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A REVIEW OF CURRENT KNOWLEDGE CONCERNING THE BREEDING AND SUMMER DISTRIBUTION OF THE CORDILLERAN FLYCATCHER (*EMPIDONAX OCCIDENTALIS)* IN MEXICO

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ABSTRACT

The Cordilleran Flycatcher (*Empidonax occidentalis*) is one of many North American birds whose distribution crosses the US–Mexican border and for which little is presently known about summer distribution and breeding biology south of this border. In addition, the Cordilleran Flycatcher presents ornithologists with a number of challenging questions surrounding its taxonomy, migration, distribution, population structure, and species limits. In particular, there remains a good deal of uncertainty concerning the species-level relationships, seasonal movements, and the wintering and breeding distributions of both recognized subspecies of Cordilleran Flycatcher in Mexico. Using field observations, a thorough review of the literature, and the examination of several distributional databases, we compile current knowledge on Mexican populations during the summer months and emphasize directions for future research. We document the northern limit of confirmed breeding Cordilleran Flycatchers in Mexico and point to gaps in our understanding of its summer range south of the US border. Currently available data point to a potential migratory divide in northern Mexico, which has implications for species limits and evolutionary dynamics within the Cordilleran Flycatcher.

RESUMEN

El mosquero barranqueño (*Empidonax occidentalis*) es una de varias especies de aves norteamericanas cuya distribución cruza la frontera entre México y los Estados Unidos, y de la cual se conoce poco acerca de su distribución durante el verano y su biología reproductiva al sur de esta frontera. Además, el mosquero barranqueño presenta a los ornitólogos una serie de preguntas acerca de su taxonomía, migración, distribución, estructura poblacional, y límites taxonómicas adentro de la especie. En particular, sigue bastante incierto nuestro conocimiento sobre las relaciones filogenéticas entre ambas subespecies del mosquero barranqueño, sus movimientos estacionales, sus distribuciones durante el verano, y su reproducción adentro de México. Usando observaciones de campo, una revisión exhaustiva de la literatura, y examinación de varias bases de datos distribucionales, recompilamos el conocimiento actual sobre las poblaciones mexicanas durante la temporada reproductiva y sugerimos direcciones para investigaciones futuras. Documentamos el límite norte de reproducción del mosquero barranqueño confirmado en México y señalamos vacíos en nuestra comprensión de su rango estival al sur de la frontera con los Estados Unidos. Los datos actualmente disponibles apuntan a la posibilidad de una brecha migratoria en el norte de México, la existencia de cual tiene implicaciones para los límites de las especies y la dinámica evolutiva dentro del mosquero barranqueño.

KEY WORDS: Biogeography, Distribution, Natural History, Nesting Biology, Tyrannidae.

INTRODUCTION

The genus *Empidonax*, as currently defined, includes 15 species of small, drab-plumaged flycatchers (Dickinson and Christidis 2014; Fitzpatrick 2018). As a whole, these shy, unobtrusive flycatchers are notoriously difficult to identify. In particular, distinguishing Cordilleran Flycatcher (*E. occidentalis*) from the very similar Pacific-slope Flycatcher (*E. difficilis*) presents a myriad of challenges (Phillips et al. 1964; Whitney and Kaufman 1986). Long considered conspecific and collectively known as Western Flycatcher, these taxa were split based on differences in vocalizations, breeding distributions, and genetics (Monroe et al. 1989), including some evidence from allozyme frequencies and potential assortative mating in a zone of overlap in the Siskiyou region of northeastern California (Johnson 1980, Johnson & Marten 1988). The decision to split these taxa is not supported by all ornithologists, however, as Beedy and Pandolfino (2013) recently observed that some "Cordilleran" males in northern California appear to give calls typical of both species, while Rush et al. (2009) have identified a second hybrid zone in southern British Columbia and Alberta where admixture is widespread. Given our poor understanding of the distribution, movements, and geographic variation among "Western Flycatchers" in Mexico, it seems likely that our current taxonomic treatment fails to incorporate important variation within the species' complex that could be as evolutionary and taxonomically as important as any differences between Cordilleran and Pacific-slope flycatchers.

Currently, three subspecies of the "Western Flycatcher" species-complex are considered to belong to Pacific-slope Flycatcher and two are considered subspecies of Cordilleran Flycatcher (del Hoyo and Collar 2016). Overall, however, a thorough evaluation of the relationships between the taxa involved continues to be hindered by a paucity of information on their genomics, vocalizations, ontogenetic shifts and regional variation in plumage coloration, morphometric variation, natural history, and their respective geographic ranges during breeding and migration (Lowther et al. 2016; Farnsworth and Lebbin 2018). In particular, for the two subspecies of Cordilleran Flycatcher, as is the case for so many species whose ranges span the US–Mexican border (e.g., Curson and Goguen 1998; Russell and Monson 1998; Barber et al. 2000; Johnson et al. 2002), nearly all information available on breeding and distribution is derived from studies from the northern portion of Cordilleran Flycatcher's range (Wise-Gervais 2005; Farnsworth and Lebbin 2018), while south of the Mexican border with Arizona and New Mexico, but also including western Texas, our understanding of the breeding, distribution, and taxonomic affinities of various populations is exceedingly poor. Here, we compile existing reproductive

and distributional data for the Cordilleran Flycatcher in Mexico during the breeding season, refining the current descriptions of its breeding range south of the US border (Johnson 1980; Howell and Webb 1995; Lowther 2000; Lowther et al. 2016). We document northward extensions of its breeding range and illuminate important gaps in currently available breeding and distributional information.

MATERIALS AND METHODS

We created a database of distributional records of Cordilleran Flycatcher in Mexico from five major sources: VertNet (http://portal.vertnet.org); eBird (http://ebird.org); xeno-canto (http://xeno-canto.org); museum specimens; and published literature. Due to the difficulty in distinguishing between Cordilleran and Pacific-slope flycatchers in the field (Phillips et al. 1964; Whitney and Kaufman 1986), we acknowledge that some eBird records may represent identification errors. However, so far as is known, there are no breeding populations of Pacific-slope Flycatcher in Mexico, apart from subspecies *cineritius*, which is confined to the Baja Peninsula (Brewster 1888; Dickinson and Christidis 2016). Given this, the presence of Pacific-slope Flycatcher in Mexico outside of Baja California during the breeding season (May-August) is unlikely, making Cordilleran Flycatcher relatively easy to separate from potentially sympatric *Empidonax* species during these months: e.g., Buff-breasted Flycatcher (*E. fulvifrons*); Pine Flycatcher (*E. affinis*); see Howell and Cannings 1992; Howell and Webb 1995.

We considered the following as concrete evidence of local reproduction: museum specimens with obvious signs of current reproduction, including shelled or unshelled eggs in the oviduct, males with enlarged testes during June–August, or any specimens or observations of active nesting, including eggs or nestlings. Additionally, we scored the presence of fledglings as evidence for breeding, but with the following qualifications. We only considered museum specimen records, and the specimen needed to show external signs of immature status such as incompletely developed flight feathers, and/or inflated rictal flanges (i.e., not simply undeveloped gonads). When label data did not provide details of how the birds were aged, we examined skins labeled as immature in the VertNet database (either directly or via photographs), rejecting any records that were not clearly juveniles and not including any that we were not able to examine. We are confident, therefore, that all included records of fledglings are truly representative of locally-raised individuals.

In that Cordilleran Flycatchers are presumably breeding in June and July throughout their summer Mexican range, we scored all sight records from montane locations during these months as breeding. Similarly, most sight records in May and August *probably* represent breeding birds, but could possibly represent migrating Cordilleran Flycatchers or Pacific-Slope Flycatchers, especially in costal lowland areas that would be unsuitable breeding locations for Cordilleran Flycatcher. Although error introduced by misidentified sight records is unlikely to alter our main conclusions, we excluded all sight records from the Pacific coastal lowlands at locations that are below the known altitudinal breeding range of Cordilleran Flycatcher and thus more likely to represent late- or early-migration records of Pacific-slope Flycatchers (Lowther 2000; Howell and Webb 1995). We scored specimens cataloged in VertNet using the same criterion (e.g. May–August: breeding). Several collections were cursorily checked by HFG (FMNH, USNM, AMNH, MLZ, WFVZ, UAZ), and questionable records were either examined more closely by HFG or with the help of collections personnel.

RESULTS AND DISCUSSION

Cordilleran Flycatchers nest in shady, forested mountain habitats, especially canyons, ravines and riparian areas, at elevations of 1000-3500m (Andrews and Righter 1992; Lowther 2000; Wise-Gervais 2005). North of the Mexican border, the bulk of the breeding range of Cordilleran Flycatcher (Fig. 1) extends from the interior of southern British Columbia (i.e., Okanagan Valley, Kootenay Region), southwestern Alberta and southeastern Washington, eastward to west-central Montana and Wyoming, then south through eastern Nevada, Utah, western Colorado, northern and southeastern Arizona, northern and southwestern New Mexico, and extreme western Texas (Monroe et al. 1989; Lowther et al. 2016; Farnsworth and Lebbin 2018). In Mexico, the Cordilleran Flycatcher nests in both the eastern (Oriental) and western (Occidental) ranges of the Sierra Madres, south to central Oaxaca (west of the Isthmus of Tehuantepec). The data presented herein demonstrate that Cordilleran Flycatchers occur only in the highlands during the breeding season (Fig. 1), which agrees with earlier descriptions (Johnson 1980; Howell and Webb 1995; Farnsworth and Lebbin 2018; Schulenberg 2018).

Breeding records – Among our set of summer records, we found a subset of 86 records that confirm reproductive activities at various locations in Mexico (Table 1; Fig. 2; Appendix 1). We provide an updated northern-most record of breeding for Cordilleran Flycatcher in the Sierra Madre Occidental based on an active nest (Carlos González, eBird) in the Reserva Forestal Nacional y Refugio de Fauna Silvestre Ajos Bavispe (30°34'N, 109°45'W) (Fig. 2c), which is located in the mountains c.20 km due west of El Pinto, Sonora. Previously, the northernmost published breeding record within the Sierra Madre Occidental was from Sierra Obscura (Russell and Monson 1998; Fig. 2f), around 45 km due south of Yécora (Sonora; 27°59'N, 109°00'W). The Ajos Bavispe nest, therefore extends the known breeding range in western Mexico northward by around 280 km. Suitable breeding habitat, however, appears to occur, albeit increasingly fragmented in the Sky Islands, from these localities northward through eastern Sonora almost to the Arizona border (Flesch 2008a, 2014).

The northernmost confirmed breeding records in Chihuahua were previously from the Barranca del Cobre re-

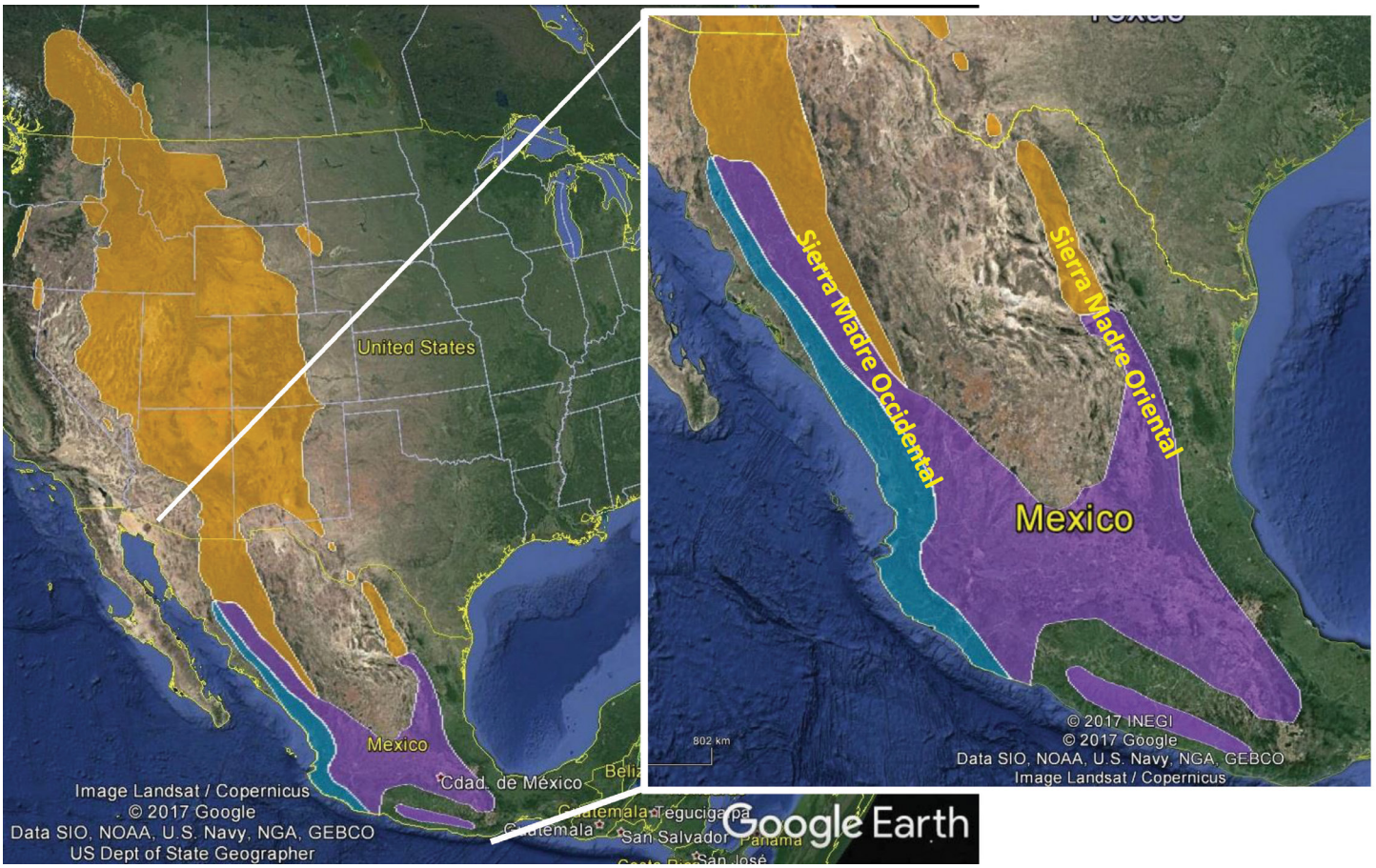


Fig. 1: Currently accepted distribution map for Cordilleran Flycatcher (*Empidonax occidentalis*) (based on Lowther 2000; Lowther et al. 2016; Schulenberg 2018). Orange = breeding only; Purple = year-round; Blue = Wintering only.

gion of the southeastern portion of the state (also western chain, 27°22'N, 107°53'W, Stager 1954; Fig. 2g), c.150 km ESE of Yecora. We found no solid confirmation of breeding elsewhere in the Sierra Nevada Occidental of western Chihuahua, although the occurrence of an immature bird collected on 1 August 1888 near "Bravo" (Appendix 1; Fig. 2d) in central Chihuahua strongly suggest the presence of a breeding population. Topography suggests that this would be the easternmost breeding location for northern Sierra Madre Occidental populations. West of Bravo, however, the fairly contiguous distribution of potentially suitable breeding locations from Barranca del Cobre, northward through the mountains east of Yécora into northwestern Chihuahua (to at least 30°32'N), and in the mountains southwest of Janos, Chihuahua (30°53.5'N, 108°11.5'W; Fig. 2), suggests breeding could occur further north in this portion of Mexico, possibly as far as the Arizona/New Mexico border. Indeed, breeding populations are known just north of the border in both the Chiricahua Mountains of SE Arizona (Balda 1967; Greeney pers. observ.) and the Animas Mountains of SW New Mexico (Niles 1966; Figs. 2a-b). In the Sierra Madre Oriental, the northern-most records of breeding come from the northeastern-most portion of its Mexican summer range in the Sierra del Carmen region of northern Coahuila (this study, Figs. 2i-j). Previously, the northernmost report of breeding activity was c.450 km south in southeastern Coahuila, around 14 km east of Saltillo (Ely 1960, 1962; Fig. 2k).

Summer distribution – Our analysis indicates that the confirmed breeding (e.g., June–July) distribution of Cordilleran Flycatcher is rather small, and somewhat fragmented (Fig. 3). Adding records from May and August (Fig. 4) does little to change this. However, when we use records from all four summer months and extrapolate to include all apparently suitable nesting habitat (e.g. elevation and forest type, Fig. 5), it is clear that our knowledge is far from complete. It does, however, approximate currently-accepted distribution maps (Fig. 1).

Status of Cordilleran Flycatcher in northern Mexico – In northwestern Mexico (northern Sonora), the Cordilleran Flycatcher was, until recently, considered to be rare or lacking as a summer resident (Marshall 1957; Russel and Monson 1994). Historically, there has been much confusion in the literature on this point (see Van Tyne 1929; Moore 1940b; Van Rossem 1945; Brodkorb 1949). This uncertainty occurred largely because many late spring records from Sonora were considered by some authors to be late migrants and by others to represent nesting populations but, as stated by Marshall (1957), "there [was] no evidence that the Western Flycatcher nest[ed] in Sonora or northwestern Chihuahua," leaving the area south of the Arizona border as a rather substantial dis-

Table 1: Breeding records for Cordilleran Flycatcher (*Empidonax occidentalis*) in Mexico. Locations: detailed locations and coordinates are given in Appendix 1 under the corresponding Mexican state and unique locality number provided.

Nesting stage	Notes	Date	Location (See Appendix 1)	Source
Building	nearly complete nest	19 July 1961	Oaxaca ***[22]***	Rowley 1984
Building	nearly complete nest	12 July 1965	Oaxaca ***[26]***	Rowley 1966
Building	nest construction	18 May 2006	Sonora ***[37]***	ML-459627-30; photo Larry R. Arbanas
Building	nest construction	5 May 2007	Coahuila ***[2]***	Eliot T. Miller in litt. 2015
Building	nest construction	16 May 2007	Coahuila ***[2]***	Eliot T. Miller in litt. 2015
Building	nest construction	29 May 2007	Coahuila ***[2]***	Eliot T. Miller in litt. 2015
Building	adults inspecting nest sites on cliff	13 May 2013	Jalisco ***[12]***	Julio Alejandro Álvarez Ruíz in litt. 2017
Building	nest construction	11 May 2014	Veracruz ***[44]***	eBird; José Alberto Lobato García
Building	nest construction	14 April 2015	Oaxaca ***[27]***	Benjamin M. Winger in litt. 2017
Building	adult carrying nest material	23 April 2015	Jalisco ***[12]***	Julio Alejandro Álvarez Ruíz in litt. 2017
Building	adult carrying nest material	9 May 2015	Jalisco ***[12]***	Julio Alejandro Álvarez Ruíz in litt. 2017
Building	adult carrying nest material	21 June 2015	Veracruz ***[46]***	eBird; Amy McAndrews
Building	adult carrying nest material	15 April 2017	Veracruz ***[46]***	eBird; Gustavo Contreras Cuevas
Building	nest construction	9 May	Oaxaca ***[24]***	Forcey 2002
Laying	first eggs appeared in nest	13 May 1950	Chihuahua ***[1]***	Stager 1954
Laying	shelled egg in oviduct	19 July 1961	Oaxaca ***[22]***	Binford 1989; AMNH-778513
Laying	first eggs appeared in nest	15 July 1966	Oaxaca ***[26]***	Rowley 1966
Laying	first eggs appeared in nest	29 May 2007	Coahuila ***[2]***	Eliot T. Miller in litt. 2015
Incubation	nest with undeveloped eggs	15 May 1947	San Luis Potosí ***[31]***	WFVZ-166911
Incubation	nest with undeveloped eggs	15 May 1947	San Luis Potosí ***[31]***	WFVZ-166912
Incubation	nest with eggs	4 June 1948	Michoacán ***[16]***	Edwards & Martin 1955
Incubation	nest with eggs, c.1/3 developed	19 June 1948	San Luis Potosí ***[31]***	WFVZ-166821
Incubation	nest with eggs	23 May 1958	Coahuila ***[3]***	Ely 1960
Incubation	nest with eggs	27 May 1958	Coahuila ***[3]***	Ely 1960
Incubation	nest with undeveloped eggs	21 May 1960	Morelos ***[19]***	Rowley 1962; WFVZ-25551
Incubation	nest with undeveloped eggs	21 May 1960	Morelos ***[19]***	Rowley 1962; WFVZ-25552
Incubation	nest with undeveloped eggs	14 June 1960	Morelos ***[19]***	Rowley 1962; WFVZ-25553
Incubation	nest with undeveloped eggs	22 June 1960	Morelos ***[19]***	Rowley 1962; WFVZ-25554
Incubation	nest with undeveloped eggs	2 June 1961	Morelos ***[19]***	WFVZ-186313
Incubation	eggs close to hatch	5 May 1962	Oaxaca ***[28]***	Rowley 1966
Incubation	nest with undeveloped eggs	7 May 1963	Oaxaca ***[28]***	Rowley 1966; WFVZ-25556
Incubation	nest with eggs	27 May 1963	Sinaloa ***[34]***	WFVZ-159564
Incubation	nest with eggs	6 May 1964	Sinaloa ***[33]***	Hubbard & Crossin 1974; WFVZ-159563
Incubation	nest with undeveloped eggs	29 April 1965	Oaxaca ***[26]***	Rowley 1966; WFVZ-27632
Incubation	nest with undeveloped eggs	5 May 1965	Oaxaca ***[28]***	Rowley 1966; WFVZ-21186
Incubation	nest with undeveloped eggs	5 May 1965	Oaxaca ***[28]***	Rowley 1966; WFVZ-21187
Incubation	nest with slightly developed eggs	9 May 1965	Oaxaca ***[26]***	Rowley 1966; WFVZ-27622
Incubation	nest with slightly developed eggs	21 May 1965	Oaxaca ***[28]***	Rowley 1966; WFVZ-21183
Incubation	nest with undeveloped eggs	29 May 1965	Oaxaca ***[28]***	Rowley 1966; WFVZ-21184
Incubation	nest with undeveloped eggs	29 May 1965	Oaxaca ***[28]***	Rowley 1966; WFVZ-21185
Incubation	nest with eggs	9 June 1965	Sinaloa ***[32]***	WFVZ-11662

Nesting stage	Notes	Date	Location (See Appendix 1)	Source
Incubation	nest with eggs	29 May 2007	Coahuila ***[2]***	Eliot T. Miller in litt. 2015
Incubation	nest with eggs	8 June	Oaxaca ***[24]***	Forcey 2002
Incubation	nest with eggs	20 May 1893	Veracruz ***[43]***	USNM-B26229
Nestling	newly-hatched nestlings	13 June 1958	Coahuila ***[3]***	Ely 1960
Nestling	nestlings ready to fledge	30 May 1959	Morelos ***[19]***	Rowley 1962
Nestling	nestlings ready to fledge	18 June 1963	Oaxaca ***[26]***	Rowley 1966
Nestling	nestlings, c.1 week old	9 May 1965	Oaxaca ***[26]***	Rowley 1966; CAS-72018
Nestling	newly-hatched nestlings	31 May 1965	Oaxaca ***[28]***	Rowley 1966
Nestling	nestlings ready to fledge	2 June 1965	Oaxaca ***[26]***	Rowley 1966
Nestling	nest with young nestlings	10 June 1984	Sonora ***[40]***	Russell & Monson 1998
Nestling	nest with nestlings	24 May 2015	Colima ***[5]***	eBird; Eric Clough
Nestling	nest with nestlings	17 July 2015	Durango ***[8]***	eBird; Bernardo Rodríguez
Fledgling	dependent young	20 July 1940	Michoacán ***[17]***	Blake & Hanson 1942
Fledgling	dependent young	25 July 1940	Michoacán ***[17]***	Blake & Hanson 1942
Fledgling	stub-tailed immature	16 June 1942	Estado de México ***[15]***	MLZ-32721
Fledgling	stub-tailed immature	27 June 1946	Guanjuato ***[9]***	MLZ-42732
Fledgling	dependent young	23 July 1949	Jalisco ***[14]***	Zimmerman & Harry 1951; UMMZ-136078
Fledgling	stub-tailed immature	10 October 1951	Jalisco ***[13]***	MLZ-53099
Fledgling	stub-tailed immature	10 June 1965	Oaxaca ***[26]***	Binford 1989; WFVZ-27630
Fledgling	dependent young	5 August 2007	Oaxaca ***[29]***	Matt Brady in litt. 2017
Fledgling	dependent young	21 August 2009	Sonora ***[37]***	Scott Olmstead in litt. 2017
Fledgling	dependent young	14 June 2014	Districto Federal ***[6]***	eBird; Joren van Schie
Fledgling	dependent young	16 May 2015	Morelos ***[18]***	eBird; Annamaria Savarino
Fledgling	dependent young	8 July	Oaxaca ***[24]***	Forcey 2002
Fledgling	dependent young	No date	Hidalgo ***[10]***	Martínez-Morales et al. 2013
Fledgling	Stub-tailed immature	1 August 1888	Chihuahua ***[0]***	MCZ-223838
Post-fledge	adults in vicinity of recently-fledged nest	30 July 2016	Sonora ***[39]***	H. F. Greeney unpubl.
Active nest	adult collected while on a nest	4 June 1938	Sinaloa ***[35]***	Moore 1940a
Active nest	paired adults near "the sink-holes in which they nested"	May 1949	Tamaulipas ***[41]***	Robbins & Heed 1951
Active nest	adult sitting on active nest	13 July 1965	Oaxaca ***[26]***	Rowley 1966
Active nest	adult sitting on active nest	13 July 1965	Oaxaca ***[26]***	Rowley 1966
Active nest		18 May 2009	Veracruz ***[45]***	eBird; Amy McAndrews
Active nest		12 May 2011	Veracruz ***[45]***	eBird; Amy McAndrews
Active nest		21 May 2012	Sonora ***[36]***	eBird; Carlos González
Active nest		no date	Sonora ***[37]***	Flesch 2014
Active nest		19 April 2015	Veracruz ***[45]***	eBird; Amy McAndrews
Active nest		27 May 2015	Colima ***[4]***	eBird; Eric Clough
Active nest		4 July 2015	Jalisco ***[11]***	Julio Alejandro Álvarez Ruíz in litt. 2017
Active nest		1 May 2016	Puebla ***[30]***	eBird; Nicola Cendron
Active nest		22 June 2016	Districto Federal ***[7]***	eBird; Annamaria Savarino
Active nest		6 May	Oaxaca ***[24]***	Forcey 2002
Active nest		26 May 2017	Veracruz ***[45]***	eBird; Amy McAndrews

Nesting stage	Notes	Date	Location (See Appendix 1)	Source
Active nest	2 active nests, few details	no date	Oaxaca ***[25]***	Hunn et al. 2001
Breeding	adult carrying food [= nestlings or fledglings]	17 May 2015	Veracruz ***[42]***	eBird; Amy McAndrews
Breeding	male with enlarged testes	8 May 1941	Nuevo León ***[20]***	Sutton et al. 1942
Breeding	male with enlarged testes	15 May 1962	Oaxaca ***[23]***	Binford 1989

continuity in its eastern range. Thanks to extensive survey work in the past decade, however, we now know or suspect that at least a few of the higher Sky Island mountain ranges in this region support breeding Cordilleran Flycatchers (Flesch and Hahn 2005; Flesch 2008a, 2008c, 2014; Flesch et al. 2015, 2016). At least some areas that have been carefully explored in the past decade (Flesch 2008b), however, appear to lack breeding Cordilleran Flycatchers. The Sierra Madre Occidental of northern Sonora, western Chihuahua and northern Durango is still inadequately explored, and additional confirmation of breeding there by Cordilleran Flycatchers is sorely needed help to fill or confirm this apparent distributional gap.

Subspecific distributions of Cordilleran Flycatcher and the migratory divide – As currently defined, and for the purposes of this work, the Cordilleran Flycatcher is considered to include two subspecies, one endemic to Mexico and presumed to be largely sedentary (nominate *occidentalis*), and one whose breeding range lies largely within the United States (*hellmayri*). The wintering range of the latter is considered to lie entirely within Mexico (Lowther 2000; Farnsworth and Lebbin 2018). The nominate *occidentalis* is said to breed and winter from Durango, southeastern Sinaloa, southeastern Coahuila, and Nuevo Leon southward to Guerrero, Oaxaca and western Veracruz (Traylor 1979; Farnsworth and Lebbin 2018). Migratory *hellmayri* reportedly breeds in the Sierra Madre Oriental only in northern Coahuila, but in the Sierra Madre Occidental it breeds in Sonora and western Chihuahua (Moore 1940b; Traylor 1979; Farnsworth and Lebbin 2018). Understanding the exact breeding distributions of the two subspecies, however, presents a complex problem, and remains unclear. The currently accepted distribution maps for the two subspecies are, in many parts of their range, based on extrapolation or conjecture. Based on the currently described distributions of the two subspecies (Fig. 6), there is no clear geographic barrier separating the two populations, one supposedly migratory, one sedentary, especially in the Sierra Madre Occidental.

The degree to which the two subspecies come into contact or overlap in distribution is unknown, and unlikely to be resolved without careful sampling of this region. The situation is particularly confusing in some regions as a result of differing opinions as to the subspecific taxa involved and by the historical use of subspecific synonyms (i.e., *bateli*, see below). Nesting individuals in the vicinity of the Concordia municipality in southeastern Sinaloa (Moore 1940b; Hubbard and Crossin 1974; both as *E. bateli*; Fig. 6 line A), are of potential interest, as this would perhaps be the next likely northern limit of *occidentalis*. The affinities of this population, however, are unclear. Indeed, Hubbard and Crossin (1974) felt that specimens collected there in late May represented (in equal porportions) *hellmayri*, *occidentalis*, and nominate *difficilis*. Phillips (1966) considered *bateli* to likely represent *hellmayri*, while Traylor (1979) synonymized *bateli* with nominate *occidentalis*. Around 200 km SE of here, specimens in "full breeding condition" in late June and July, collected in the vicinity of Milpillas (23°05.5'N, 103°40.5'W) were, at the time, considered to represent a slight southward extension of the breeding range of *hellmayri* (Webster 1958). The Sierra Madre Occidental in this area becomes strongly fragmented, with peaks separated by wide, flat valleys in the east and steep river valleys (e.g., Río Verde, Río Juchipila, Río Bolaños) cutting into the mountains in the west as streams drain into the Rio Grande de Santiago. This major river valley cuts through the Sierra Madre Occidental, flowing northwest out of Lake Chapala (near Ocotlán, Jalisco) through Jalisco and Nayarit as it descends to the coastal lowlands and empties into the Pacific Ocean 16 km northwest of San Blas, Nayarit. It seems possible that the fragmentation of the Sierra Madres in this area might provide a natural North-South break, with *hellmayri* to the north and *occidentalis* to the south in western Mexico (Fig. 6 - line B).

Early authors (Brodkorb 1949; Miller 1955) considered birds in the Sierra del Carmen of Coahuila to represent *hellmayri*, an opinion that is now generally agreed upon (Howell and Webb 1995; Farnsworth and Lebbin 2018). Indeed, this location is only 80km southeast of the higher parts of the Chisos Mountains in the Big Bend National Park of Texas, the type locality of *hellmayri* (Fig. 6; Brodkorb 1935). The two mountain areas are part of the same system of uplifts, but are separated by the Rio Grande Valley. Cordilleran Flycatchers are, with a few presumed "accidental" exceptions, absent from both of these areas during the winter. In the Chisos Mountains they begin arriving as early as the first week of April (Miller 1955). In early April, however, Cordilleran Flycatchers in this area, especially those at lower elevations, also likely include migrants heading towards more northern breeding grounds, as suggested by Miller's (1955) observations that males collected during this time showed *either* well developed testes *or* testes still at non-reproductive size. Somewhat remarkably, the Cordilleran Flycatcher has not previously been reported as a breeding bird in the Sierra del Carmen, leading to a presumed discontinuity of its nesting range in the Sierra Madre Oriental (Marshall 1957). A sizable gap of confirmed breeding sites remains, however, even after considering breeding populations discovered in southern Coahuila (Ely 1960) and the documentation of breeding in the Sierra del Carmen (this

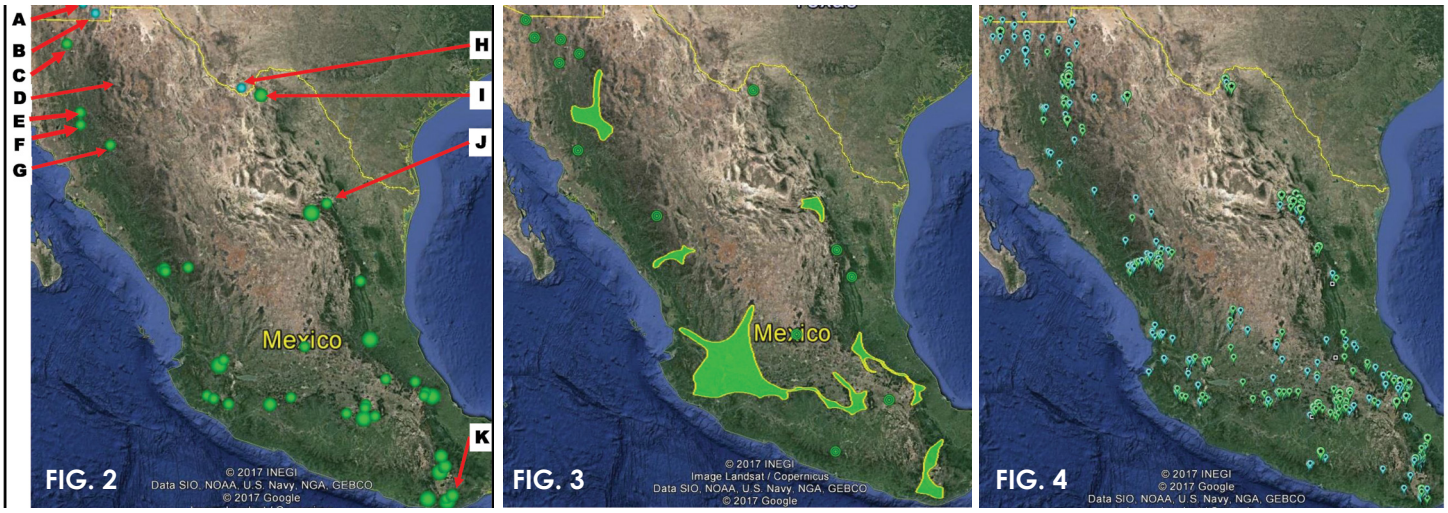


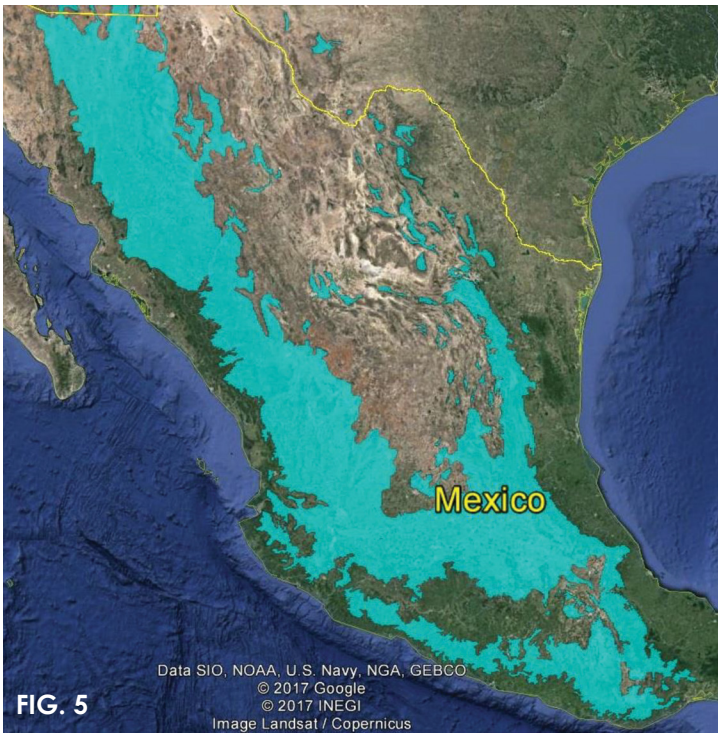
Fig. 2: Breeding localities of Cordilleran Flycatcher (*Empidonax occidentalis*) in Mexico (green) and extreme southern United States (blue). Records include active nests, stub-tailed fledglings, and adults with well-developed gonads (Table 1). The size of markers indicates the relative number of records at a single location (1-7 records). **A** – *Southeasternmost breeding records in Arizona*: vicinity Southwestern Research Station, Chiricahua Mountains, c.31°53'N, 109°13'W; active nests; Balda (1967) and Greeney pers. observ. **B** – *Southernmost breeding record in New Mexico*: Indian Creek, Animas Mountains, 31°35'N, 108°46'W, active nest; eBird, Christopher Rustay. **C** – *Northernmost Mexican breeding record*: Reserva Forestal Nacional y Refugio de Fauna Silvestre Ajos Bavispe, Sonora, 30°34'N, 109°45'W, active nest; eBird, Carlos González. **D** – *Northernmost evidence of breeding in Chihuahua*: vicinity of Nicolás Bravo, c.29°21'N, 107°56'W, MCZ-223838; see Table 1 and Appendix 1. **E** – *Third most northerly breeding locality in Sonora*: Mesa Campañera, vicinity of Yécora, 28°21'N, 109°01.5'W; Greeney pers. observ., see Table 1. **F** – *Additional breeding locality in the Sierra Madre Occidental*; Sierra Obscura, Sonora, 27°58.5'N 109°00'W; active nest; Russell & Monson (1998). **G** – *Northernmost, previously known breeding locality in Chihuahua*: Barranca del Cobre, 27°22'N, 107°53'W; active nest; Stager (1954). **H** – *Southernmost known breeding location in Texas*: Boot Springs, Chisos Mountains, 29°13.5'N, 103°18.5'W; recently fledged young, Van Tyne (1929). **I** – *Northernmost breeding location in the Mexican Sierra Madre Oriental*: Area de Protección de Flora y Fauna Maderas del Carmen, 28°59.5'N, 102°36.5'W; several breeding records; E. T. Miller in litt. (2015), see Table 1. **J** – *Northernmost, previously documented breeding location in the Mexican Sierra Madre Oriental*: vicinity of Saltillo, Coahuila, 25°20'N, 100°57.5'W; active nests; Ely (1960).
Fig. 3: Confirmed breeding distribution of Cordilleran Flycatcher (*Empidonax occidentalis*) in Mexico as confirmed by records of adults in June or July or records of local reproductive activity (see text). Circles represent individual records. All polygons or records are separated by at least 80km. Polygons are the smallest possible to include groups of locations.
Fig. 4: Records of Cordilleran Flycatcher (*Empidonax occidentalis*) in Mexico from May to August. Blue = May or August; Green = June or July

study). In addition to the lack of studies from this region, this gap in breeding records is perhaps best explained by the patchy distribution and general dearth of appropriate breeding habitat through most of Coahuila and western Chihuahua. This explanation also presumably accounts for the lack of records from desert regions on the plateau country between the two cordilleras, from eastern Chihuahua and central Coahuila southward, and from the Chihuahuan Desert biome between the mountains of western Texas and northern Coahuila east to the Madrean Archipelago of western Chihuahua and eastern Sonora (Johnson 1980). Small uplifts with potentially viable nesting habitat at suitable altitudes are, however, scattered across these regions of apparent absence, and these should be more carefully surveyed before these gaps are accepted as real.

Conclusions and directions for future research – A good deal of uncertainty remains concerning the taxonomic affinities of Mexican Cordilleran Flycatcher populations, their movements, and wintering and breeding distributions. Using the information summarized herein, future planned research and data collection can be better focused. Moreover, our clarification of the Cordilleran Flycatcher summer ranges and breeding locations in Mexico will be useful in elucidating key genetic and distribution questions.

The distribution patterns described above posit the possibility that a migratory divide occurs between migratory Cordilleran Flycatchers and geographically-proximate but non-migratory populations in northern Mexico. Differential migratory patterns between sympatric or parapatric populations – termed a migratory divide – have been shown to drive evolutionary patterns and even generate incipient speciation in other bird taxa. For example, a small population of Eurasian Blackcaps (*Sylvia atricapilla*) from the German–Austrian border region apparently began to overwinter in the British Isles in the 1960s, while the remaining population overwinters in the Iberian Penninsula (Helbig 1991; Bearhop et al. 2005). This migratory divide has led to rapid phenotypic evolution and genomic divergence, and even the development of assortative mating between migratory phenotypes (Rolshausen et al. 2009).

Likewise, migratory divides have been found in North American birds. The well-studied migratory divide of Swainson's Thrush (*Catharus ustulatus*) has demonstrated islands of genomic divergence between migratory types (Delmore et al. 2015), further implicating migratory differences as drivers of avian speciation. A different form of migratory divide has been demonstrated in Painted Buntings (*Passerina ciris*): western Painted buntings undergo molt-migration, whereby post-breeding birds migrate to a staging area in northwestern Mexico prior to their prebasic molt and then continue to



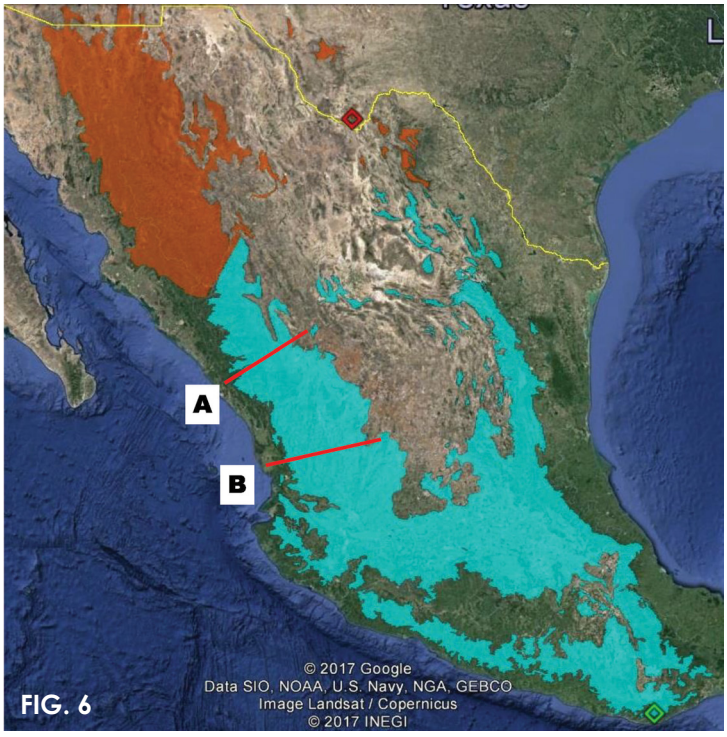


Fig. 5: Potential breeding distribution of Cordilleran Flycatcher (*Empidonax occidentalis*) in Mexico based on all records of adults, young, or nests, from May-August. Polygons include all summer records and are expanded to include all potentially suitable habitat based on elevation and habitat.

Fig. 6: Potential breeding distribution and type localities of the two subspecies of Cordilleran Flycatcher (*Empidonax occidentalis*) in Mexico. Brown polygons/red diamond = subspecies hellmayri; blue polygons/ green diamond = subspecies occidentalis. The two red lines indicate alternate hypothesized southern distributional limits of *hellmayri* (A) near Concordia, Sinaloa and (B) in the mountains south of Milpillas, Zacatecas.

tropical wintering grounds, while eastern birds typically complete their prebasic molt on breeding grounds prior to southerly migration, leading Thompson (1991) to suggest that this taxon actually represents two species. Subsequently, genetic studies have found evidence of reduced gene flow across this migratory divide (Battey et al. 2018; Contina et al. 2018). Although migratory differences logically can drive substantial evolutionary differences within bird species, few studies have found evidence for migratory divide in species where some populations migrate and others do not. For example, Buerkle (1999) found evidence of greater population differentiation between non-migratory and migratory Prairie Warblers (*Dendroica discolor*) but no evidence of substantial genetic isolation between these populations. Nonetheless, migration patterns in many bird species vary over time, and migration behavior can often be flexible, and so differences in migratory phenotype may not indicate substantial genetic differentiation (Sutherland 1998). Studies of closely-related taxa with differing migratory phenotypes may elucidate the genetic architecture underlying passerine migration (Liedvogel et al. 2011).

Thus, the most important future research need in Mexico is conducting a comprehensive study to examine differences in genetic structure of breeding Cordilleran Flycatcher in Mexico relative to North American populations. This study should use genome-wide data; either with reduced-representation genomic data such as RAD-Seq (e.g., Battey et al. 2018), or whole genome data (e.g., Walsh et al. 2018). Reduced-representation genomic data sets consist of thousands or tens of thousands of genetic markers spread randomly across the genome. Variation within these markers can be used to identify differences among populations, and can also be used to measure historical demographic variation such as changes in population size and range expansion. Because the genome is reduced, more individuals can be sampled for a given research budget. However, genome reduction data sets are unlikely to uncover loci under selection between populations, such as genes responsible for different migration phenotypes. For such a study, whole genome datasets are preferable, but have the trade-off of sampling fewer individuals for a given budget allocation.

Whatever marker set is used for the study of range-wide population structure, the goal will be to look for the existence of a discontinuity or clinal gradient between birds breeding north of Sonora and more southern breeders. Mexican-based researchers could do genomic studies exclusively within that country. The goal of such a study would be to look for genomic differences between birds that remain to breed in southern Mexico and those that are shown to move northward to breed. Our current review of distributional limits should help point researchers towards where to effectively sample.

Likewise, future studies should focus on summer surveys for breeding birds in the mountainous regions of Mexico, par-

ticularly in the areas of the Sky Islands in northern Sonora and eastern Chihuahua. These surveys will verify if breeding occurs, and the timing of those reproductive events. The genetic affinities of these northerly populations will be particularly important for defining subspecific range limits.

A final potential productive effort would be to utilize geolocators on Cordilleran Flycatchers in southern Mexico and on those breeding in the northern part of the country. We have utilized this tool in southwestern Colorado (Boyce et al. in prep) and have found that it works well on documenting large-scale movements of Cordilleran Flycatchers. Birds do return to their breeding locations in Colorado and Arizona on an annual basis (van Riper pers. obs.), and recovery of the geolocators will help to pinpoint the wintering locations of northern Mexican breeding populations. This will allow determination if there are indeed separate populations of Cordilleran Flycatchers in Mexico, or if there is only a cline of movement to breeding locations.

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APPENDIX 1. Locations from where there is direct evidence of local breeding (dependent fledglings, active nests, etc.) for Cordilleran Flycatchers (*Empidonax occidentalis*) in Mexico. Locations are organized alphabetically by state and then latitude (North – South). The numbers in [ ] preceeding each location are referred to in Table 1.

Chihuahua – [0] Nicolás Bravo, c.29°21'N 107°56'W (MCZ-223838)[1]; ***[1]*** W of Churo, c.27°22'N, 107°53'W (Stager 1954): ***Coahuila – [2***] Area de Protección de Flora y Fauna Maderas del Carmen, 28°59.5'N, 102°36.5'W (Eliot T. Miller in litt. 2015); ***[3]*** Rancho Las Vacas, 25°19'N, 100°54'W (Ely 1960): ***Colima – [4]*** 2.2km NW of Laguna de Carrizalillo, 19°25.5'N, 103°41.5'W (eBird; Eric Clough); ***[5]*** Laguna de Carrizalillo, 19°25'N, 103°40.5'W (eBird; Eric Clough): ***Districto Federal – [6]*** Viveros de Coyoacán, 19°21'N, 99°10.5'W (eBird; Joren van Schie); ***[7]*** Parque Ecológico de la Ciudad de México, 19°15'N, 99°12'W (eBird; Annamaria Savarino): ***Durango – [8]*** Cabañas Rancho Molinillos, 23°38.5'N, 105°03.5'W (eBird; Bernardo Rodríguez): ***Guanajuato – [9]*** Rancho Enmedio, 21°12.5'N, 101°10.5'W (MLZ-42732): ***Hidalgo – [10]*** Rancho Santa Elena, 20°08'17.1"N, 98°30'13.8"W (Martínez-Morales et al. 2013): ***Jalisco – [11]*** Volcán de Tequila, 20°47.5'N, 103°51'W (Julio Alejandro Álvarez Ruíz in litt. 2017); ***[12]*** arroyo El Carrizal, 20°38'N, 103°59.5'W (Julio Alejandro Álvarez Ruíz in litt. 2017); ***[13]*** Zapotillo, 19°40.5'N 104°23'W (MLZ-53096/99); ***[14]*** c.10km SE of Tecomatlán, 19°35'N, 104°10'W (Zimmerman & Harry 1951; UMMZ-136078): ***México (Estado de) – [15]*** W slope of Nevado de Toluca, c.19°06'N, 99°49'W, 3350m (MLZ-32721): ***Michoacán – [16]*** Lago de Pátzcuaro, 19°38′N, 101°38′W (Edwards & Martin 1955); ***[17]*** Pico de Tancítaro, 19°25′N, 102°19′W (Blake & Hanson 1942): ***Morelos – [18]*** Club Campestre Ecológico Centro Asturiano Cuautla, 18°58.5'N, 98°52.5'W (eBird; Annamaria Savarino); ***[19]*** near Cuernavaca, c.18°55′N, 99°14′W (Rowley 1962; WFVZ): ***Nuevo León – [20]*** Cerro de Chipinque, 25°36.5'N, 100°22.5'W (Sutton et al. 1942): ***Oaxaca – [21]*** Sierra de Juárez, c.17°35'N, 96°40'W (Binford 1989); ***[22]*** 16.1km NE of Cerro San Felipe, c.17°15'N, 96°32.5'W (Rowley 1984, Binford 1989; AMNH-778513); ***[23]*** 1.9km NE of La Cumbre, 17°11'N, 96°35.5'W (Binford 1989); ***[24]*** near Oaxaca de Juárez, 17°04′N, 96°43′W (Forcey 2002); ***[25]*** Miahuatlán, 16°16'N, 96°18'W (Hunn et al. 2001); ***[26]*** Puerto Escondido Road near La Cima, c.16°11.5'N, 97°07'W (Rowley 1966; Binford 1989; WFVZ, CAS); [27] San José del Pacífico, 16°10'N, 96°30'W (Benjamin M. Winger in litt. 2017); ***[28]*** Río Molino, 16°04'N, 96°28'W (Rowley 1966; WFVZ); ***[29]*** La Soledad, Sierra de Miahuatlán, 15°59'N, 96°31.5'W (Matt Brady in litt. 2017): ***Puebla – [30]*** Reserva Azul, 20°00.5'N, 97°31'W (eBird; Nicola Cendron): ***San Luis Potosí – [31]*** near Xilitla, 21°23'N, 98°59.5'W (WFVZ): ***Sinaloa – [32]*** 3.2km NNW of El Palmito, 23°35.5'N, 105°51'W (WFVZ-11662); ***[33]*** Rancho Liebre, 23°35'N, 105°52.5'W (WFVZ-159563); ***[34]*** Rancho Carrizo, 23°33.5'N, 105°56'W (WFVZ-159564); ***[35***] Rancho Batel, 23°30'N, 105°49.5'W (Moore 1940): ***Sonora – [36]*** Sierra Púrica, 30°34'N, 109°45'W (eBird; Carlos González); ***[37]*** Sierra el Tigre, c.30°32.5'N, 109°10'W (Flesch 2014); ***[37]*** Barranca de Yécora, 28°22.5'N, 109°03'W (Scott Olmstead in litt. 2017); ***[39]*** Mesa Campanera, 28°21'N, 109°01.5'W (Greeney pers. observ.); ***[40]*** Sierra Oscura, 27°58.5'N, 109°00'W (Russell & Monson 1998): ***Tamaulipas – [41]*** Joya de Salas, 23°12'N, 99°17'W (Robbins and Heed 1951): ***Veracruz – [42]*** c.2.1km N of Cruz Blanca, 19°39.5'N, 97°10.5'W (eBird; Amy McAndrews); [43] Perote, 19°33.5'N, 97°13.5'W (USNM-B26229); ***[44]*** Parque Ecológico Cerro de Macuiltépetl, 19°33'N, 96°55'W (eBird; José Alberto Lobato García); ***[45]*** Parque Ecológico El Haya, 19°31'N, 96°56.5'W (eBird; Amy McAndrews); ***[46]*** Parque Natura, 19°31'N, 96°53.5'W (eBird; Amy McAndrews).

Footnotes for Appendix 1:

[1]The label gives the locality as Bravo, Chihuahua, which we were unable to locate. We have, therefor, used Nicolás Bravo, a small city on the edge of Laguna de Bavicora in the east-central portion of the state. The town is at a suitable elevation and surrounding mountains would appear to provide ample breeding sites.

APPENDIX 2. Mexican locations where Cordilleran Flycatchers (Empidonax occidentalis) have been collected or observed in June or July, or are reported as breeding residents based on published fieldwork. Locations are organized alphabetically by state and then latitude (North – South).

Aguascalientes – Las Piletas, 2660m, 22°14.5'N, 102°36'W (eBird; Adrián Romo García); Cabañas Las Manzanillas, 2610m, 22°11.5'N, 102°37'W (eBird; Adrián Romo García); El Zepo, 2570m, 22°11.5'N, 102°36'W (eBird; Adrián Romo García); La Congoja, 2480m, 22°09.5'N, 102°33'W (eBird; Rodrigo Huerta, Martha Ambriz); Los Alisos, 1730m, 21°54'N, 102°41.5'W (eBird; Adrián Romo García); Calvillo, 2420m, 21°44'N, 102°42'W (eBird; Moisés Arellano, Adrián Romo García); Cienega de Quijas, 2360m, 21°44'N, 102°42.5'W (eBird; Fabián Velásquez López): ***Chihuahua*** – Mesa las Guacamayas, 30°33'N, 108°37'W (Lammertink et al. 1996); Zona Arqueológica Cuarenta Casas, 2210m, 29°33'N, 108°10'W (eBird; David MacKay); Rancho Cinco Millas, 2380m, 29°20'N, 108°11'W (Scott Olmstead in litt. 2017); Santaurio Madera, 2700m, 29°19.5'N, 108°12.5'W (eBird; Javier Cruz Nieto); above Socorro Rivera, 2290m, 29°17.5'N, 108°10.5'W (eBird; Alan Knue); La Capilla, 2250m, 29°12.5'N, 108°10'W (eBird; Javier Cruz Nieto); Río Sirupa, near Rainbow House, 1820m, 29°11.5'N, 108°18.5'W (eBird; Alan Knue); Babicora, 2130m, 29°04'N, 108°10.5'W (eBird; Paul van Els); Bisaloachi, 2540m, 28°39.5'N, 108°17.5'W (Rich Hoyer in litt. 2017); c.2km SSE of El Portal, 2710m, 28°39'N, 108°17.5'W (eBird; Jan Wilson, Mike San Miguel); Arroyo Mesteño, Sierra del Nido, c.28°37'N, 106°07'W (Johnson 1980); Refugio de Flora y Fauna La Cotorra Serrana, 2370m, 28°29.5'N, 108°17.5'W (XC-57543; Paul van Els); c.8km SE of Tutuaca, 1980m, 28°27.5'N, 108°08.5'W (Alán Palácios in litt. 2017); Pinos Altos, 28°16'N, 108°18'W (Miller et al. 1957); Otachique, 2135m, 27°52'40.2"N, 108°09'02.5"W (eBird; Javier Cruz Nieto); Creel, 2450m, 27°45'N, 107°38'W (eBird; John Collins); Cascadas de Cusárare, 2450m, 27°38'N, 107°36.5'W (Scott Olmstead in litt. 2017); Cerro Mohinora, 25°57.5'N, 107°03'W Miller et al. 1957): ***Coahuila*** – El Jardín, 1575m, 29°07.5'N, 102°41'W (eBird; Javier Ochoa Espinoza); Rancho Pasta del Cristo, 1420m, 28°53'N, 102°28.5'W (eBird; Javier Ochoa Espinoza); Rancho las Navajas, 1975m, 25°33'N, 100°41.5'W (eBird; René Valdés); Cerro de La Viga, 3000m, 25°21.5'N, 100°33.5'W (eBird; Adrián Ganem Sada); 4.3km S of Los Irios, 2470m, 25°21'N, 100°35.5'W (eBird; Alfredo García); 8 miles E of Saltillo, 25°20'N, 100°575'W (Ely 1960); Mesa de las Tablas, 2550m, 25°19'N, 100°31'W (eBird; Chuck Sexton, Greg Lasley); San Antonio de las Alanzas, 2160m, 25°16'N, 100°36'W (XC-222782; Peter Boesman); Renacer de la Sierra, 2860m, 25°13'N, 100°23'W (eBird; Adrienne Warner): ***Colima*** – c.2.2km NW of Laguna de Carrizalillo, 1490m, 19°25.5'N, 103°41.5'W (eBird; Eric Clough); Laguna de Carrizalillo, 1500m, 19°25'N, 103°40.5'W (eBird; Eric Clough): ***Distrito Federal*** – Bosque de Chapultepec, 2425m, ca. 19°24'N, 99°13'W (eBird; $n > 10$); Lomas de Bezares, Casa Mexico, 2490m, 19°23.5'N, 99°14.5'W (eBird; Manuel Grosselet); Barranca Río Becerra, 2460m, 19°22.5'N, 99°15'W (eBird; Manuel Grosselet); Parque Ecológico las Águilas, 2440m, 19°21'N, 99°12.5'W (eBird; Rubén Ortega Álvarez); Bosque de Tlalpan, 2430m, 19°17.5'N, 99°11.5'W ($n > 20$); Parque Ejidal San Nicolás Totolapan, 2930m, 19°15'N, 99°15'W (eBird; $n > 20$); Parque Ecológico La Loma, 2470m, 19°20'N, 99°14'W (eBird; Rubén Ortega Álvarez); La Venta, 2870m, 19°20'N, 99°18.5'W (eBird; Manuel Grosselet); Jardín Botánico del Instituto de Biología de la Universidad Nacional Autónoma de México, 2325m, 19°19'N, 99°12'W (eBird; $n > 20$); Parque Ecológico San Bernabé, 3060m, 19°18'N, 99°16.5'W (eBird; Rafael Calderón Parra, Rubén Ortega Álvarez); Contreras, 2850m, 19°18'N, 99°16'W (eBird; Héctor Gómez de Silva); Río Magdalena, Dinamos II, 2790m, 19°17'N, 99°16.5'W (eBird; Miguel Ángel Aguilar Gómez, Annamaria Savarino); Parque Ecológico de la Ciudad de México, 19°15'N, 99°12'W (eBird; Annamaria Savarino); La Gran Palapa, 2860m, 19°09'N, 98°59.5'W (eBird; Joren van Schie); Milpa Alta, 3150m, 19°07.5'N, 99°07'W (eBird; $n = 4$); La Cima (Distrito Federal), 3040m, 19°06.5'N, 99°12'W (eBird; Rubén Ortega Álvarez); Chilpetonco, 3150m, 19°06.5'N, 99°04.5'W (eBird; $n = 1$): ***Durango*** – 5 miles N of Coyote and 12 mi N El Salto, c.23°57'N, 105°22'W (Johnson 1980); Cabañas La Muralla, 2440m, 24°05.5'N, 104°56'W (eBird; José Hugo Martínez Guerrero, Esmeralda Nevárez Aragón); Parque Nacional El Tecuán, 2450m, 23°56'N, 105°01'W (eBird; Bryan Sharp); Las Quebradas, El Soldado, 2230m, 23°55.5'N, 104°56.5'W (eBird; Bryan Sharp); Ejido Ojo de Agua del Cazador, 2370m, 23°53.5'N, 105°17'W (eBird; René Valdés); 2 mi NW Nombre de Dios, c.23°53'N, 104°16'W (Johnson 1980); Hacienda Llano Grande, 2445m, 23°52.5'N, 105°12'W (eBird; Bryan Sharp); Ejido La Victoria, 2560m, 23°45.5'N, 105°22.5'W (eBird; Anuar López); Mexiquillo, 2540m, 23°44'N, 105°17.5'W (eBird; Alejandro Sagone); near La Ciudad, 23°44'N, 105°41'W (Johnson 1980); c.9 miles SW El Saito, c.23°42.5'N, 105°29'W (Johnson 1980); Parque Nacional Mexiquillo, 2610m, 23°41.5'N, 105°40'W (Andrew Spencer in litt. 2017); Cabañas Rancho Molinillos, 23°38.5'N, 105°03.5'W (eBird; $n = 4$); Arroyo La Jarrilla, 2330m, 23°38.5'N, 105°03.5'W (eBird; $n = 3$); El Salto de Agua Llovida, 2300m, 23°32.5'N, 104°57.5'W (eBird; $n = 4$): ***Guanajuato*** – Xichú, 21°17.5'N, 100°03.5'W (Miller et al. 1957): ***Guerrero*** – Carrizal de Bravo, 2490m, 17°38.5'N, 99°51'W (eBird; Nick Lethaby); Chilpancingo, 17°33'N, 99°30'W (Johnson 1980); Puerto de Gallo, 17°28.5'N, 100°10.5'W (Navarro-Sigüenza 1992); Cerro de Teotepec, 17°28'N, 100°08'W (Johnson 1980): ***Hidalgo*** – 4.5km NNE of Tlanchinol, 21°02'N, 98°39'W (Howell and Webb 1992); Bosque de Grutas de Tolantongo, 1220m, 20°39'N, 98°59.5'W (eBird; Annamaria Savarino); Parque Nacional El Chico, 20°12'N, 98°43'W (Johnson 1980); 3 miles S of Mineral del Chico, c.20°11'N, 98°44'W (Johnson 1980): ***Jalisco*** – La Carbonera, 1890m, 21°04.5'N, 102°41.5'W (eBird; Noé Muñóz-Padilla); Arroyo Las Pilas, 1560m, 20°43'N, 104°02.5'W (Julio Alejandro Álvarez Ruíz in litt. 2017); Bosque Los Colomos, 1640m, 20°42.5'N, 103°24'W (eBird; Mónica Guillón); Mesa de San Juan, 1840m, 20°41'N, 103°30.5'W (eBird; Francisco Javier León González); Sierra de Ameca, c.20°37.5'N, 104°01'W (Miller et al. 1957); Zapotillo, 19°40.5'N 104°23'W (MLZ-53096/99); Área Natural Protegida Bola, 1830m, 20°39'N, 104°03'W (Julio Alejandro Álvarez Ruíz in litt. 2017); El Floripondio, 2750m, 19°37.5'N, 103°37.5'W

(eBird; Rubén Ortega Álvarez); between Autlán and Las Joyas, 1870m, 19°37'N, 104°17'W (eBird; Mary Gustafson); Reserva de la Biosfera Las Joyas, 1990m, 19°36'N, 104°16'W (eBird; Ken Rosenberg); Los Joyas Biological Station, 1955m, 19°35'N, 104°16.5'W (eBird; Mary Gustafson); Volcán de Fuego, 2380m, ca. 19°33.5'N, 103°33.5'W (eBird; *n* = 9): ***México (Estado de)*** – Cascada La Concepción, 2300m, 20°09'N, 99°55'W (eBird; Valentina Magana, Jonathan Hiley); San Francisco Magú, 2560m, 19°41.5'N, 99°21.5'W (eBird; Francisco Emilio Roldán Velásco, Gustavo Hernández Orta); El Mapa, 3140m, 19°11.5'N, 99°51.5'W (eBird; Héctor Gómez de Silva); Cieneguillas, 2610m, 19°09.5'N, 99°54.5'W (eBird; Héctor Gómez de Silva); El Pinal, Valle de Bravo, 2455m, 19°06'N, 100°05'W (eBird; Rubén Ortega Álvarez); near Temascaltepec de González, 1780m, 19°02.5'N, 100°02.5'W (Miller et al. 1957, Ornelas et al. 1988, Garza 1997): ***Michoacán*** – 5 mi via road WNW Cherán, c.19°42.5'N, 102°00'W (Johnson 1980); Cañada de los Filtros Viejos Morelia, 1950m, 19°41'N, 101°09.5'W (eBird; Paul Lewis); Puerto Morillos, 2150m, 19°40'N, 101°06.5'W (WFVZ-15690/MLZ-57490); Cerro de Garnica, 2875m, 19°40'N, 100°49.5'W (eBird; Paul Lewis); Pontezuelas, 2090m, 19°39.5'N, 101°00'W (eBird; Paul Lewis); Pino Real, 2200m, 19°39'N, 101°01'W (eBird; Paul Lewis); Lago de Pátzcuaro, 2300m, 19°38′N, 101°38′W (Edwards & Martin 1955); 3 miles N of Tzitzio, c.19°36.5'N, 100°55.5'W (Johnson 1980); Rancho la Nogalera, 2000m, 19°29.5'N, 102°00.5'W (eBird; Rubén Ortega Álvarez); Parque Nacional Barranca del Cupatitzio, c.19°26'N, 102°07'W (Chávez-León 2007, 2015); Pico de Tancítaro, 3110m, 19°25′N, 102°19′W (Blake & Hanson 1942); Uruapan, 19°24.5'N, 102°02.5'W (Miller et al. 1957); 5.3km NW of Yoricostio, 2570m, 19°22.5'N, 101°27'W (eBird; Jilly Rodríguez Méndez, Eric Antonio Martínez); 4.8km N of Tzitzio, 2650m, 19°20'N, 101°32.5'W (Johnson 1980; MLZ-51822); Tacambaro Highway, 29km S of Pátzcuaro, c.19°189'N, 101°32'W (Johnson 1980): ***Morelos*** – Tres Marías, 2810m, 19°03.5'N, 99°14.5'W (eBird; Manuel Grosselet); Coajomulco, 2660m, 19°02'N, 99°11.5'W (eBird; Joren van Schie, Nicola Cendron); Camino al Tepozteco, 1920m, 19°00'N, 99°06'W (eBird; *n* = 3); above Huitzilac, 2685m, 19°01.5'N, 99°17'W (eBird; Héctor Gómez de Silva); Mirador La Pera, 2340m, 19°01'N, 99°09'W (eBird; Héctor Gómez de Silva); Granja Tixib, 2055m, 19°00.5'N, 99°04'W (eBird; Miguel Ángel Aguilar Gómez); El Tepozteco, 2070m, 19°00'N, 99°06'W (eBird; Rubén Ortega Álvarez, Oscar Johnson); Tepoztlán, c.1800m, c.18°59.5'N, 99°06.5'W (eBird; Peter Blancher); Bosques de San Andrés de la Cal, 1460m, 18°57.5'N, 99°06.5'W (eBird; *n* = 3); Salto de San Antón, 1490m, 18°55'N, 99°14.5'W (eBird; Héctor Gómez de Silva); Cuentepec, Río Hormiga Colorada, 1360m, 18°51.5'N 99°20'W (eBird; Annamaria Savarino, Raúl Caballero Jiménez); Zona Arqueológica Xochicalco, 1330m, 18°48'N, 99°18'W (eBird; Annamaria Savarino, Gerardo Águilar): ***Nayarit*** – La Nória, 1625m, 21°29'N, 104°59.5'W (eBird; Mark Stackhouse); Laguna de Santa María del Oro, 750m, 21°21.5'N, 104°34'W (eBird; Carlos Lorenzo Villar Rodríguez)[2]: ***Nuevo León*** – Puerto Conejo, 2475m, 25°29.5'N, 100°34.5'W (eBird; Alfredo García); Cañón de San Isidro, 1490m, 25°23'N, 100°18.5'W (eBird; David Ward); along road between El Hondable and Mesa del Oso (multiple locations), 2225-2350m, ca. 25°17.5'N, 100°145'W (eBird; *n* > 10); Arroyo La Rumorosa, 2080m, 25°16'N, 100°13'W (eBird; Martin Hagne); near Cienega del Toro, 1930m, 25°05'N, 100°16'W (eBird; Greg Lasley, Chuck Sexton); Cerro El Potosí, 3690m, 24°52'N, 100°14'W (eBird; Paul van Els, Dan Jones); ca. 7km NW of Santa Catarina, 2150m, 25°24.5'N, 100°17.5'W (eBird; Aldo Ceballos); Cerro Potosí, 24°52.5'N, 100°14'W (Johnson 1980); General Zaragoza, 1380m, 23°58.5'N, 99°46.5'W (eBird; René Valdés); El Cañón de Ejido Tapozanes, 2250m, 23°55.5'N, 99°42.5'W (eBird; Dave Slager): ***Oaxaca*** – Oaxaca-Tuxtepec road, 1890-2380m, ca. 17°35'N, 96°29'W (eBird; *n* = 3); Capulálpam de Mendez, 17°18.5'N, 96°26.5'W, (Burcsu 2006); Cerro del Jaguar, 2180m, 17°16.5'N, 96°29'W (eBird; Adriana Eloeza, Miguel Ángel Aguilar Gómez); Santa Catarina Lachatao, 2040m, 17°16'N, 96°29'W (eBird; Rafael Calderón Parra, Rubén Ortega Álvarez); Arroyo Guacamaya, 2720m, 17°14.5'N, 96°43'W (eBird; Francesca Albini); NE of Etla, 2435m, 17°13'N, 96°44.5'W (eBird; Eric Antonio Martínez); S of Ixtlan, 2385m, 17°11'N, 96°33'W (eBird; Eric Antonio Martínez); La Nevería, 2930m, 17°10.5'N, 96°40.5'W (eBird; *n* = 3); near Oaxaca de Juárez, 750-2500m, 17°04′N, 96°43′W (Forcey 2002); Cabañas Puesta del Sol, 2480m, 16°10.5'N, 96°30.5'W (eBird; Geoffrey Williamson); 3.5km SW of San Miguel Suchixtepec, 2290m, 16°04.5'N, 96°29.5'W (eBird; *n* = 5); Puerto Angel - Oaxaca road, KM 158, 2320m, 16°04.5'N 96°29.5'W (eBird; Michael Retter, Alan Knue); La Soledad, c.1.8km S of Santa María Jalatengo, 1510m, 15°59'N, 96°31.5'W (eBird; Alan Knue, Michael Retter); 3km NW of Copalita, 1800m, 15°58.5'N, 96°29'W (eBird; Peter Bono); above Santa María Huatulco, 950m, 15°55'N, 96°18'W (eBird; *n* = 3): ***Puebla*** – Huauchinango area, c.20°10.5'N, 98°04'W (Miller et al. 1957; Johnson 1980); El Venerable, 26 mi NW Texmelucan, c.19°21'N, 98°38'W (Johnson 1980); 10 miles SW of Villa Juárez, c.18°55'N, 98°08'W (Johnson 1980): ***Querétaro*** – "20 miles southwest of Xilitla (San Luis Potosi)," c.21°13.5'N, 99°11'W (Johnson 1980): ***Sinaloa*** – 3.2km NNW of El Palmito, 23°35.5'N, 105°51'W (WFVZ-11662); Reserva de La Chara Pinta, 2180m, 23°35.5'N, 105°52'W (Andrew Spencer in litt. 2017); 9 miles E of Santa Lucía, c.23°27'N, 105°44.5'W (Johnson 1980); 4km NW of La Petaca, 1530m, 23°27'N, 105°49.5'W (eBird; Josh Beck, Kathi Borgmann): ***Sonora*** – Rancho La Arizona near Sáric, 1075m, c.31°12'N, 111°W (Van Rossem 1931; 11 skins at UCLA); "near Oposura" [= c.20km NNW of Nacozari de García], >/= 1600m, 30°33'N, 109°45'W (MCZ-223800-814)[1]; "La Chumata," c.30°N, 110°W (Thayer & Bangs 1906); Barranca de Yécora, 28°22.5'N, 109°03'W (Scott Olmstead in litt. 2017); Mesa Campanero, 28°21'N, 109°01.5'W (HFG): ***Tamaulipas*** – Miquihuana, 23°34.5'N, 99°45.5'W (Miller et al. 1957); 16km SW of Soledad, 1935m, 23°07.5'N, 99°16.5'W (eBird; Chris Butler, Alán Monroy Ojéda): ***Tlaxcala*** – Route 99, 20 km ENE Texcoco, c.19°33.5'N, 98°42.5'W (Johnson 1980); Volcán La Malinche, ca. 19°13.5'N, 98°02.5'W (eBird; Eugene Hunn): ***Veracruz*** – between Cruz Blanca and Las Minas, 2330m, 19°39.5'N, 97°10.5'W (eBird; *n* > 10); 5 mi N Jalapa (= Xalapa), c.19°35.5'N, 96°54.5'W (Johnson 1980); Parque Ecológico Cerro de Macuiltépetl, 1580m, 19°33'N, 96°55'W (eBird; José Alberto Lobato García); Los Pescados-El Conejo, 3115m, 19°32.5'N, 97°09'W (eBird; Amy McAndrews); Barranca Honda, 1420m, 19°32.5'N,

96°57'W (eBird; José Alberto Lobato García); San Antonio, 1450m, 19°32.5'N, 96°585'W (eBird; Alán Monroy Ojéda); Agua Escondida, 1250m, 19°27'N, 96°59.5'W (eBird; Alan Monroy Ojeda): ***Zacatecas*** – Laguna Valderrama, 23°13'N, 103°32'W (Webster 1958); 9-13mi W Milpillas (61-65mi W Fresnillo), c.23°06'N, 103°50.5'W (Johnson 1980).

Footnotes for Appendix 2:

[1] The only Oposura we found in Sonora was a portion of the larger town of Nacozari de García, 110km S of the Arizona/Sonora border. The Sierra Cobriza, c.5.5km SW of Oposura (30°20'N, 109°43.5'W) peaks at around 1800m. Around 9km to the ESE (30°20.5'N, 109°36'W) is a small range that peaks around 2200m. Both of these small ranges, however, appear fairly arid and sparsely vegetated. A slightly more forested cluster of peaks (c.2200m; 30°16.5'N, 109°32.5'W, lies 18.5km to the SE, but the seemingly most likely collecting locality for such a long series of specimens would be the more forested range north of Púrica, ca. 20km NNW of Oposura, reaching c.2450m, where breeding has already been confirmed (Table 1, Figure 5).

[2] This location is somewhat low when compared with other mid-summer records (this record 1 June 2011). As a singleton record it should be viewed as tentative until confirmed with further observations. It did not escape our notice, however, that it is at the margin of a sizeable lake that is nearly surrounded with steep, forested slopes reaching 1100-1200m. Such habitat, though below the "normal" altitudinal range of Cordilleran Flycatcher, may still provide suitable breeding conditions.

APPENDIX 3. Mexican locations within protected areas where Cordilleran Flycatchers (*Empidonax occidentalis*) have been collected or observed in June or July. Locations are organized alphabetically by state and then latitude (North – South).

Chihuahua – Reserva El Carricito (eBird; Jan Wilson, Mike San Miguel); Área de Protección de Flora y Fauna Tutuaca (eBird; Alán Palácios); Refugio de Flora y Fauna La Cotorra Serrana (XC-57543; Paul van Els): ***Distrito Federal*** – Parque Nacional Los Dinamos (eBird; n > 10); Parque Nacional Cumbres del Ajusco (Parque Ejidal San Nicolás Totolapan) (eBird; n > 20); Parque Nacional Desierto de los Leones (eBird; n >10); Parque Nacional Bosque del Pedegral (n > 20); Parque Ecológico La Loma (eBird; Rubén Ortega Álvarez); Parque Bosque de Chapultepec (eBird; n > 10); Parque Ecológico de la Ciudad de México (eBird; Annamaria Savarino); Parque Ecológico las Águilas (eBird; Rubén Ortega Álvarez); Reserva Ecológica Comunitaria Milpa Alta (eBird; n = 1); Jardín Botánico del Instituto de Biología de la Universidad Nacional Autónoma de México (eBird; n > 20): ***Durango*** – Parque Nacional Mexiquillo (Andrew Spencer in litt. 2017); Parque Nacional El Tecuán (eBird; Bryan Sharp): ***Guerrero*** – Parque Nacional de Guerrero (eBird; Nick Lethaby): ***Jalisco*** – Parque Nacional Volcán Nevado de Colima (eBird; n > 10); Área Natural Protegida Bola (Julio Alejandro Álvarez Ruíz in litt. 2017); Bosque Los Colomos (eBird; Mónica Guillón); Reserva de la Biosfera Sierra de Manantlán (Zimmerman & Harry 1951; UMMZ-136078); Reserva de la Biosfera Las Joyas (eBird; Ken Rosenberg): ***Michoacán*** – Parque Nacional Cerro de Garnica (eBird; Paul Lewis): ***Morelos*** – Parque Nacional El Tepozteco (eBird; Joren van Schie, Nicola Cendron); Zona Arqueológica Xochicalco (eBird; Annamaria Savarino, Gerardo Águilar): ***Nayarit*** – Reserva Ecológica Sierra de San Juan (eBird; Mark Stackhouse): ***Nuevo León*** – Parque Nacional Cumbres de Monterrey (eBird; n > 20); Zona Sujeta a Conservación Ecológica Cerro El Potosí (eBird; Paul van Els, Dan Jones): ***Oaxaca*** – Parque Nacional Benito Juárez (eBird; n = 3): ***Sinaloa*** – Reserva de La Chara Pinta, 2180m, 23°35.5'N, 105°52'W (Andrew Spencer in litt. 2017): ***Tamaulipas*** – Reserva de la Biósfera El Cielo (eBird; Chris Butler, Alán Monroy Ojéda): ***Tlaxcala*** – Parque Nacional La Malinche (eBird; n > 10): ***Veracruz*** – Parque Nacional Cofre de Perote (eBird; Amy McAndrews); Parque Ecológico Cerro de Macuiltépetl (eBird; José Alberto Lobato García); Parque Ecológico El Haya (eBird; n > 20).

APPENDIX 4. Mexican locations where Cordilleran Flycatchers (***Empidonax occidentalis***) have been collected or observed in May or August but not June or July (Appendix 1). Locations are organized alphabetically by state and then latitude (North – South).

Aguascalientes – Pabellón de San Blas, 1950m, 22°11'N, 102°21'W (eBird; Manuel Grosselet): ***Chihuahua*** – Sierra La Brena, 2130m, 30°08'N, 108°12.5'W (eBird; Bill Howe); Ejido Largo, 2425m, 29°17.5'N, 108°10.5'W (eBird; Jorge Montejo, Amy McAndrews); Yahuirachi, 2070m, 29°08'N, 108°22.5'W (eBird; Javier Cruz Nieto); Vallecillo, 2400m, 28°30'N, 108°05.5'W (eBird; Javier Cruz Nieto); Cascada Basaseachic, 2050m, 28°08.5'N, 108°13.5'W (eBird; David MacKay); San Feliz, 2000m, 25°50'N, 107°10'W (MLZ-15968): ***Distrito Federal*** – Barranca Jalalpa, 2500m, 19°22'N, 99°14.5'W (eBird; Manuel Grosselet); Barranca San Borja, 2435m, 19°22'N, 99°13.5'W (eBird; Manuel Grosselet); Parque Valle de las Monjas, 2770m, 19°20'N, 99°18'W (eBird; *n = 3*); Convento Desierto de los Leones, 2910m, 19°20'N, 99°18.5'W (eBird; Georgita Ruiz Michael, Manuel Grosselet); Cerro Colorado, 2970m, 19°19.5'N, 99°19'W (eBird; Rubén Ortega Álvarez): ***Durango*** – Rancho Los Negros, 2490m, 24°17.5'N, 105°05'W (eBird; José Hugo Martínez Guerrero): ***Guerrero*** – San Vicente, 17°28'N, 99°45'W and Acahuizotla, 17°21.5'N, 99°28'W (Miller et al. 1957): ***Jalisco*** – Rancho El Destierro, 1900m, 21°34'N, 102°09'W (eBird; Adrián Romo García); Unidad de Manejo Ambiental Agua Blanca, 1500m, 20°45'N, 103°53'W (Julio Alejandro Álvarez Ruíz in litt. 2017); Los Llanitos, 1765m, 20°38'N, 104°02'W (eBird; Julio Alejandro Álvarez Ruíz); Las Neverías, 2200m, 19°51'N, 104°27'W (eBird; Rubén Ortega Álvarez); ca. 15.5km W of Zapoltiltic, 2480m, 19°37'N, 103°34'W (Andrew Spencer in litt. 2017): ***México*** – Parque Ecoturístico La Esmeralda, 2620m, 19°07.5'N, 98°43.5'W (eBird; Rafael Calderón Parra); Tejupilco, 1460m, 18°54'N, 100°10.5'W (eBird; *n = 1*): ***Michoacán*** – Casa Julia, 1920m, 19°40'N, 101°12.5'W (eBird; Terry Poulton): ***Morelos*** – Santo Domingo Ocotitlán, 2050m, 19°00.5'N, 99°04'W (eBird; Miguel Ángel Aguilar Gómez): ***Nuevo León*** – Mesa de Chipinque, 1525m, 25°36.5'N, 100°22.5'W (Sutton & Burleigh 1941b); Parque Ecológico Chipinque, 1250m, 25°36.5'N, 100°21.5'W (eBird; *n = 3*); San José de la Martha, 2350m, 25°10.5'N, 100°24'W (eBird; René Valdés, Ruben Deschamps): ***Oaxaca*** – c.9km ENE of Santiago Comaltepec, 2245m, 17°36'N, 96°28'W (eBird; *n = 3*); Corral de Piedras, Camino La Cumbre, 2930m, 17°11'N, 96°37'W (eBird; *n = 3*); Arroyo El Jilguero, 2270m, 17°05.5'N, 96°30.5'W (eBird; Noah Strycker); Las Salinas, 2080m, 17°05'N, 96°30.5'W (eBird; Noah Strycker); Xaagá, 1930m, 17°02.5'N, 96°31.5'W (eBird; Jilly Rodríguez Méndez, Eric Antonio Martínez); El Mirador, 2160m, 17°02'N, 97°47.5'W (eBird; Rafael Calderón Parra); c.3km SW of San Miguel Suchixtepec, 2390m, 16°04.5N, 96°29.5'W (eBird; Amy McAndrews, Jorge Montejo); 2.1km S of Santa María Jalatengo, 1530m, 15°59'N, 96°31.5'W (eBird; Amy McAndrews, Jorge Montejo): ***Sonora*** – Sierra Púrica, 30°34'N, 109°45'W (eBird; Carlos González)

APPENDIX 5. Mexican locations within protected areas where Cordilleran Flycatchers (Empidonax occidentalis) have been collected or observed in May or August, but not June or July. Locations are organized alphabetically by state and then latitude (North – South).

Chihuahua – Parque Nacional Cascada de Basaseachi (eBird; David MacKay): Distrito Federal – Parque Valle de las Monjas (eBird; *n* = 3): México – Parque Nacional Iztaccíhuatl - Popocatépetl (Parque Ecoturístico La Esmeralda) (eBird; Rafael Calderón Parra): Sonora – Reserva de Ajos-Bavispe, 30°34'N, 109°45'W (eBird; Carlos González)