USFWS 1994). Habitat information will include identification of the dominant woody species, approximate percent cover and relative canopy height (methods adapted and modified from Grzybowski 1994).

4. Identify and contact key landowners and agencies in Mexico in order to establish and promote management guidelines, protection measures, and conservation goals for breeding BCVI.

5. Identify major land use threats to breeding BCVI.

Summary Of Progress:

Please see Attachment A.

Significant Deviations:

None.

Location: Mexican states of Coahuila, Nuevo Leon, Tamaulipas, and San Luis Potosi

Cost: $39,054.00 (Total)
$29,290.50 (Federal Share)

Prepared by: Craig Farquhar **Date:** 02/25/2005

Approved by: **Date:** 02/28/2005
Neil (Nick) E. Carter
Federal Aid Coordinator

Breeding Habitat, Distribution and Population Status of the Black-capped Vireo in Northern México

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Section 6 Grant No. E-17
Final Report

First photographic evidence of breeding BCVI in México
(Cañón del Sotol, Serranías del Burro, Municipio de Zaragoza, Coahuila; Farquhar et al., 2003)

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Acknowledgments

This was a very successful, bi-national, cooperative effort between Texas Parks and Wildlife Department, Austin, Texas, and the Universidad Autónoma de Nuevo León (UANL), Monterrey, Nuevo León. We gratefully acknowledge the Section 6 program at Texas Parks and Wildlife Department, in cooperation with the U. S. Fish & Wildlife Service, for their financial support of our study. Prior to this work very little was known about the biology, ecology and conservation of the federally (U.S.) endangered Black-capped Vireo. The results will greatly assist efforts in range-wide conservation planning and management, and will direct future research efforts. The present study was initiated in 2001 with the participation of Dr. Jose I. Gonzalez and his students; their high level of motivation and energy made this project thrive and achieve very positive results. Their efforts are to be highly commended. Many UANL students and staff assisted with field work, lab work, data entry, and logistical efforts; their participation was essential to the overall success of the project. Three thesis students were involved to the greatest extent: Oscar Ballesteros Medrano, Mario Guerrero Madriles, and Adriana Nuñez Gonzalo. Other students who graciously lent their support for various tasks included Irene Ruvalcaba Ortega, Alina Ollala Kerstupp, Gabriel Ruiz Ayma, Jose Arnoldo Sanchez Almazan, Mariam Latofski Robles, Armando Jimenez Camacho, Amanda Cavazos Alvarez, Rene Valdes Peña, and Cesar Espinoza Lopez. UANL faculty who lent their expertise included Glafiro Alanis Guzman, Alejandro Ledezma Menxuerio, Hidalgo Rodriguez Vela, Dr. Antonio Moreno Talamantes, and Dr. Jose Angel Villareal Quintanilla. Nest and habitat location was greatly enhanced by the efforts of John Maresh and, for nest location, Wes Bailey.

Since the expiration of the project's Section 6 funding in 2004 the UANL team has moved forward and secured additional funding to continue the project in the long-term.

Introduction

This project was generated in response to a pronounced lack of data on the breeding ecology, distribution, conservation threats, and management strategies for populations from México of the federally endangered Black-capped Vireo (BCVI; *Vireo atricapilla*). Comparatively, the breeding biology, habitat, and distribution of the BCVI is well-known in the central Texas and northward (Oklahoma) portions of their U. S. geographic distribution (Graber 1957, 1961, Oberholser 1974, Marshall et. al 1985, Grzybowski 1986, 1988, 1989a, 1989b, 1990a, 1990b, 1990c, 1990d, 1995, Grzybowski et al., 1986, 1994). Data collected for this project were envisioned to be useful in better understanding the conservation status of this species.

Only sparse information is available in the literature with regard to Mexican populations of the BCVI during the breeding season, April through August. Breeding habitat, which is thought to occur in distinct attitudinal zones in México, has been described mainly from northern Coahuila (Graber 1961). Lowland habitat has been described as "rich, dense, desert shrub" at the base of several mountain ranges in northern México (Marshall et al., 1985, Grzybowski 1995). Benson and Benson encountered "montane low forest" characterized by Ponderosa pine-type pine-oak woodlands with dense shinnery up to 1300 m, and open conifer dominated mesas above 2000 m. Although sightings of adult BCVI had been irregularly recorded (Graber 1961, Marshall et al., 1985) during the breeding season in Nuevo León, Tamaulipas, and San Luis Potosí, none had been confirmed as part of a breeding population prior to the current study.

Except for the few nests (n<10) reported by Graber (1961) for central Coahuila no nesting has been confirmed in México.

Two contrasting estimates of breeding population size in México existed prior to this project (Marshall et al. 1985, Benson and Benson 1990). Marshall et al. (1985) examined four regions of northern Coahuila and determined the population to not exceed 131 pairs, a value subsequently used elsewhere (Steed 1988). Benson and Benson (1990), however, examined four localities by opportunistically walking 165 m wide ‘strip transects’ in suspected BCVI habitat in 4 sites in northern Coahuila. They observed 28 singing males, and calculated 1.43 pairs/km^2, using a weighted average (assuming 73% of males are mated), and extrapolated that figure to 6,301 +/- 3,162 pairs, for potential habitat in the survey zone. Scott and Garton (1991), however, pointed to serious flaws in the statistical methods applied by Benson and Benson mainly regarding variance estimates. Benson and Benson (1991) replied with a reanalysis using a distance algorithm (Burnham et al, 1980), arriving at a figure of 1.65 singing males/km^2 (0.02 singing males/ha), extrapolating to 7,286 +/- 3,891 singing males for the survey zone.

Regardless, BCVI population size (i.e., density) is at best roughly presumed to be greater than that of the Texas and Oklahoma range. McKinney (1998) corroborates high density estimates of Benson and Benson (1990) with values of 26 and 20 singing males in four and six hectares, respectively, in northern Coahuila. If true, these densities are incompatible with the more generally accepted individual male territory size of 1.0 - 2.0 hectares (Grzybowski 1995).

Relatively little is known about conservation threats to BCVI in México, but they can be presumed to be similar to those encountered in the U. S.. Consequently, brood parasitism is very likely a factor to consider as the Brown-headed Cowbird (*Molothrus ater*) is abundant throughout the range of the BCVI in México and should be expected to have similar impacts on breeding BCVI as has been found in the U. S.. The single anecdotal report of BCVI brood parasitism by Bronzed Cowbirds (*M. aeneus*; Bryan *in* USFWS 1991:26) has not been corroborated elsewhere, but they range widely in NE México (east of Coahuila; Howell and Webb 1995) and could impact BCVI there. The Shiny Cowbird (*M. bonariensis*), spreading westward from SE U.S., has been recorded in the vicinity of BCVI nesting habitat in Oklahoma (Grzybowski and Fazio 2001) and Texas (Lasley and Sexton 1990), but is not listed as parasitizing the BCVI by Ortega (1998).

Cowbird control has been widely advocated (USFWS 1991, Grzybowski 1995, Campbell 1995, Beardmore et al., 1996, TNC 2004) as an effective measure in reducing brood parasitism and increasing BCVI (and other host) productivity. No cowbird control programs are currently underway in México, as far as we know.

Habitat degradation and destruction probably can be encountered throughout the range in México, as can related effects of urbanization and other anthropogenic landscape conversion.

The objectives of this study were to:

(1) To census breeding populations and characterize habitat of BCVI in northern México, and

(2) To identify key landuse threats, and develop management strategies.

Preliminary results of this project have been reported elsewhere (Farquhar et al., 2000, 2001, 2002, 2003).

Study Area

Early references (Renardo 1886, Moore 1938, Miller 1955, Van Hoose 1955, Graber 1961) suggest the breeding range of the BCVI in México did not extend south of central Coahuila, although a small number of breeding season records exists for west central Tamaulipas (Phillips 1911, Graber 1961), along with one for southeastern San Luis Potosí (Davis *in* Graber 1961). Sightings compiled by

Marshall et al. (1984, 1985) included three from the mid-1970's in Nuevo León. This study covered the following states (Fig. 1) from which BCVI was either known or suspected to occur during the breeding season: Coahuila, Nuevo León, Tamaulipas, and San Luis Potosí.

Figure 1. Study area for investigating breeding Black-capped Vireos in northeastern México.

Methods

The methods for this project are from the Approach section of the Project Statement (TPWD Contract # 99824) for this project:

1) Populations of BCVI will be located and mapped using previously published information and information from landowner and agency contacts. To the extent possible, territories will be mapped and reproductive activity will be monitored by locating and observing individuals. The number, sex ratio, and parasitism rates of brood parasites (Brown-headed Cowbirds and/or Bronzed Cowbirds) will be recorded. The presence of potential predators will also be noted.

2) BCVI will be censused by randomly assigning line transects within known habitat and analyzed following standard methods (e.g., Bibby et al.l992). Every effort will be made to incorporate distance detectability estimates in order that absolute densities may be calculated.

   Note: examination of specific field conditions at each site led to the conclusion that point, rather than line, transects would be more appropriate. In addition, we incorporated the design framework and analytical components of Distance Sampling (Buckland et al., 2001), using associated software (Distance, v. 4.0; Thomas, et. al. 2002).

3) Principal vegetative components will be identified and tabulated following USFWS guidelines (USFWS 1994). Habitat information will include identification of the dominant woody species, approximate percent cover and relative canopy height (methods adapted and modified from Grzybowski et al., 1994).

4) Identify and contact key landowners and agencies in México in order to establish and promote management guidelines, protection measures, and conservation goals for breeding BCVI.

5) Identify major land use threats to breeding BCVI.

Results and Discussion

2004 Results

This final year of our study we re-visited established sites in Coahuila, Nuevo León and Tamaulipas. One five-day visit (2 researchers) was conducted in May near the Tamaulipas localities of Palmillas and Miquihuana, where we had observed BCVI last year. Three five-day visits were carried out in June at Rancho Minas Viejas, Nuevo León (site described in Farquhar et al., 2002), by three researchers, and one five-day visit was conducted in June and July at Rancho La Escondida, Coahuila (site described in Farquhar et al., 2000), by three researchers. The latter visits were hampered by inclement weather, and no useful data were obtained. Field effort for the 2004 season totaled 680 researcher-hrs.

Population Survey

Rancho Minas Viejas, Nuevo León

We established and surveyed fifty-one distance sampling plots on 12-16 and 23-24 June, 2004, at our Rancho Minas Viejas study site in similar fashion to those at Rancho La Escondida in 2002 (Farquhar et al. 2003). A total of 95 BCVI

registrations were tallied from the plots (Table 1). However, as in our pilot study at this site last year (2003), we had great difficulty in acquiring reliable distance

Table 1. Distance sampling data obtained from a 2004 survey for BCVI at Rancho Minas Viejas, Villaldama, Nuevo León.

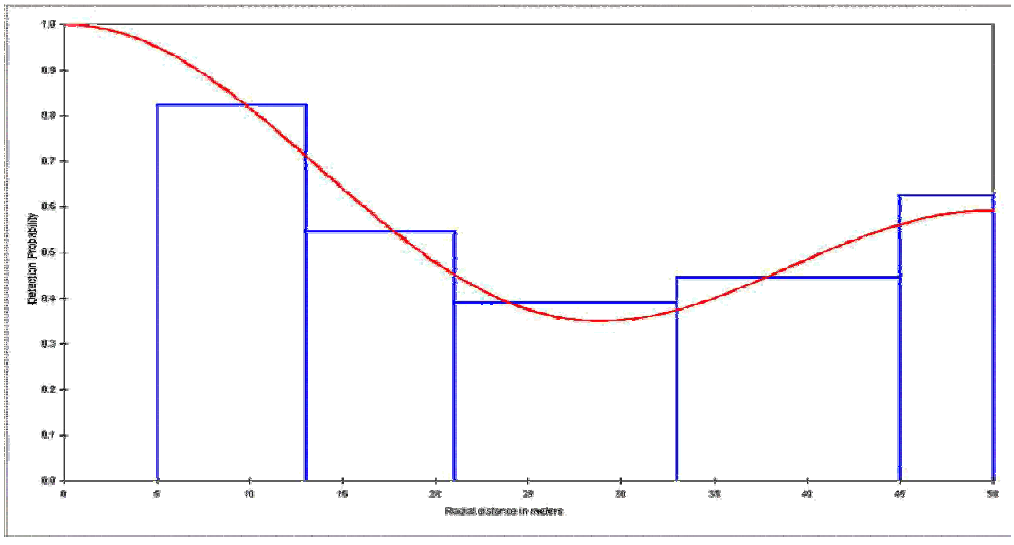
Obs	Date 2004	Pt	Time	Dist (m)	E	N	Elev (masl)	0-3 min	3-8 min
1	12-Jun	1	7:03	48	363758	2948411	934	x	
2	12-Jun	1	7:03	27	363758	2948411	934	x	
3	12-Jun	2	7:40	9	363758	2948566	946	x	
4	12-Jun	2	7:40	37	363758	2948566	946		x
5	12-Jun	2	7:40	43	363758	2948566	946		x
6	12-Jun	3	8:40	40	363781	2948727	946	x	
7	12-Jun	3	8:40	22	363781	2948727	946		x
8	12-Jun	4	9:22	38	363806	2948888	916		x
9	12-Jun	5	9:49	49	363836	2949034	901	x	
10	12-Jun	6	10:21	0	363988	2948998	906		
11	12-Jun	7	10:58	47	364005	2948848	921		x
12	12-Jun	8	11:21	33	363996	2948703	932		x
13	12-Jun	9	11:38	39	364004	2948559	940	x	
14	12-Jun	9	11:38	45	364004	2948559	940	x	
15	12-Jun	9	11:38	48	364004	2948559	940		x
16	14-Jun	10	7:15	0	363983	2948405	940		
17	14-Jun	11	7:53	10	364127	2948397	947	x	
18	14-Jun	11	7:53	22	364127	2948397	947	x	
19	14-Jun	12	8:59	16	364157	2948564	945		x
20	14-Jun	13	9:31	47	364211	2948709	939		x
21	14-Jun	14	9:55	37	364211	2948854	930	x	
22	14-Jun	14	9:55	31	364211	2948854	930	x	
23	14-Jun	14	9:55	28	364211	2948854	930		x
24	14-Jun	15	10:35	20	364231	2949005	914	x	
25	14-Jun	16	11:27	27	364601	2948800	961		x
26	14-Jun	16	11:27	34	364601	2948800	961		x
27	14-Jun	16	11:27	48	364601	2948800	961		x
28	15-Jun	17	7:59	11	364643	2948637	991	x	
29	15-Jun	18	8:37	0	364694	2948488	1000		
30	15-Jun	19	8:59	18	364757	2948348	1009	x	
31	15-Jun	19	8:59	14	364757	2948348	1009	x	
32	15-Jun	19	8:59	24	364757	2948348	1009		x
33	15-Jun	20	9:26	38	364841	2948209	1005	x	
34	15-Jun	20	9:26	47	364841	2948209	1005	x	
35	15-Jun	20	9:26	50	364841	2948209	1005	x	
36	15-Jun	21	9:59	0	364997	2948262	1039		
37	15-Jun	22	10:45	34	364957	2948418	1036	x	
38	15-Jun	22	10:45	28	364957	2948418	1036	x	
39	15-Jun	23	11:32	0	364878	2948575	1005		
40	15-Jun	24	11:52	43	364827	2948739	1000	x	

41	15-Jun	24	11:52	50	364827	2948739	1000	x	
42	15-Jun	24	11:52	50	364827	2948739	1000	x	
43	16-Jun	25	7:30	46	364748	2948806	985		x
44	16-Jun	25	7:30	33	364748	2948806	985		x
45	16-Jun	26	7:47	28	364877	2948902	997	x	
46	16-Jun	26	7:47	47	364877	2948902	997	x	
47	16-Jun	26	7:47	27	364877	2948902	997	x	
48	16-Jun	27	8:10	41	364894	2949100	1009		x
49	16-Jun	28	8:25	31	365057	2949062	1039	x	
50	16-Jun	28	8:25	40	365057	2949062	1039	x	
51	16-Jun	28	8:25	50	365057	2949062	1039	x	
52	16-Jun	29	8:40	5	365211	2949082	1060	x	
53	16-Jun	29	8:40	5	365211	2949082	1060	x	
54	16-Jun	29	8:40	8	365211	2949082	1060	x	
55	16-Jun	29	8:40	42	365211	2949082	1060	x	
56	16-Jun	29	8:40	10	365211	2949082	1060		x
57	16-Jun	30	9:01	0	365389	2949076	1062		
58	16-Jun	31	9:20	0	365548	2949037	1107		
59	16-Jun	32	10:00	10	365020	2949194	1017		x
60	16-Jun	33	10:30	17	364734	2949142	986	x	
61	16-Jun	34	10:47	38	364579	2949181	947	x	
62	16-Jun	34	10:47	49	364579	2949181	947		x
63	16-Jun	35	11:26	0	365075	2948968	1038		
64	23-Jun	36	7:28	47	364445	2948702	967		x
65	23-Jun	36	7:28	40	364445	2948702	967		x
66	23-Jun	37	8:25	0	364487	2948544	960		
67	23-Jun	38	9:17	34	364553	2948409	983	x	
68	23-Jun	39	9:45	49	364595	2948301	978	x	
69	23-Jun	39	9:45	38	364595	2948301	978	x	
70	23-Jun	40	10:37	16	364603	2948160	970	x	
71	23-Jun	40	10:37	28	364603	2948160	970	x	
72	23-Jun	40	10:37	37	364603	2948160	970	x	
73	24-Jun	41	8:22	27	362653	2947207	834		x
74	24-Jun	41	8:22	35	362653	2947207	834		x
75	24-Jun	42	8:44	0	362806	2947270	849		
76	24-Jun	43	8:58	0	362917	2947394	853		
77	24-Jun	44	9:13	47	363039	2947530	863		x
78	24-Jun	45	9:35	18	363027	2947688	876	x	
79	24-Jun	45	9:35	38	363027	2947688	876	x	
80	24-Jun	45	9:35	34	363027	2947688	876		x
81	24-Jun	46	9:50	48	363159	2947795	878	x	
82	24-Jun	47	10:06	0	363320	2947865	894		
83	24-Jun	48	10:25	43	363314	2948029	905	x	
84	24-Jun	48	10:25	38	363314	2948029	905	x	
85	24-Jun	49	10:40	49	363440	2948135	915	x	
86	24-Jun	49	10:40	37	363440	2948135	915	x	
87	24-Jun	49	10:40	34	363440	2948135	915		x
88	24-Jun	49	10:40	46	363440	2948135	915		x

89	24-Jun	50	10:56	20	363537	2948270	923	x	
90	24-Jun	50	10:56	19	363537	2948270	923	x	
91	24-Jun	50	10:56	32	363537	2948270	923	x	
92	24-Jun	50	10:56	34	363537	2948270	923	x	
93	24-Jun	51	11:15	25	363676	2948378	934		x
94	24-Jun	51	11:15	35	363676	2948378	934		x
95	24-Jun	51	11:15	18	363676	2948378	934		x

measurements with our laser rangefinders. This problem was due to the dense and impenetrable nature of the vegetation and the corresponding difficulty in obtaining reliable distance measurements on vocalizing BCVI. Analyses of the data obtained this year revealed troublesome bimodal frequency distributions (Fig. 2) that precluded generation of satisfactory detection functions, without which density estimates cannot be satisfactorily estimated (Buckland et al., 2001). As a result, we had to abandon our attempt at distance sampling at this site. Other BCVI researchers have had similar problems in other parts of the range (see The Nature Conservancy 2004). Our recommendation is that another method of obtaining measurements be considered. Perhaps using ladders at each point to allow the observer to see above the vegetation and obtain good measurements to vocalizing birds. But this would only work if the researcher can carry a ladder through the dense vegetation in a time efficient manner, and this may be prohibitive. An interesting alternative might be the use of "autonomous recording devices," as implemented at Ft. Hood Military Reservation by staff from the Cornell Laboratory of Ornithology (K. Fristrup, pers. comm.). Such a technique employs recording devices set aloft by helium balloons and guided by onboard global positioning system (GPS) units. Preliminary data suggest this technique holds much promise.

Figure 2. Bimodal detection function generated from distance sampling data, Rancho Minas Viejas, 2004.



Tamaulipas

We toured areas during May 2004 near the towns of Palmillas and Miquihuana, in the same vicinity visited last year (Farquhar et al., 2003). However, we failed this year to observe Black-capped Vireos which contrasts sharply with our finding from the previous year when we strongly suspected breeding had occurred as evidenced by observation of family groups (Farquhar et al., 2003). After surveying the sites this May we concluded that there had been drastic habitat changes that might have prevented successful re-establishment by the vireos. Compared to last year's visit we encountered very dry conditions exacerbated by an extended drought in the region. Additionally, particularly for the area around Miquihuana where we had observed BCVI last year, the landscape had undergone extensive impact due to grazing and browsing by livestock. Other areas in Tamaulipas were not well surveyed this year due to heavy rains and poor visibility during our visit.

Vegetation analyses

We obtained data this year from Rancho Minas Viejas to compare against those collected from Rancho La Escondida last year. Our goal was to better understand breeding habitat for BCVI across northern México. The vegetational community at the Minas Viejas site (elev. ~ 1000 m) can be described as dense, low stature (< 3 m) thornshrub in hilly regions of NE Nuevo León to the west of the Sierra Madre Oriental. The greatest species richness occurs at the 0.0 - 0.5 m level, comprised of grasses, herbaceous plants and woody seedlings; whereas, the greatest dominance of shrub material occurs at the 1 – 2 m interval (Fig. 3a, 3b). In contrast, habitat for BCVI at Rancho La Escondida (elev. ~ 1200 m) is in a mountainous region in the Sierra Madre Occidental of northern Coahuila, México, where vegetation includes scrub oak woodlands and thornshrub along the bases of the slopes and along drainages in canyons. The habitat here is quite open compared to that in Nuevo León (note lower sums of hits per species [dominance] in each interval, Fig. 4a, 4b).

Figure 3a. Comparison of species richness and dominance at Rancho La Escondida, Coahuila, 2003. Sum of hits per species per point. Numbers on the y-axis refer to height intervals (1 = 0-0.5, 2 = 0.5-1.0, 3 = 1.0-2.0, 4 = 2.0-3.0, 5 = 3.0+; meters).

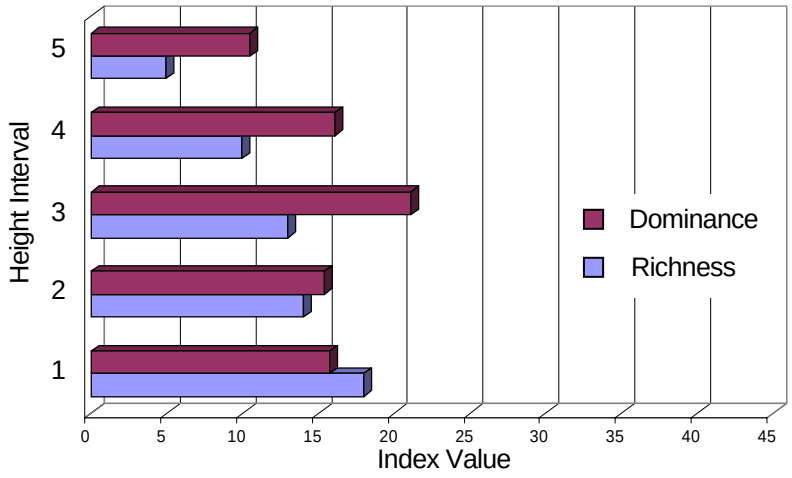


Figure 3b. Comparison of species richness and dominance at Rancho Minas Viejas, Nuevo León, 2003. Sum of hits per species per point. Numbers on the y-axis refer to height intervals (1 = 0-0.5, 2 = 0.5-1.0, 3 = 1.0-2.0, 4 = 2.0-3.0, 5 = 3.0+; meters).

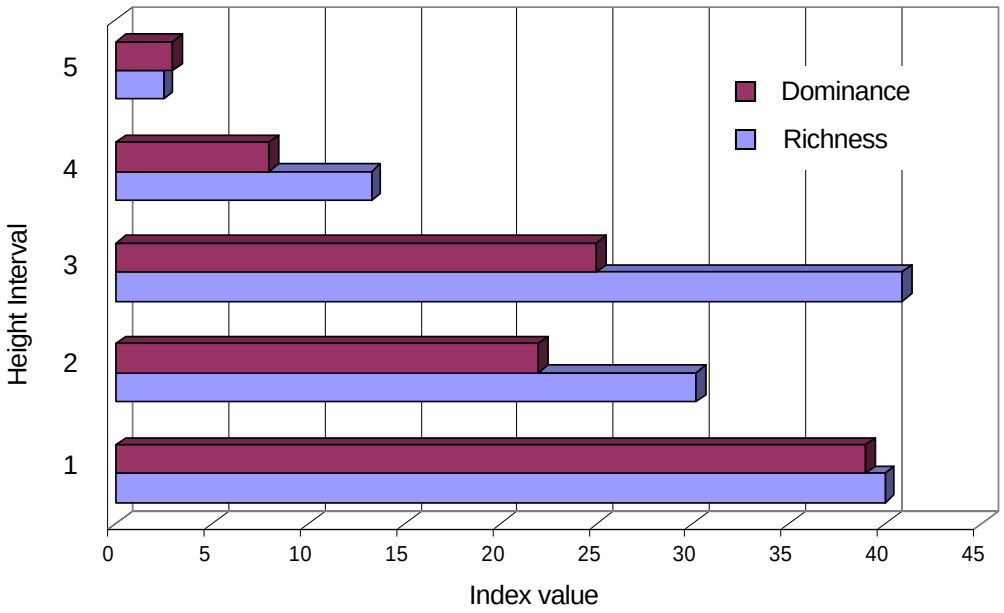
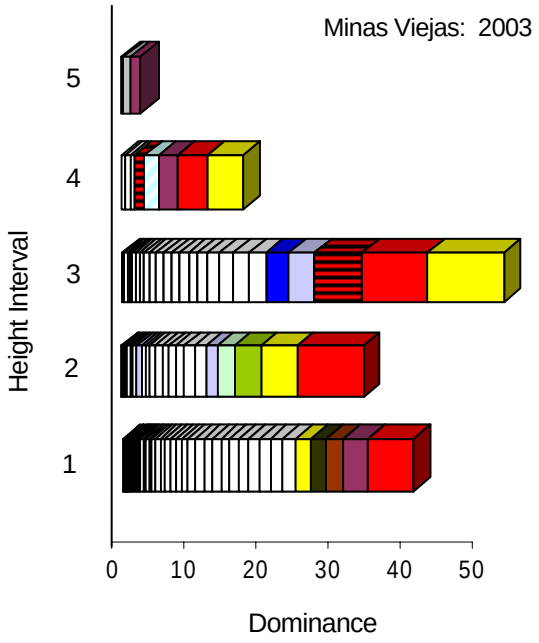


Figure 4a. Shrub dominance (sums of hits per specie per point) by height interval (y axis, meters) for Rancho Minas Viejas, Villaldama, Nuevo León, in 2003 (upper panel) and 2004 (lower panel). Five most dominant species are shown per interval. Numbers on the y-axis refer to height intervals (1 = 0-0.5, 2 = 0.5-1.0, 3 = 1.0-2.0, 4 = 2.0-3.0, 5 = 3.0+; meters). Values on x-axis are sums of hits per species divided by number of points sampled (see Methods). Color key on next page.



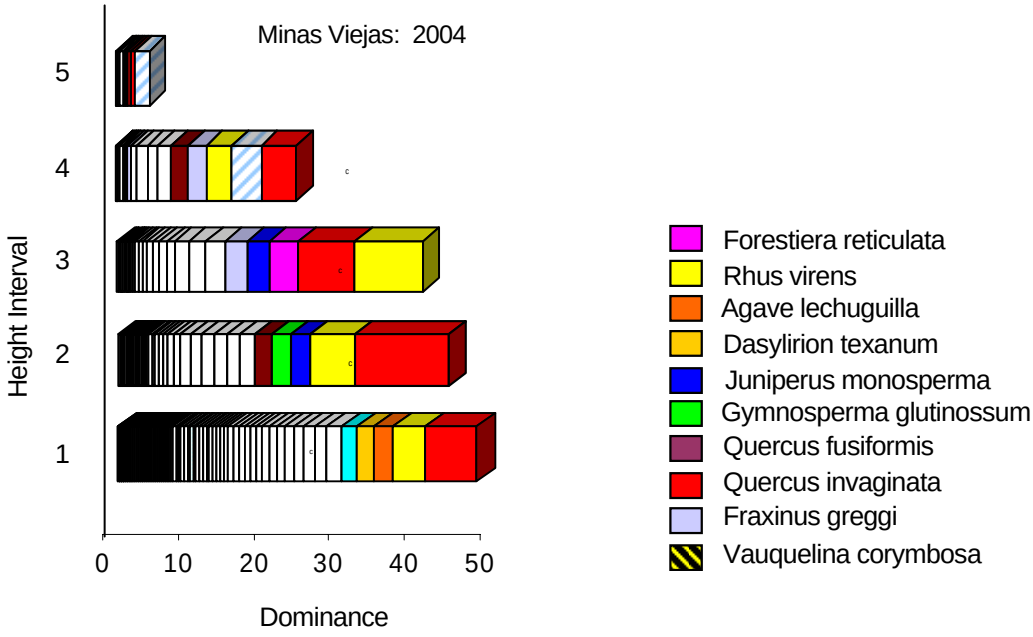
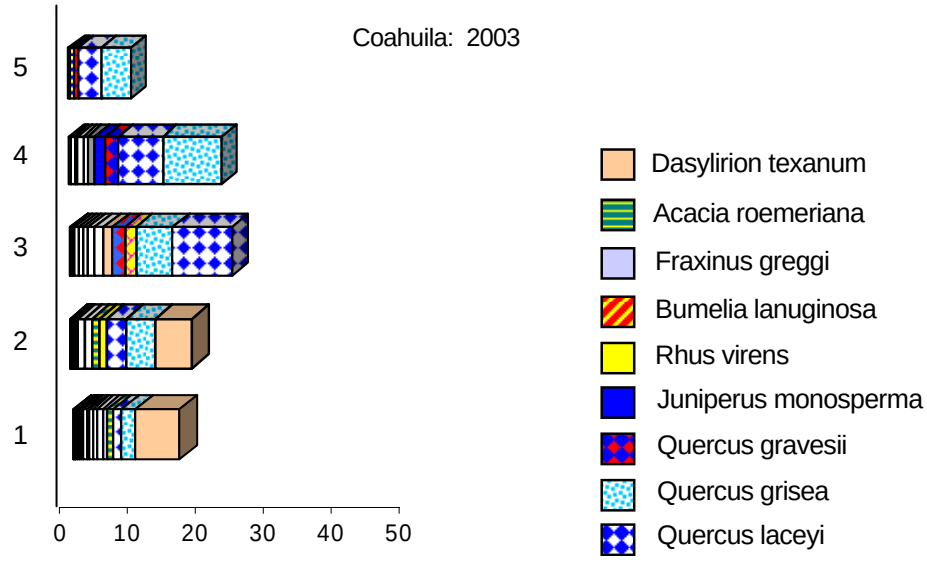


Figure 4b. Shrub dominance (sums of hits per species per point) by height interval (y axis, meters) for Rancho La Escondida, Coahuila, in 2003. Five most dominant species are shown per interval. Values on x-axis are sums of hits per species divided by number of points sampled (see Methods).



Community similarity

Estimates of community similarity were calculated based upon the qualitative data collected. These data are qualitative, rather than quantitative, because no measure of species abundance (number of individuals per species) was collected. From the vegetation transects at each a list of species was recorded (Table 2).

Table 2. Plant list developed from vegetation transects in BCVI habitat in Nuevo León (Rancho Minas Viejas) and Coahuila (Rancho La Escondida).

Nuevo León 2003	**Nuevo León 2004**	**Coahuila 2003**
Acacia farnesiana	*Acacia berlandieri*	*Acacia berlandieri*
Acacia greggii	*Acacia farmesiana*	*Acacia roemeriana*
Acacia rigidula	*Acacia sp.*	*Bumelia lanuginosa*
Acacia sp.	*Agave americana*	*Cercis canadensis*
Agave lechugilla	*Agave lechugilla*	*Cercocarpus montanus*
Agave sp.	*Agave striata*	*Cyperaceae sp.*
Argythamnia humilis	*Amyris madrensis*	*Dasylirion texanum*
Aristida sp.	*Aristida sp.*	*Eysenhardtia polystachia*
Bauhinia congesta	*Berberis trifololiata*	*Fraxinus greggii*
Berberis trifoliolata	*Bernardia miricifolia*	*Garrya ovata*
Bernardia myricaefolia	*Bouteloua uniflora*	*Juniperus flaccida*
Bernardia myricaefolia	*Bouvardia ternifolia*	*Juniperus monosperma*
Berveris trifololiata	*Calyptocarpus vialis*	*Leucaena retusa*
Bothriochloa barbinodis	*Cercis canadiensis*	*Menodora scabra*
Bouteloua hirsuta	*Chamaecrista greggii*	*Mulenbergia sp.*
Bouteloua repens	*Chiococca pachyphylla*	*Prunus serotina*
Cassia greggii	*Croton sp.*	*Quercus gravesii*
Castilleja lanata	*Croton torreyanus*	*Quercus grisea*
Chiococca pachyphylla	*Dasylirion texanum*	*Quercus laceyi*
Cordia boisierii	*Diospyros texana*	*Rhamnus betulifolia*
Dasylirium texanum	*Erigeron sp.*	*Rhus trilobata*
Diospyros texana	*Erioneuron avenaceum*	*Rhus virens*
Eysenhardtia polystachya	*Eysenhardtia polystachya*	*Setaria sp.*
Foresteria angustifolia	*Foresteria reticulata*	*Ungnadia speciosa*
Foresteria reticulata	*Forestiera racemosa*	*Yucca thompsoniana*
Forestiera angustifolia	*Fraxinus greggi*	
Forestiera reticulata	*Guaphalium cotorreyanus*	
Fraxinus greggii	*Gymnosperma glutinossum*	
Gymnosperma glutinosum	*Hedeoma drummondii*	
Juniperus monosperma	*Hedeoma nanum*	
Karwinskia humboldtiana	*Helietta parvifolia*	
Galactea sp.	*Jatropha dioca*	
Leucaena greggii	*Juniperus monosperma*	
Leucophyllum frutescens	*Karwinskia humboldtiana*	
Mascagnia macroptera	*Leptoloma cognatum*	
Panicum hallii	*Leucaena greggii*	
Pithecellobium pallens	*Malvastrum coromandelianum*	

Quercus fusiformis	*Mimosa malacophylla*	
Quercus invaginata	*Muhlenbergia sp*	
Quercus sp.	*Notholaena sinuata*	
Rhus virens	*Opuntia sp.*	
Sclerocarpus sp.	*Panicum hallii*	
Serjania cystocarpa	*Parthenium hysterophorus*	
Sida filipes	*Phyllantus sp.*	
Sophora secundiflora	*Quercus fusiformis*	
Tridens texanus	*Quercus invaginata*	
Vauquelinia corymbosa	*Rhus virens*	
	Scutellaria sp	
	Setaria macrostachya	
	Sida filipes	
	Sida sp.	
	Sophora secundiflora	
	Stipa leucotricha	
	Telocactus sp.	
	Tridens muticus	
	Vauquelinia corymbosa	
	Zanthoxylum fagara	

Community similarity indices were calculated from the data in Table 1, revealing only moderate similarity between the two sites in Nuevo León, and very little similarity between either of the Minas Viejas datasets (2003, 2004) and the Coahuila data. Two commonly used beta-diversity indices were selected for analysis (Marguran 1988):

Jaccard index

$$Cj = j/(a+b-j)$$

Where j = number of species common to both sites.
a = number of species in site A, and
b = number of species in site B.

Sorenson index

$$Cs = 2j/(a+b)$$

Table 3. Community similarity indices (percent similarity) calculated for woody vegetation in BCVI habitat from Nuevo León (Rancho Minas Viejas) and Coahuila (Rancho La Escondida).

Site comparison	**Jaccard**	**Sorenson**
Nuevo León 2003 compared to Nuevo León 2004	**44**	**28**
Nuevo León 2003 compared to Coahuila 2003	**12**	**6**
Nuevo León 2004 compared to Coahuila 2003	**22**	**13**

PROJECT SUMMARY

Field Effort

A total of 34 site visits was conducted across four states (Coahuila, Nuevo León, Tamaulipas, and San Luis Potosí) during 2001-2005 (the latter year's breeding season included here as supplementary information). Typically, visits consisted of five days each conducted by two to three researchers, and a total of 2,880 researcher-hours was accumulated across the 5-year study period. A total of 6,700 km of highway and secondary roads was traveled throughout the four states (see Attachment A, map of routes traveled throughout study period). One thesis (Guerrero 2004) was produced from this project.

Breeding biology and distribution

Heretofore, very little was known about the breeding distribution of BCVI in México. Although vague, the report by Renardo (1886) stating that the bird "is common in the breeding season," and which also states that nests (number unknown) were found "in the Rio Grande valley," is perhaps the first record of breeding in México. However, this same report concludes with the statement that the bird was "seen in winter about Campeche." The state of Campeche, in the Yucatán peninsula, is at least 800 km east of the easternmost verified BCVI location, and without further data we find this report lacking in credibility. The first verified breeding populations in México were determined by Graber (1961) to have been made by Miller (1955) and Van Hoose (1955) who found them in the Sierra del Carmen and Sierra del Pino ranges, respectively, north of Ocampo, Coahuila. We reviewed the literature on BCVI distribution (breeding and nonbreeding) in México, and recorded a total of 147 localities of occurrence (Table 4). Of these, 55 (37%) come from the breeding season in the states of Coahuila, Nuevo León, Tamaulipas, and San Luis Potosí. The lone San Luis Potosí record, 20 miles south of Ciudad Valles, is the southernmost record within the breeding season, but no data are available to confirm breeding in that area. Therefore, our SW Tamaulipas (Palmillas, Bustamante, and Miquihuana) records stand as the southernmost confirmed breeding of BCVI, an extension of at least 700 km south from the previous southern record (central Coahuila). Our study provides also the first photographic evidence of nesting for this species in México (Rancho La Escondida, Coahuila; Fig. 5a, 5b. Farquhar et al., 2003).

Table 4. Occurrences recorded from literature review, and present study, for Black-capped Vireos in México. Emphasis is on geographic distribution. Multiple records from a given site already tabulated (e.g., point transects in this report, or others) were not included. Morelos locality included, but not considered as valid *V. atricapilla* record (see text). Data below displayed in Figure 6.

Locality	State	Date	Lat	Long	Reference/Notes
Sabinas	Coah.	2-Apr-1910	27.8500	-101.1200	AMNH
Sabinas	Coah.	19-Apr-1910	27.8500	-101.1200	MVZ
Sierra del Pino, 6 MI N, 6 MI W Acebuches	Coah.	3-Jul-1952	28.3000	-103.0300	Urban,1959
Sierra del Carmen, 5 mi W Piedra Blanca	Coah.	23-Apr-1953	29.0600	-102.4700	MVZ; Graber, 1957
Sierra del Carmen, 5 mi W Piedra Blanca	Coah.	24-Apr-1953	29.0600	-102.4700	MVZ; Graber, 1957
Sierra del Carmen, 5 mi W Piedra Blanca	Coah.	26-Apr-1953	29.0600	-102.4700	MVZ; Graber, 1957
Sierra del Carmen, 5 mi W Piedra Blanca	Coah.	27-Apr-1953	29.0600	-102.4700	MVZ; Graber, 1957
N base of Sierra Madre	Coah.	24-May-1953	27.0600	-102.2600	Marshall et al.,1985
Sierra Padilla	Coah.	8-May-1954	27.2800	-101.5000	Graber,1957
16 MI E, 18 MI N Ocampo	Coah.	8-May-1954	27.5500	-102.6200	Urban,1959
Sierra Padilla	Coah.	9-May-1954	27.2800	-101.5000	Graber,1957
16 MI E, 18 MI N Ocampo	Coah.	9-May-1954	27.5500	-102.6200	Urban,1959
Sierra Madera	Coah.	17-Jun-1956	27.0300	-102.3000	Graber,1957
Ocampo, 10 MI S, 4 MI E	Coah.	17-Jun-1956	27.1200	-102.4700	FMNH; Graber 1957
Ocampo, 10 MI S, 4 MI W	Coah.	18-Jun-1956	27.1200	-102.4700	FMNH; Graber 1957
Ocampo, 10 MI S, 4 MI W	Coah.	18-Jun-1956	27.1200	-102.4700	FMNH; Graber 1957
Rancho La Babia N Sierra La Encantada	Coah.	17-Apr-1962	28.5600	-102.0600	CMN
Presa El Tulillo, General Cepeda	Coah.	17-Apr-1983	25.6700	-101.4400	MAM
Sierra San Marcos	Coah.	20-May-1983	26.4500	-101.5700	Marshall et al.,1985
Sierra San Marcos	Coah.	21-May-1983	26.4600	-101.6600	Marshall et al.,1985
Serranía del Burro	Coah.	7-Jun-1983	29.0000	-102.0000	Marshall et al.,1985
N base Sierra La Encantada	Coah.	5-Oct-1984	28.3900	-102.1900	Marshall et al.,1985
Cañon Las Huertas, S Sierra El Carmen, W Sierra El Infante	Coah.	6-Jun-1987	28.6700	-102.0700	Benson and Benson, 1990
Sierra La Encantada, near Valle Los Venados, c.f. Marshall et al., 1985	Coah.	8-Jul-1988	28.6200	-102.2700	Benson and Benson, 1990
Sierra El Tule, unnamed canyon, drained by Arroyo Las Amapolas	Coah.	9-Jul-1988	28.9000	-102.2700	Benson and Benson, 1990
Arroyo de La Zorra, S Sierra El Bonito, N Sierra El Veladero	Coah.	15-Apr-1989	29.0300	-101.9200	Benson and Benson, 1990
Rancho La Escondida, Zaragoza	Coah.	8-May-2003	28.9300	-101.8700	Farquhar et al., 2003

Rancho Santa Ana, Melchor Muzquiz	Coah.	29-Aug-2003	28.1000	-101.8100	CEPACI
Rancho El Pavo	Coah.	1-Sep-2003	28.2300	-101.5200	CEPACI
Rancho Calvillo	Coah.	16-Sep-2003	27.8800	-101.7300	CEPACI
Rancho El 90	Coah.	23-Sep-2003	28.0700	-101.6400	CEPACI
Rancho Mariposa	Coah.	26-Apr-2005	28.1774	-101.8168	Ballesteros, et al., unpubl. data
Rancho Mariposa	Coah.	26-Apr-2005	28.1797	-101.8288	Ballesteros, et al., unpubl. data
Rancho Mariposa	Coah.	27-Apr-2005	28.1805	-101.7911	Ballesteros, et al., unpubl. data
Rancho Mariposa	Coah.	27-Apr-2005	28.1810	-101.7798	Ballesteros, et al., unpubl. data
Rancho Margarita	Coah.	29-Apr-2005	28.1437	-101.9787	Ballesteros, et al., unpubl. data
Rancho Margarita	Coah.	29-Apr-2005	28.1449	-101.9716	Ballesteros, et al., unpubl. data
Rancho Margarita	Coah.	30-Apr-2005	28.1547	-101.9829	Ballesteros, et al., unpubl. data
Cañon Miguel, Rancho Santa Maria (CEMEX), Sierra Pajaros Azules	Coah.	6-Jul-2005	27.0570	-100.8901	Ballesteros,O.;unpubl.Data
Cañon Miguel, Rancho Santa Maria (CEMEX), Sierra Pajaros Azules	Coah.	7-Jul-2005	27.0584	-100.8856	Ballesteros,O.;unpubl.Data
Cañon Miguel, Rancho Santa Maria (CEMEX), Sierra Pajaros Azules	Coah.	8-Jul-2005	27.0581	-100.8893	Ballesteros,O.;unpubl.Data
Cañon Miguel, Rancho Santa Maria (CEMEX), Sierra Pajaros Azules	Coah.	8-Jul-2005	27.0508	-100.8915	Ballesteros,O.;unpubl.Data
15 mi nw of Manzanillo	Col.	27-Oct-1957	19.1583	-104.4822	MVZ
La Media Luna, the north slope	Col.	8-Feb-1959	19.2100	-103.5592	DMNH
Finca de San Antonio, Col.	Col.	23-Mar-2002	19.4329	-103.6986	Powell, R.; unpubl. data
Finca de San Antonio, Col.	Col.	23-Mar-2002	19.4329	-103.6982	Powell, R.; unpubl. data
Finca de San Antonio, Col.	Col.	23-Mar-2002	19.4327	-103.6983	Powell, R.; unpubl. data
Rancho Guasimal, 6 Mi W Birimoa	Dur.	13-Oct-1937	25.1236	-106.6850	Graber, 1957
Rancho Guasimal, 6 Mi W Birimoa	Dur.	21-Oct-1937	25.1236	-106.6850	Graber, 1957
3 Km NE Tamazula	Dur.	21-Nov-1937	24.9911	-106.9475	Graber, 1957
3 Km NE Tamazula	Dur.	10-Dec-1937	24.9700	-106.9656	Graber, 1957
Chilpancingo	Guer.	2-Mar-1940	17.0967	-99.1828	Graber, 1957
Acahuizotla	Guer.	27-Jan-1985	17.3606	-99.4672	CMN
El Rincon	Guer.	Oct-1888	16.8625	-99.6436	Graber, 1957
Jacala	Hid.	15-Oct-1984	21.0050	-99.1900	Marshall et al.,1985
Chacala, S Jal.	Jal.	15-Mar-1941	19.3261	-104.2836	MLZ
Sapotillo, 22 mi SW Autlan	Jal.	19-Feb-1952	19.7708	-104.3694	Graber, 1957
Sapotillo, 22 mi SW Autlan	Jal.	21-Feb-1952	19.7708	-104.3694	Graber, 1957
San Sebastian	Jal.	19-Mar-1955	20.7617	-104.8500	Graber, 1957

El Refugion Suchitlan	Jal.	3-Dec-1956	20.4431	-105.5458	DMNH
El Tuito, Cobre Cabo Corrientes	Jal.	1-Mar-1959	20.3197	-105.3261	LSUMZ
22 MI N Tomatlan along the road	Jal.	4-Mar-1959	19.9408	-105.2486	LSUMZ
La Huerta	Jal.	26-Sep-1980	19.9394	-103.6781	MZFC; No. Catalogo 006005
Sierra de Manantlan, Jal.	Jal.	5-Mar-2002	19.7035	-104.3828	Powell, R.; unpubl. data
Barranca el Choncho, Jal., approx 16 km N of Barra de Navida	Jal.	22-Mar-2003	19.3395	-104.7381	Powell, R.; unpubl. data
Microondas San Francisco, Jal., 7.5 km NE of Autlan	Jal.	29-Mar-2003	19.4317	-103.7015	Powell, R.; unpubl. data
Estacion Bilógica Chamela	Jal.	0 Nov-1984	19.5267	-105.0731	Condor 96:105118
Estacion Bilógica Chamela	Jal.	0 Nov-1984	19.5267	-105.0731	Condor 96:105118
Barranca del Portillo, Guadalajara	Jal.	Jan 12, 1891	20.6764	-103.3461	Graber, 1957
Volcán de Toluca	Mex.	Sep 11, 1893	19.1600	-99.8800	Graber, 1957
MICH 10 Mi N Tiquicheo	Mich.	1-Jan-1953	18.9000	-100.7372	Graber, 1957
Querendaro	Mich.	1-Jan-1953	19.8092	-100.8939	Marshall et al.,1985
South slope Cerro Chautepetl, N Cuernavaca, W Huitzilac*	Mor.	4-Jun-1954	19.02833*	99.26722*	Marshall et al.,1984; *V. nelsoni*, A. R. Phillips.**????**
East base of Cerro El Potosí	N. L.	28-May-1970	24.8700	-100.2700	Marshall et al.,1985
NE side of Monterrey	N. L.	19-Mar-1975	25.8200	-100.1500	Marshall et al.,1985
Cañon del Gallo	N. L.	2-Oct-1984	26.1200	-99.8500	Marshall et al.,1985
San Isidro, Laguna de Sánchez	N. L.	21-May-1996	25.3500	-100.3000	Berstock and Eubanks,1997
Parque La Estanzuela, Monterrey	N. L.	29-Apr-2000	25.5700	-100.3000	Gonzalez, J. I., unppubl. Data
Ojo de Agua, Agualeguas	N. L.	31-Mar-2002	26.2100	-99.9000	Farquhar et al., 2003
"Los Altares" Iturbide	N. L.	17-Apr-2002	24.7400	-99.8500	Farquhar et al., 2003
Bustamante, "EL Palmito"	N. L.	21-Apr-2002	26.5000	-100.5300	Farquhar et al., 2003
Minas Viejas, Villaldama	N. L.	22-May-2002	26.6500	-100.3300	Farquhar et al., 2003; this report, Table 1
Parque La Estanzuela, Monterrey	N. L.	19-Oct-2003	25.5700	-100.3000	Farquhar et al., 2003
Sombreretillo Reservoir, Sabinas	N. L.	25-Oct-2003	26.3000	-99.9600	Farquhar et al., 2003
3.5 Mi SW Tepic	Nay.	27-Oct-1938	21.4300	-104.8400	Graber, 1957
Chacala (wich lies south of San Blas west Las Varas)	Nay.	15-Mar-1941	21.1661	-105.2275	Graber, 1957
San Blas	Nay.	19-Mar-1948	21.5395	-105.2853	Graber, 1957
SW Nay., 9 Mi E Las Varas	Nay.	16-Nov-1952	21.1800	-105.0000	Graber, 1957
SW Nay., 1 Mi SSE Las Varas	Nay.	25-Nov-1952	21.1781	-105.1367	DMNH; coordinates Las Varas
SW Nay., 1 Mi SSE Las Varas	Nay.	28-Nov-1952	21.1781	-105.1367	DMNH; coordinates Las Varas
SW Nay., 6.3 Mi S Compostela	Nay.	30-Nov-1952	21.1400	-104.8800	Graber, 1957

Nay. , 14.5 Mi W Tepic	Nay.	8-Oct-1955	21.6800	-105.0600	Graber, 1957
Las Varas, 2.5 Mi E	Nay.	28-Dec-1955	21.1814	-105.1008	FMNH
Las Varas, 2.5 Mi E	Nay.	29-Dec-1955	21.1814	-105.1008	FMNH
3 Mi W Tepic	Nay.	16-Oct-1956	21.5161	-104.8939	BMNH; coordinates Tepic
14.5 Mi W Tepic	Nay.	4-Oct-1957	21.6800	-105.0600	Graber, 1957
San Blas, La Tovara	Nay.	10-Oct-1957	21.5392	-105.2206	DMNH
N. Nay., 10 Mi W San Blas	Nay.	4-Nov-1957	21.6122	-105.1722	DMNH
5 miles NW Tepic	Nay.	3-Nov-1984	21.5914	-104.9442	Marshall et al.,1985
El pescadero	Nay.	6-Nov-1984	23.9411	-106.4242	Marshall et al.,1985
Junatan to El Pino (El Espino)?	Nay.	6-Nov-1984	21.9006	-104.4100	Marshall et al.,1985
La Bajada, Nay.	Nay.	7-Feb-2002	21.5086	-105.1456	Powell, R.; unpubl. data
Laguna Santa Maria del Oro	Nay.	17-Feb-2002	21.3778	-104.5619	Powell, R.; unpubl. data
Laguna Santa Maria del Oro	Nay.	17-Feb-2002	21.3786	-104.5622	Powell, R.; unpubl. data
Laguna Santa Maria del Oro	Nay.	19-Feb-2002	21.3547	-104.5603	Powell, R.; unpubl. data
Sayulita	Nay.	23-Feb-2002	20.8553	-105.4481	Powell, R.; unpubl. data
Singayta Road, Nay., 7.5 km NE of San Blas	Nay.	1-Mar-2003	21.5803	-105.2399	Powell, R.; unpubl. data
Cerro de San Juan, approx. 10 km SW of Tepic	Nay.	5-Mar-2003	21.5186	-104.9715	Powell, R.; unpubl. data
Cerro de San Juan, approx. 10 km SW of Tepic	Nay.	5-Mar-2003	21.5198	-104.9717	Powell, R.; unpubl. data
Pig farm trail, Laguna Santa Maria del Oro, 52 km SE of Tepic	Nay.	10-Mar-2003	21.3539	-104.5600	Powell, R.; unpubl. data
Laguna Santa Maria del Oro, 52 km SE of Tepic	Nay.	11-Mar-2003	21.3787	-104.5622	Powell, R.; unpubl. data
Laguna Santa Maria del Oro, 52 km SE of Tepic	Nay.	11-Mar-2003	21.3787	-104.5622	Powell, R.; unpubl. data
Laguna Santa Maria del Oro, 52 km SE of Tepic	Nay.	11-Mar-2003	21.3775	-104.5616	Powell, R.; unpubl. data
9.5 km al Oeste de Tepic	Nay.	20-Jan-2004	21.1859	-104.3102	Julio C. Gallardo, unpubl. Data
N. San Gabriel Mixtepec	Oax.	8-Dec-1963	16.0925	-97.0822	DMNH
N. San Gabriel Mixtepec	Oax.	11-Dec-1963	16.0925	-97.0822	DMNH
Distrito de Juquila, 4 km E Peñas	Oax.	1-Apr-1994			MZFC; exact coordinates unknown
7 km N San Miguel del Puerto , Municipio de San Miguel del Puerto	Oax.	20-Feb-2004	15.9688	-96.5116	Julio C. Gallardo, unpubl. Data
20 miles S Valles	S. L. P.	6-Apr-1947	21.6800	-99.0100	Marshall et al.,1985
Rosario	Sin.	18-Dec-1933	23.0375	-105.7178	Graber, 1957
Rosario	Sin.	6-Jan-1934	23.0375	-105.7178	Graber, 1957
Chele	Sin.	9-Feb-1935	23.2039	-105.8914	Graber, 1957
Chele	Sin.	15-Feb-1935	23.2039	-105.8914	Graber, 1957

Rosario	Sin.	26-Feb-1935	23.0375	-105.7178	Graber, 1957
San Ignacio	Sin.	18-Mar-1937	23.9411	-106.4242	Graber, 1957
San Ignacio	Sin.	20-Mar-1937	24.1842	-106.4103	Graber, 1957
Iguana, 3 Mi N San Marcos	Sin.	21-Feb-1938	24.4319	-106.5042	Graber, 1957
Copala	Sin.	13-Jan-1947	23.3942	-105.9328	Graber, 1957
Copala	Sin.	25-Jan-1947	23.3942	-105.9328	Graber, 1957
Concordia, 3 Mi W	Sin.	21-Dec-1955	23.2878	-106.0664	FMNH
11 Mi NE Presa Sanalona	Sin.	23-Feb-1965	24.8792	-106.9864	KUNHM
Rancho Carrizo	Sin.	12-Apr-1972			DMNH; exact coordinates unknown
Concordia	Sin.	7-Nov-1984	23.4092	-105.9917	Marshall et al.,1985
Rancho Mojocoan, 4 km oeste de Copala	Sin.	3-Dec-1999	23.3942	-105.9328	MZFC; coordinates Copala
Panuco Road, Dur. Hwy km post 248 (28 km NE of Concordia)	Sin.	6-Feb-2003	23.4081	-105.9322	Powell, R.; unpubl. data
La Noria Road, aloa, 10 km N of Mazatlan, off of Hwy 15 to C	Sin.	8-Feb-2003	23.4448	-106.3261	Powell, R.; unpubl. data
2.7 km W on Hwy 5 03 off turnoff from Hwy 15, 11.1 km N of	Sin.	17-Feb-2003	23.3455	-106.4427	Powell, R.; unpubl. data
La Noria Road, aloa, 10 km N of Mazatlan, off of Hwy 15 to C	Sin.	22-Feb-2003	23.4441	-106.3259	Powell, R.; unpubl. data
Cd. Obregón	Son.	1-Nov-1955	27.4892	-109.9350	Graber, 1957
Santa Leónor, 11 mi NW Cd. Victoria	Tamps.	12-Apr-1909	23.8587	-99.2286	Phillips, 1911; coord. estimated from Marshall et. al, 1984.
Alta Cumbre	Tamps.	13-Oct-1984	23.6100	-99.2000	Marshall et al., 1985
Km 28, Hwy to Miquihuana	Tamps.	13-Jul-2003	23.5200	-99.6500	Farquhar et al., 2003
Palmillas	Tamps.	15-Jul-2003	23.3000	-99.6000	Farquhar et al., 2003
Ej. Los Arrieros, Hwy 101	Tamps.	22-May-2005	23.2900	-99.6200	This report, see Table 5
Hwy from Rcho Capulin a Bustamante	Tamps.	10-Jun-2005	23.3200	-99.7000	This report, see Table 5
Hwy from Rcho Capulin a Bustamante	Tamps.	10-Jun-2005	23.3200	-99.7000	This report, see Table 5
Km 9, Hwy to Miquihuana	Tamps.	30-Jun-2005	23.3700	-99.6100	This report, see Table 6 & 7
Alta Cumbre	Tamps.	May mid-1970s	23.6100	-99.2000	Arvin, J., *in* Marshall et al., 1984

AMNH: American Museum of Natural History, New York

MVZ: Museum of Vertebrate Zoology, Berkeley, California

FMNH: Field Museum of Natural History, Chicago, Illinois

CMN: Canadian Museum of Nature, Ottowa, Ontario, Canada

MAM: Museo de las Aves, Saltillo, Coahuila

DMNH: Delaware Museum of Natural History, Delaware

MLZ: Moore Laboratory of Zoology, Occidental College, Los Angeles, California

MZFC: Museo Zoológico de la Facultad de Ciencias (Univ. Nacional Autónoma de México)

BMNH: Burke Museum of Natural History, University of Washington, Seattle, Washington

KUNHM: Kansas University National History Museum, Lawrence, Kansas

CEPACI: Consejo Ecológico de Participación Ciudadana de la Región Carbonífera, A.C

LSUMZ: Louisiana State University Museum of Zoology, Baton Rouge, Louisiana

O. Ballesteros: UANL Biologist funded by present study's Section 6 grant

R. Powell: Texas A&M Univ. graduate student

Much more work in Nuevo León, Tamaulipas, and San Luis Potosí, is needed to determine the full extent of breeding in México. Figure 6 displays the currently known localities for breeding, migratory and wintering BCVI in México (based on Table 4). We propose the breeding limits of BCVI in México to roughly surround the set of occurrences displayed in Figure 6. The state of San Luis Potosí holds promise for further breeding records, as suitable habitat appears to be found around the town of Cerritos in the south-central portion of the state. Further search effort needs to be placed in that region.

Of considerable interest is the fact that southern breeding range localities generally grade into Volcanic Belt Pine-Oak habitat linking breeding and wintering grounds (see "Potential Migratory Route," Fig. 6). Given what know about BCVI distribution in México, it is entirely possible that migration could occur across the shrubby, submontane vegetation associated with the Volcanic Belt Pine-Oak Forests. An earlier report (Moore 1938) suggested that SW Chihuahua and NW Durango containing deeply incised canyons among the Sierra Madre Occidental might provide migratory corridors for BCVI making a more northerly trans-montane migration. However, Graber (1961) made some visits to the area and found no evidence of BCVI habitat. It is unlikely that migration would occur across the high mountain regions of Sierra Madre Occidental, even though it would be the shortest linear route to take back to the breeding grounds in Texas and Oklahoma. That suggestion was also made prior to the discovery that this species nests much further south in México than was previously known, making a southerly, central Mexican trans-volcanic migratory route more plausible.

Figure 5a. First nesting record of Black-capped Vireo in México. Photo taken 11 May 2003. Rancho La Escondida, Cañón del Sotol, Serranías del Burro, Municipio de Zaragoza, Coahuila.

Figure 5b. Second nesting record of Black-capped Vireo in México. Photo taken 11 May 2003, Rancho La Escondida, Coahuila.

Figure 6. Geographic distribution of Black-capped Vireos in México based upon literature review and present study.

Population Surveys

Our surveys in Coahuila, Nuevo León, Tamaulipas, and to a lesser extent, in San Luis Potosí, helped to better identify the limits of the breeding range, but can best be regarded as a preliminary step toward a more complete understanding of the breeding ecology of this endangered songbird. Similar to other published data (e.g., Benson and Benson 1990) we estimated unusually high breeding density in northern Coahuila. In our study at Rancho La Escondida, Coahuila (Farquhar et al., 2003), we obtained 139 registrations of singing males from 50 point transects, yielding an estimated 3.29 singing males per hectare (+/- 0.37 SE, 11.25 CV). This represents roughly three times the widely accepted value from Texas (Grzybowski 1995). We cannot extrapolate to a larger area because we lack appropriate landscape level habitat data. We also recommend that this result be considered preliminary until further data can substantiate it.

The Minas Viejas site in Nuevo León presented problems too difficult to overcome for standard distance sampling methodology. We could not obtain useful data despite two seasons of effort (see above, 2004 Field Effort) due to the extreme density and impenetrability of the vegetation. Accurate distance readings with the laser rangefinder were precluded as a result. Densities, however, may approach those in Coahuila, based on 99 registrations of singing males from 34 point transects. We hope to remedy the sampling problems in 2006 with the assistance of the Cornell Laboratory of Ornithology. Visits to nearby breeding areas in Bustamante, Nuevo León, suggest a smaller, less dense population, although no distance-sampling efforts were conducted there. Although this was the first site outside of Coahuila to suggest breeding by BCVI in México (see Farquhar et al., 2002), disturbance from traffic to the cave entrance popular with spelunkers and other cave enthusiasts, in addition to considerable impact from local goat herds may limit breeding opportunities for BCVI in that area.

Brief visits to SW Tamaulipas in 2002 revealed the presence of potentially substantial numbers of BCVI; however, no formal surveys were conducted. Birds were seen (at least one family group was observed) in appropriate habitat which at the time was quite plentiful in the areas near Palmillas and Miquihuana. A return visit in May, 2003, revealed that the once present population could not be located. Substantial habitat alteration was evident from excessive numbers of goats browsing the landscape and this may have contributed to the disappearance of the population. This same area was revisited in May, 2004; however, substantial rains during the visits precluded adequate searching. Due to the high probability of breeding BCVI in this area we will continue search efforts in years to come.

As part of our tour to SW Tamaulipas in 2003 and 2004, we made brief forays into the state of San Luis Potosí. There had been one sight record of BCVI in April, 1947, near the town of Ciudad Valles (Davis, *in* Marshall et al., 1985), so we organized a tour that included that area and points west in the vicinity of habitat that appeared suitable. No BCVI were located in the state of San Luis Potosí

during visits in June 2003 and 2004. However, suitable habitat is scattered throughout the region, especially near Cerritos. These areas should be checked in the future during the breeding season.

Additional notes, beyond the expiration date of the funded project: during late May and mid June, 2005, areas in Tamaulipas that had been visited in 2002 – 2004 were revisited, and with the exception of the road to Bustamante, W off Hwy 101 S of Palmillas, no vireos were resighted. One adult male was captured at Ejido Los Arrieros, along Hwy 101 near Palmillas, on 22 May 2005. On the road to Bustamante, a winding, descending paved road covering approximately 5 km, an estimated 5 to 6 territorial males were observed singing. Elevation ranged from 1680 m to 1550 m, higher than BCVI habitat documented throughout most of the range. Attempts to capture birds in this area proved successful twice (Table 5). Habitat in this area consisted of moderately tall (2-3 m), dense, acacia-dominated submontane thornscrub. Vegetation transects will be carried out by UANL personnel in 2005.

Table 5. Capture data for two BCVI encountered along the road from Hwy 101, near Palmillas, to Bustamante, Tamaulipas.

Easting	Northing	USFWS Band	Elev. (m)	Age/Sex	Locality	Capture Date
437078	2576129	2370-56106	*	SY/M	Windmill, Ejido "Los Arrieros"	5/22/05
428619	2579042	2370-56112	1674	SY/M:	road to Bustamante	6/10/05
428357	2579367	2370-56113	1555	ASY/M:	road to Bustamante	6/10/05

We subsequently visited a new area NW of Palmillas, beginning at kilometer 9 NW along the road to Miquihuana, off Hwy 101 (the same road traveled during 2002-2004). Here, we observed the presence of approximately 20 adult BCVI, and four fledglings (Table 6; also see Fig. 7). Habitat in this area consisted of arroyo edge with vegetation similar to that on the slope to Bustamante area (see above), and dry rocky slope vegetation consisting of shorter (<2 m), less dense submontane thornscrub. The latter habitat is abundantly widespread on south – west facing slopes and there is great potential for substantial BCVI occurrence here. Elevations are similar to those at the Bustamante site.

These 2005 data confirmed our prediction that BCVI may be well-established in SW Tamaulipas during the breeding season. This marks the first documented breeding for this species south of the Tropic of Cancer (see Fig. 7).

Table 6. Observation data for BCVI encountered along Hwy to Miquihuana, NW from Hwy 101. Distance below represents number of kilometers heading NW from Hwy 101.

Easting	Northing	Elev (m)	Distance	Date	Notes
437982	2584161	*	km 9	6/30/2005	One adult male singing
437851	2584098	*	km 10	6/30/2005	One adult male singing
438198	2584136	*	km 11	7/2/2005	One fledgling fed by adult male
438247	2584145	*	km 12	7/1/2005	Three males singing
438342	2584221	*	km 13	7/1/2005	One adult male singing
438284	2583737	1590	km 14	6/29/2005	Fledglings in vicinity (ca. 2)
438296	2583833	*	km 15	6/29/2005	One adult male singing
438188	2583896	1580	km 16	6/29/2005	Fledglings in vicinity (at least one)
438410	2584150	1590	km 17	6/29/2005	Adult male and female observed
438620	2584064	1660	km 18	6/29/2005	One adult male singing
438083	2583853	*	km 19	6/30/2005	Banded male observed, number unknown.
438099	2584472	1500	km 20	6/30/2005	Shrad call heard
437996	2583715	1493	km 21	6/30/2005	Shrad call heard
438156	2583476	*	km 22	6/30/2005	One adult male singing
438022	2583637	*	km 23	7/1/2005	One adult male singing
438050	2583726	*	km 24	7/1/2005	Adult male and female observed
438139	2584251	1526	km 25	7/1/2005	Adult pair, plus fledlings (number unknown)
438139	2584251	1526	km 26	7/2/2005	Adult female

To date, seven adult BCVI have been captured in Tamaulipas, including the three in Table 3, the additional four birds were captured along the road to Miquihuana (Table 7).

Table 7. BCVI captured along Hwy to Miquihuana, at km 9.

Easting	Northing	USFWS Band	Elev (m)	Age/Sex	Capture date
437938	2583866	2370-56114	1489	ATY/M	6/11/2005
438128	2583804	2370-56115	1488	ATY/M	6/12/2005
438280	2583945	2370-56116	1532	ATY/M	6/12/2005
438231	2583679	2370-56200	1505	SY/M	7/2/2005

On 6-8 July, 2005, a site visit was made to property belonging to CEMEX in the Pajaros Azules range in northeastern Coahuila (Fig. 8). This site is located on one of the many uplifts scattered throughout the northern central plateau region of northeastern México. Habitat suitable for breeding BCVI appears to be rather common at these formations, which are generally surrounded by otherwise unsuitable, xeric Chihuahuan desert biota.

Figure 7. Expanded view of BCVI localities and nest locations, and routes visited in Tamaulipas; 2001-2005. Imagery: Landsat 7 Thematic Mapper, year 2000.

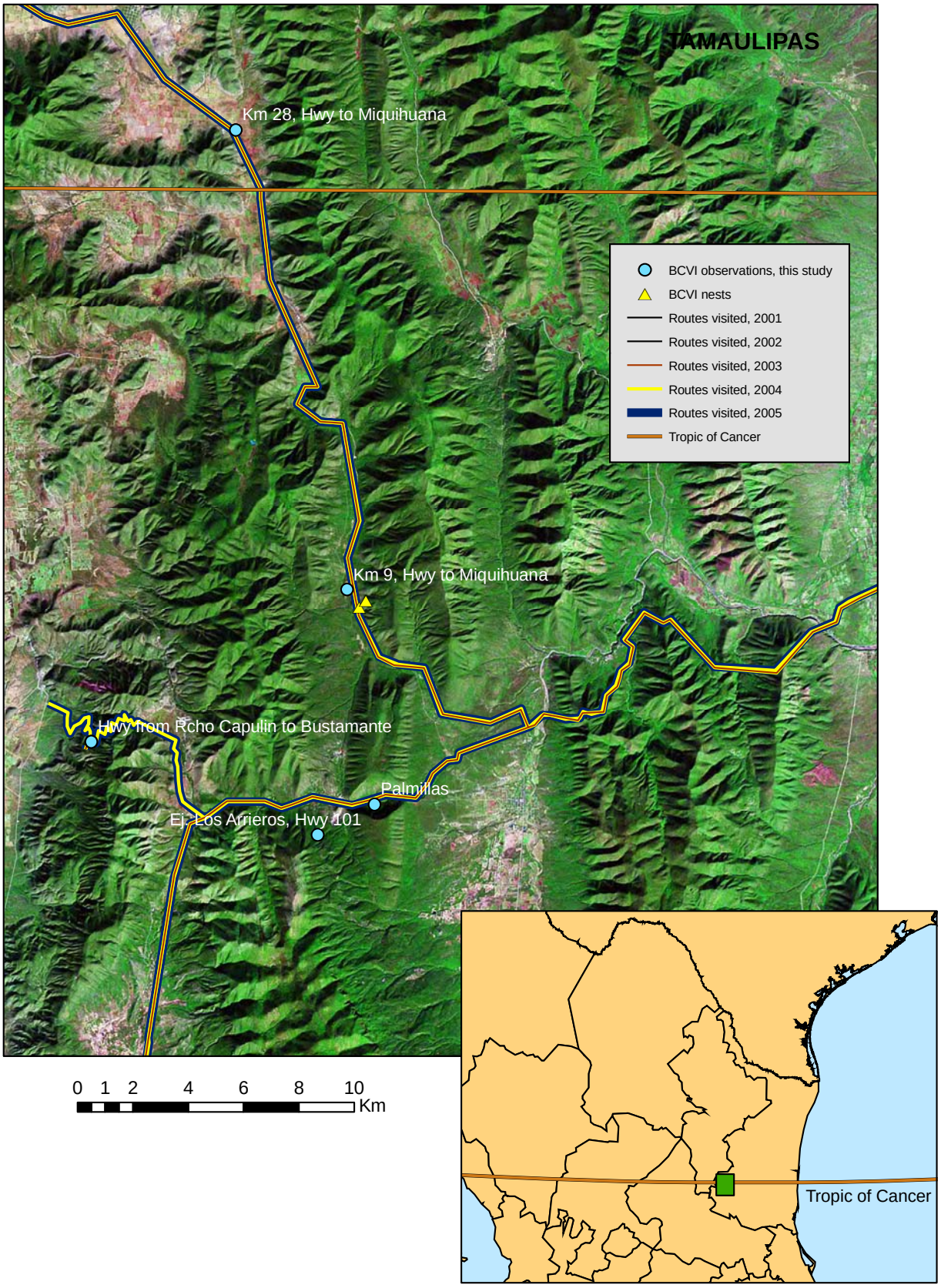
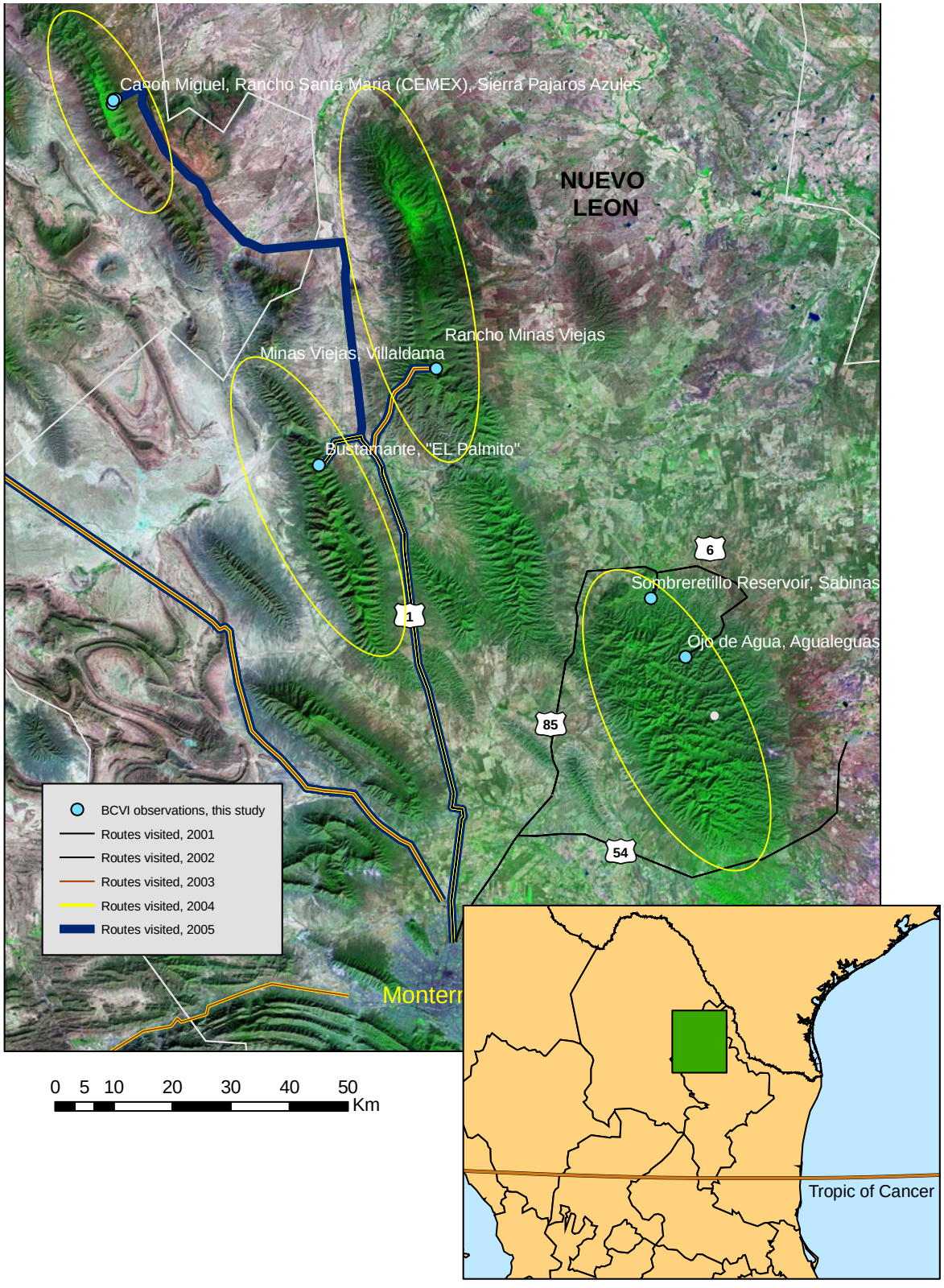


Figure 8. Expanded view of BCVI locations, and routes visited during 2001-2005. Note uplifts (outlined in yellow) scattered across Central Plateau which hold suitable BCVI breeding habitat. Imagery: Landsat 7 Thematic Mapper, year 2000.



Threats to Conservation

Brood parasitism

During nest location activities at Rancho La Escondida, Coahuila, on 6 June 2004 a BCVI nest was observed to be parasitized by a single Brown-headed Cowbird egg (UTM 220744 N; 3203744 E; Fig. 9), the first such record for BCVI in México. BHCO were observed in small flocks (approx. 10-15 individuals) near the main residence where well-stocked bird feeders are present year-round. No cowbird control has been undertaken, nor is planned, at La Escondida. The landscape of the ranch, although well-maintained, is grazed by cattle. BHCO are present in most parts of the ranch, including BCVI nesting areas. No formal surveys of cowbirds were conducted on the property but the local cowbird populations appear to be lower in abundance compared to areas of central Texas.

Nests of BCVI were located in our other study areas, Nuevo León (n = 2) and Tamaulipas (n = 2). In the former area nest location was hampered by extreme density of shrubs, lack of nest-searching experience by local field staff, and by time being directed toward other activities including vegetation characterization, mist-netting, and population surveying. However, field efforts in 2005 (after expiration of the funded project) two nests were found at Ranch Minas Viejas, Nuevo León, by Wes Bailey (graduate student, Univ. Missouri) and UANL staff (O. Ballesteros, A. Nunez). Field efforts in Tamaulipas (2003-2004) were restricted to roadside surveys, and much of the BCVI observation was of birds on private lands for which we had no permission to access. Two nests were discovered in 2005 in SW Tamaulipas (see Population Surveys section above), the first of which was parasitized (see Fig. 10). However, in both states cowbirds (*M. ater* and *M. aeneus*) were rarely encountered.

In our experience at the sites in Nuevo León and, possibly, Tamaulipas livestock (e.g., cattle, sheep and goats) ranching tends to occur at higher elevations than those in which BCVI breeding habitat occurs. The steep, rocky slopes of the foothills containing suitable BCVI habitat (Matorral Tamaulipeco; submontane thornscrub) presents a more difficult challenge to the rancher in the form of thin soils and dense thornscrub than does the relatively flat, pine-oak forests of the highlands which have deeper soils and can be cleared for pasture with less effort. Consequently, cowbird populations may not regularly come in contact with BCVI in these areas which, in turn, may provide a more secure breeding environment for the vireos. Further research should focus on this aspect of BCVI breeding ecology in northeastern México.

Figure 9. First record of brood parasitism of Black-capped Vireo by Brown-headed Cowbird in México. Photo taken 6 June 2004, Rancho La Escondida, Coahuila.

Other threats

In the areas of our study the main disturbance factors related to BCVI breeding habitat are similar to those reported earlier (Graber 1961); including, fires (naturally occurring, accidental, and prescribed), logging (roads and clearing of adjacent habitat), livestock grazing and browsing (at elevations below 1000 m), drought and severe cold weather (regularly occurring in late spring at elevations greater than 1000 m), and anthropogenic erosion. Nest depredation is undoubtedly a mortality factor as it is in more northerly parts of the range, but we were unable to document its extent at our study sites. Local populations appear to be sensitive to disturbance as evidenced from the disappearance of the Tamaulipas population from 2003 to 2004.

Habitat and Management

Without further investigation of productivity, brood parasitism, mortality and breeding habitats in México we can offer only preliminary suggestions for management of BCVI. Much of the vegetation suitable for breeding falls into two categories: (1) Tamaulipan thornscrub, or (2) submontane pine-oak chaparral. In the former, found generally below 1000 m, but higher further south (e.g., SW Tamaulipas), there are drier more xeric conditions compared to the latter.

Vegetational communities may persist naturally in the patchy, low stature (<3 m) physiognomy characteristic of similar habitats in west Texas (e.g., Dolan Falls Preserve, Devils River State Natural Area, Big Bend National Park). In these areas (Fig. 10, 12-17) anthropogenic habitat alteration may not be necessary. In slight contrast, the pine-oak chaparral habitat (Fig. 11) encountered at higher elevations (> 1000 m), typically associated with foothills and lower slopes of the Sierra Madre Oriental (western slopes in Nuevo León and Tamaulipas), and Sierra Madre Occidental (Serranías del Burro, and other eastern slopes) mountain ranges may undergo succession toward a more closed canopy forest situation. The forest community here is fire-dependant, and BCVI habitat, consisting of low-growing oaks, sumacs, junipers, and sotol, occurring in deeper soils at the forest edges may benefit from fires and other means of retarding secondary succession. However, interdigitated among these communities are rocky slopes with soils too thin to support deeply rooted trees. Fires may occasionally impact BCVI habitat in some of these areas but may not be needed for maintenance of the habitat.

Figure 10. View of inter-montane thornscrub habitat in valleys occupied by breeding Black-capped Vireos at Rancho La Escondida, Coahuila.

Figure 11. View of pine-oak shrub habitat along slopes occupied by breeding Black-capped Vireos at Rancho La Escondida, Coahuila.

Figure 12. View of xeric Tamaulipan (submontane) thornscrub habitat occupied by breeding Black-capped Vireo near Bustamante, Nuevo León.

Figure 13. View of Tamaulipan (submontane) thornscrub habitat along rocky slopes occupied by breeding Black-capped Vireos near Bustamante, Nuevo León.

Figure 14. View of Tamaulipan (submontane) thornscrub habitat occupied by breeding Black-capped Vireo at Rancho Minas Viejas, Nuevo León.

Figure 15. View of xeric Tamaulipan (submontane) thornscrub habitat occupied by breeding Black-capped Vireo in lower elevation rolling landscapes at Rancho Minas Viejas, Nuevo León.

Figure 16. View of Tamaulipan (submontane) thornscrub habitat occupied by breeding Black-capped Vireo at approx. 1500masl, near Miquihuana, Tamaulipas.

Figure 17. View of Tamaulipan (submontane) thornscrub occupied by breeding Black-capped Vireo at approx. 1500 masl, near Palmillas, Tamaulipas.

Partnerships and Landowner Contacts

One of the goals of the current study, partnerships was envisioned as an effective mechanism to continue the pursuit of mutually beneficial conservations goals and initiatives related to conservation of the Black-capped Vireo. No such action had occurred prior to the realization of the current study. Since BCVI occur across a considerably greater range in México than had been previously known, we can consider the total of our knowledge about the species to be roughly half-complete, at best. Without active participation by Mexican biologists and conservationists there will be no real gains in our understanding of the ecology and conservation of BCVI.

Partnerships:

Dr. Jose I. Gonzalez, Mexican collaborator (address below) on this project and lead for BCVI research in México, has taken the initiative to from partnerships and collaborations, formal and informal, with various conservation agencies and landowners interested in pursuing conservation of the Black-capped Vireo. Within the breeding range, an important link was established with Pronatura. Their agreement specifies that an ongoing collaboration has been formalized with

UANL to include at minimum two years of work related to a project, entitled "Study of the conservation of the Black-capped Vireo in northeastern México." Project goals extend from the work initiated during this study with which Pronatura Noreste has been an integral partner.

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Literature Cited

Benson, R. H., and K. L. P. Benson. 1990. Estimated size of Black-capped Vireo population in Northern Coahuila, México. Condor 92:777-779.

---------- 1991. Reply to Scott and Garton. Condor 93:470-472.

Beardmore, C., J. Hatfield, and J. Lewis. 1996. Black-capped Vireo populations and habitat viability assessment. United States Fish and Wildlife Service.

Berhstock, R. A., and Eubanks, T. L. 1997. Additions to the avifauna of Nuevo León, México, with notes on new breeding records and infrequently seen species. Cotinga 7:27-30.

Bibby, C. J., N. D. Burgess, and D. A. Hill. 1992. Bird census techniques. Academic Press, NY.

Buckland, S. T., D. R. Anderson, K. P. Burnham, J. L. Laake, D. L. Borchers, and L. Thomas. 2001. Introduction to distance sampling. Oxford Univ. Press, NY.

Burnham, K. P., Anderson, D. R., and Laake, J. L. 1980. Estimation of density from line transect sampling of biological populations. Wildlife Monographs, 72: 1-202.

Campbell, L. 1995. Black-capped Vireo. Pp. 29-32, in Endangered and threatened animals of Texas: their life history and management. Texas Parks and

Wildlife Department, Resources Protection Division, Endangered Resources Branch, Austin, Texas.

Farquhar, C. C., J. I. Gonzalez, M. A. Guerrero, O. Ballesteros. 2000. Breeding habitat, distribution and population status of the Black-capped Vireo in Northern México. Interim Report, Section 6 Grant No. E-17. Wildlife Diversity Program, Texas Parks and Wildlife Department, Austin, Texas.

Farquhar, C. C., J. I. Gonzalez, M. A. Guerrero, O. Ballesteros. 2001. Breeding habitat, distribution and population status of the Black-capped Vireo in Northern México. Interim Report, Section 6 Grant No. E-17. Wildlife Diversity Program, Texas Parks and Wildlife Department, Austin, Texas.

Farquhar, C. C., J. I. Gonzalez, M. A. Guerrero, O. Ballesteros. 2002. Breeding habitat, distribution and population status of the Black-capped Vireo in Northern México. Interim Report, Section 6 Grant No. E-17. Wildlife Diversity Program, Texas Parks and Wildlife Department, Austin, Texas.

Farquhar, C. C., J. I. Gonzalez, M. A. Guerrero, O. Ballesteros. 2003. Breeding habitat, distribution and population status of the Black-capped Vireo in Northern México. Interim Report, Section 6 Grant No. E-17. Wildlife Diversity Program, Texas Parks and Wildlife Department, Austin, Texas.

Graber, J. W. 1957. A bioecological study of the Black-capped Vireo (*Vireo atricapillus*). Ph.D. dies., University of Oklahoma.

---------- 1961. Distribution, habitat requirements, and life history of the Black-capped Vireo (*Vireo atricapillus*). Ecological Monographs 31:313:336.

Guerrero, M. A. 2004. Rango reproductivo de vireo gorra negra (*Vireo atricapilla* Woodhouse) para México. Tesis. Universidad Autónoma de Nuevo León, Facultad de Ciencias Biológicas, Departamento de Zoología de Vertebrados, Laboratorio de Ornitología. San Nicolás de los Garza, Nuevo León, México.

Grzybowski, J. A. 1985. Population and nesting ecology of the Black-capped Vireo (*Vireo atricapillus*). Part 1: Population status of the black-capped vireo in Oklahoma - 1985. Oklahoma Dep. Wildl. Conserv., Oklahoma City, OK. 76 PP.

Grzybowski, J. A. 1986. Population and nesting ecology of the Black-capped Vireo (*Vireo atricapillus*). Interim report, Of rice of Endangered Species, U. S. Fish and Wildlife Service, Albuquerque, NM.

---------- 1988. Population and nesting ecology of the Black-capped Vireo (*Vireo atricapillus*) in Oklahoma. Oklahoma Department of Wildlife Conservation, Performance Report, Project E-1-2.

---------- 1989a. Population and nesting ecology of the Black-capped Vireo (*Vireo atricapillus*) in Oklahoma. Oklahoma Department of Wildlife Conservation, Final report, project E-1-3

---------- 1989b. Ecology and management of the black-capped vireo (*Vireo atricapillus*) in the Wichita Mountains, Oklahoma. Report, Wichita Mtns. National Wildl. Refuge, U.S. Fish Wildl. Serv., Indiahoma, OK. 26 pp.

----------. 1990a. Ecology and management of isolated populations of the Black-capped Vireo (*Vireo atricapillus*)in Oklahoma. Oklahoma Dep. Wildl.Conserv. Performance Report, Project E- 1 -5. 20 pp.

----------. 1990b. Ecology and management of the Black-capped Vireo (*Vireo atricapillus*) in the Wichita Mountains, Oklahoma. Wichita Mountains Nati. Wildi. Refuge, U.S. Fish and Wildl. Serv., Indiahoma, Oklahoma. 28 pp.

----------. 1990c. Population and nesting ecology of the Black-capped Vireo (*Vireo atricapillus*) 1990. Resource Protection Division, Texas Parks &W Wildlife Department, Austin, Texas. 39 pp.

---------- 1990d. Population and nesting ecology of the Black-capped Vireo (*Vireo atricapillus*) in Texas - 1988-1989. Arlington Ecological Service, U.S. Fish and Wildlife Service, Arlington, TX.

---------- 1995. Black-capped Vireo (*Vireo atricapillus*). In A. Poole and F. Gill, eds., The Birds of North America, No. 181. The Academy of Natural Sciences, Philadelphia, and The American Ornithologists Union, Washington, D. C.

Gryzbowski, J. A., and V.W. Fazio. Status Report: the Black-capped Vireo at Fot Sill, Oklahoma, 2001. Submitted to Fort Sill Natural Resources Division, Directorate of Environmental Quality.

Gryzbowski, J. A, R. B. Clapp, and J. T. Marshall, Jr. 1986. History and current population status of the Black-capped Vireo in Oklahoma. American Birds 40: 1151 - 1161.

Gryzbowski, J. A., D. J. Tazik, and G. D. Schnell. 1994. Regional analysis of Black-capped Vireo breeding habitats. Condor 96:512-544.

Howell, S. N. G., and S. Webb. 1995. A guide to the birds of México and Northern Central America. Oxford Univ. Press. New York.

Lasley, G. W., and C. Sexton. 1990. The Spring Season: March 1 – May 31, 1990. American Birds, 43:458-465.

Margurran, A. E. 1988. Ecological diversity and its measurement. Princeton Univ. Press, Princeton, N.J.

Marshall, J. T., Jr., R. B. Clapp, and J. A. Grzybowski. 1985. Status report: Vireo atricapillus Woodhouse, Black-capped Vireo. Of fice of Endangered Species, U. S. Fish and Wildlife Service, Albuquerque, NM.

McKinney, B. R. 1998. Surveying, monitoring and managing select endangered/threatened species of concern in the Trans-Pecos ecoregion of Western Texas. USFWS Final Report (No. 1448-20181-97-G932). Texas Parks and Wildlife Department, Austin, Texas.

Miller, A. H. 1955. The avifauna of the Sierra del Carmen of Coahuila, México. Condor 57:154-178.

Moore, R. T. 1938. Unusual birds and extension of ranges in Sonora, Sinaloa, and Chihuahua, México. Condor 40:23-28.

Oberholser, H. C. 1974. The bird life of Texas. University of Texas Press, Austin.

Ortega, C. P. 1998. Cowbirds and other brood parasites. University of Arizona Press. Tucson, AZ.

Phillips, J. C. 1911. A year's collecting in the state of Tamaulipas, México. Auk 28:67-89.

Renardo, J. 1886. Notes on some birds of the United States which occur in the Mexican fauna. Ornithologist and Oologist 11:132-133.

Scott, J. M., and E. O. Garton. 1991. Population estimates of the Black-capped Vireo. Condor 93:469~72.

Steed, D. L. 1988. The Black-capped Vireo (*Vireo atricapillus*) in Travis County, Texas. Tech. Brief, DLS Associates, Austin, Texas.

Tazik, D. J., J. D. Cornelius, and C. A. Abrahamson. 1993. Status of the Black-capped Vireo at Fort Hood, Texas, volume 1: distribution and abundance. Technical report EN-94/01, USACERL, Champagne, IL.

The Nature Conservancy. 2004. Endangered species monitoring and management at Fort Hood, Texas: 2004 annual report. The Nature Conservancy, Fort Hood Project, Fort Hood, Texas, USA.

Thomas, L., Laake, J.L., Strindberg, S., Marques, F.F.C., Buckland, S.T., Borchers, D.L., Anderson, D.R., Burnham, K.P., Hedley, S.L., and Pollard, J.H. 2002. Distance 4.0. Release 2. Research Unit for Wildlife Population Assessment, University of St. Andrews, UK. http://www.ruwpa.st-and.ac.uk/distance/

TPWD 1988. Endangered species: 31 T.A.C. Sec. 65.181 -65.184. PWD-LF-7100-21 -6/88.

USFWS. 1991. Black-capped Vireo (*Vireo atricapillus*) recovery plan. United States Fish and Wildlife Service, Austin, TX.

---------- 1994. Minimum procedures for determining the presence/absence of Golden-cheeked Warblers and Black-capped Vireos. United States Fish and Wildlife Service. Austin, TX.

Urban, E. 1959. Birds from Coahuila, México. University of Kansas Publications, Museum of Natural History. 11:443-516.

Van Hoose, S. G. 1955. Distributional and breeding records of some birds from Coahuila. Wilson Bulletin 67:302-303.

Attachment A. Routes traveled in search of BCVI and their breeding habitat throughout 5 year study, 2001-2005. In excess of 6,700 km were traveled during this time period (see text). Imagery: Landsat 7 Enhanced Thematic Mapper Plus, year 2000.