

DISTRIBUTION AND OCCURRENCE OF EARED QUETZAL IN THE UNITED STATES: A 45-YEAR REVIEW OF THE EARED QUETZAL IN ARIZONA AND NEW MEXICO, 1977-2021

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ABSTRACT: In 2020, at least 4 Eared Quetzals (*Euptilotus neoxenus*) were reported in the southwestern United States over a period of 6 months. Witnessing those summer and fall occurrences in Arizona led me to compare the 2020 season with historic sightings for the region. I reviewed a question first posed by Zimmerman (1978), whether the Eared Quetzal in the United States is an immigrant (suggesting possible range extension) or visitor (suggesting random wandering). To better understand Eared Quetzal status in the United States, I mapped and cataloged confirmed sightings since the year of the first accepted record in 1977. I detailed the chronology of those sightings with reference to geographical location and seasonal occurrence. Using this analysis, I looked at patterns of Eared Quetzal presence in the United States drawing insight from current research into the species' movements and occurrence in Mexico (Lammertink et al. 1996). I then looked in detail at movement patterns of the 2020 occurrences in Arizona and New Mexico, when Eared Quetzals were present intermittently for 6 months in summer and fall. Despite several hundred hours of personal observation and a thorough search of the literature, Zimmerman's (1978) question about the status of Eared Quetzal remains unanswered and as pertinent today as it was 45 years ago.

GENERAL STATUS AND U.S. OCCURRENCE

The Eared Quetzal (Figure 1) is primarily a wary endemic to northwestern Mexico, from Sonora and Chihuahua south to Michoacan. It occurs in a narrow elevation range (1,800-3,000 m) in the pine-oak habitat within the Sierra Madre Occidental and western Transvolcanic Belt (Howell and Webb 1995; Figure 2). In that zone it is most often associated with well-watered mature riparian habitat in canyons, often in inaccessible terrain that provides refugium from the disturbance of logging, allowing populations to remain stable across disturbed and undisturbed parts of this habitat zone (Lammertink et al. 1996). Marshall (1957) noted a pair of Eared Quetzal in the 1950s in Sonora only 200 km south of the U.S. border, but it would be 20 years before the first U.S. record was documented.

Eared Quetzal was first reported in the United States in 1977 when a possible family group of 4 was discovered in the South Fork of Cave Creek in the Chiricahua Mountains, Cochise County (Zimmerman 1978, Morse 1987, Taylor 1994, Rosenberg and Witzeman 1998). The original sighting was of an adult male followed within a few weeks by an adult female and shortly after by 2 other quetzals, at least one a juvenile, the other not seen as well or with the others, not yet a full adult. The 2 nonadult birds were seen by different observers at different times with the juvenile male described as mottled in both the green breast and red belly (Taylor 1994) and the fourth described as an immature



Figure 1. Female (l) and male (r) Eared Quetzals feeding on hackberry fruit at Cave Creek Canyon, Chiricahua Mountains, Cochise County, 31 October 2020. Photo by A. R. Donaldson

male in molt, less bright than the adult male that had been seen regularly with the female (Zimmerman 1978). For the next dozen years, scattered sightings of single birds, mostly male, were noted though in many years sightings were single birds seen on one or 2 days (Table 1). Eared Quetzals were seen each year, during a 9-year continuous period, 1989 to 1997, with most years having multiple documented sightings and pairs present in 5 years.

In Arizona, more sightings over a broad geographic area occurred in 1991 than in any other year. In several issues of *American Birds*, 1991 was hailed as an "Eared Trogon invasion" (the name was later changed to Eared Quetzal, Banks et al. 2002). Multiple pairs and roaming individuals were noted; a side bar in the regional summary suggested as many as 8-12 individuals could have been present that year (Rosenberg and Stejskal 1992). In June 1991, a male and female were reported together in the South Fork of Cave Creek, Chiricahua Mountains, Cochise County, for a 2-week period without subsequent observations there until a one-day sighting 8 August. A pair was noted in Ramsey Canyon, Huachuca Mountains, Cochise County, on 5 August, which continued there into late fall, and another pair was discovered 7 August in Madera Canyon, Santa Rita Mountains, Santa Cruz County, subsequently seen into September. An additional female was reported 19 August in Gardner Canyon, Santa Rita Mountains, Santa Cruz County, then a female in the Chiricahua Mountains 22 November (Table 1).

On 10 October 1991, video documentation revealed the first-known nest attempt for this species in the United States. The nest was found in a big-toothed maple (*Acer grandidentatum*) snag easily visible from the Hamburg Trail in Ramsey Canyon, Huachuca Mountains. The nest was monitored carefully with both adults observed actively feeding young. A last morning visit by one adult on 27 October revealed that the nest failed after a storm 26 October brought snow and temperatures of -3C. The chicks succumbed to hyperthermia and were assumed to be between 18-21 days old at the time of death (Williamson 1992). For the next few years, the pair was seen at several locations in the Huachuca Mountains, with the male lingering into 1997.

Between 1992 and 1997 occurrences in Arizona continued in the southeastern Arizona core areas but also extended to several locations on and below the Mogollon Rim in central and east-central Arizona in Coconino, Apache, Gila, and Greenlee counties beginning in 1992 (Table 1). It is possible that individuals detected in 4 of 10 years following the 1992 northward movement (1992, 1994, 1995, and 2002) were lingering and wandering from the unprecedented 1991 influx (Corman 2005). Between 1977 and 2007 there were 7 gaps in sightings of one to 2 years duration. From 2009 to 2015 gaps increased with 2 gaps lasting 3 and 4 years in duration. Only 9 occurrences were noted in the decade 2000-2009, followed by just 2 occurrences in the decade 2010-2019. The appearance of at least 4 individuals in Arizona and New Mexico, after a 5-year gap, was enthusiastically received by birders, and observations continued regularly from June through November 2020.

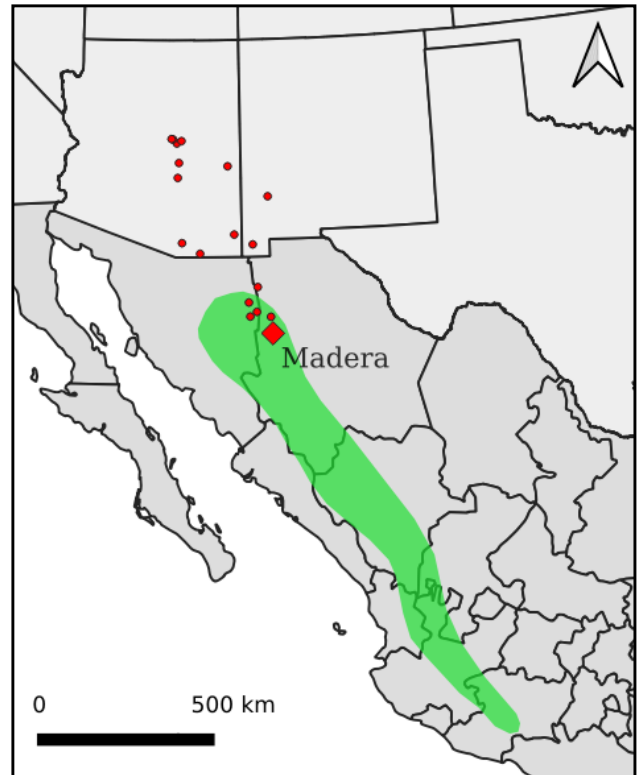


Figure 2. Historical Eared Quetzal range in Mexico (green) and occurrences in the United States since 1977. The large red diamond indicates the closest core breeding area near Madera, Chihuahua, Mexico, and red dots represent sightings of Eared Quetzal north of that core zone.

Table 1. Details of Eared Quetzal Occurrences in Arizona and New Mexico, 1977-2021

YEAR	RANGE	# of SEASONS in YEAR	SEASONS	MAX # REPORTED AT ONE SIGHTING*	GENDER	LOCATIONS CITED	COUNTY - STATE	DATE RANGE	# REPORTS	SOURCES
1977	CHIRICAHUA	2	FALL AND WINTER	4	M,F, and 2 IMM	SOUTH FORK of CAVE CREEK (SOUTH FORK)	COCHISE - AZ	15 OCT- 2 DEC	M+	ABC, ABC SUM 1974-1996, NAB VOL 32, NO 2, PUB
1977	HUACHUCA	1	WINTER	1	M	RAMSEY CANYON	COCHISE - AZ	1-3 DEC	M+	ABC, ABC SUM 1974-1996, NAB VOL 32, NO 2, PUB
1978	CHIRICAHUA	1	FALL	1	M	SOUTH FORK, STEWART CAMPGROUND	COCHISE - AZ	5 NOV	SGL	NAB VOL 34, NO 2, PUB
1979	ANIMAS	1	SUMMER	1	UNK	JUST NORTH OF RANGE	HILDAGO - NM	13 JUNE	SGL	NAB VOL 33, No. 6, PUB
1979	CHIRICAHUA	1	FALL	1	M	SOUTH FORK	COCHISE - AZ	11 AUG - 22 OCT	M+	ABC, ABC SUM 1974-1996, NAB VOL 34, No. 2, PUB
1982	CHIRICAHUA	1	FALL	1 / 1	M	SOUTH FORK	COCHISE - AZ	22 AUG, 1 OCT	SGL DAY OBS X 2	ABC, ABC SUM 1974-1996, PUB
1984	HUACHUCA	1	FALL	1	UNK	SCHEELITE CANYON	COCHISE - AZ	6 AUG	SGL	PUB
1985	CHIRICAHUA	1	FALL	1	UNK	SOUTH FORK	COCHISE - AZ	22 OCT	SGL	ABC SUM 1974-1196, NAB VOL 40, No.1, PUB
1986	CHIRICAHUA	1	SPRING	1	M	SOUTH FORK	COCHISE - AZ	26 MAY	SGL	NAB VOL 40, No. 3
1987	CHIRICAHUA	1	FALL	1	UNK	SOUTH FORK	COCHISE - AZ	1 SEPT	SGL	NAB VOL 42, No. 1, PUB
1989	HUACHUCA	1	FALL	1	F	CARR CANYON, COMFORT SPRINGS TRAIL	COCHISE - AZ	9 AUG	SGL	ABC, ABC SUM 1974-1996, NAB VOL 44 No. 1
1989	CHIRICAHUA	1	SUMMER	1	M	SOUTH FORK	COCHISE - AZ	21-22 JUNE	SGL	ABC, ABC SUM 1974-1996, NAB VOL 43, No. 5, PUB
1990	CHIRICAHUA	2	SPRING and FALL	2 / 1	M, F / UNK	SOUTH FORK (MAY), ROCK CREEK (OCT)	COCHISE - AZ	7 MAY, 7 OCT	SGL DAY OBS X 2	ABC x 2, ABC SUM 1974-1996, NAB VOL 45, No. 1
1991	CHIRICAHUA	2	SUMMER AND FALL	2	M, F	SOUTH FORK, PINERY CANYON, CAVE CREEK	COCHISE - AZ	9 JUNE - 22 NOV	M+	ABC, ABC SUM 1974-1996, NAB VOL 45, No. 5; VOL 46, No. 2 and No. 3, PUB
1991	HUACHUCA	2	FALL AND WINTER	3	M, F	RAMSEY CANYON, SCHEELITE CANYON	COCHISE - AZ	5 AUG - 16 NOV (DEC) 7 SEPT NEST DESCRIBED, 26 OCT NEST FAILED BUT ADULTS PRESENT INTO WINTER	M+	ABC (M+), ABC SUM 1974-1996, NAB VOL 46, No. 2 and No. 3, PUB
1991	SANTA RITA	1	FALL	2	M, F	MADERA CANYON, GARDNER CANYON	SANTA CRUZ - AZ	7 AUG (MADERA), 19 AUG (GARDNER)	SGL DAY OBS X 2	ABC, ABC SUM 1974-1996, NAB VOL 46, No. 2 and No. 3, PUB
1992	CHIRICAHUA	2	SPRING AND FALL	1	F	SOUTH FORK	COCHISE - AZ	17 MAY - FALL	M+	NAB VOL 46, No. 1 and No. 3, PUB

Table 1 (continued)

YEAR	RANGE	# of SEASONS in YEAR	SEASONS	MAX # REPORTED AT ONE SIGHTING*	GENDER	LOCATIONS CITED	COUNTY - STATE	DATE RANGE	# REPORTS	SOURCES
1992	HUACHUCA	4	WINTER SPRING SUMMER FALL	2	M, F	RAMSEY CANYON	COCHISE - AZ	28-29 JAN, 23/24 MAY + CONTINUING BIRD	M+	ABC, ABC SUM 1974-1996, NAB VOL 46, No. 3 and No. 5, VOL 47, No. 1 and No. 2
1992	MOGOLLON RIM	1	SUMMER	1 / 1	M / F	HOSPITAL RIDGE (JUNE), BLACK RIVER, (JULY)	COCONINO - AZ, APACHE/ GREENLEE - AZ	12 JUNE, 15 JULY	SGL DAY OBS X 2	ABC x 3, ABC SUM 1974-1996, NAB VOL 46, No. 5, PUB, T.CORMAN, pers. comm.
1992	SIERRA ANCHA	1	SUMMER	1	UNK	PARKER CREEK	GILA - AZ	17 JUNE	SGL	ABC SUM 1974-1996
1993	CHIRICAHUA	1	FALL	1	M	CAVE CREEK	COCHISE - AZ	30 SEPT +	M+	NAB Vol. 48, No. 1
1993	HUACHUCA	4	WINTER, SPRING, SUMMER, FALL	2	M,F	RAMSEY CANYON	COCHISE - AZ	SPORADIC SIGHTINGS THROUGHOUT PERIOD	M+	ABC SUM 1974-1996, NAB VOL 47, No. 3 and No. 5, NAB VOL 48, No. 1 and No. 2
1994	CHIRICAHUA	2	SPRING, SUMMER	2	M, F	SOUTH FORK (SGP), RUSTLER PARK, BARFOOT PARK (SUM)	COCHISE - AZ	1-2X IN SPRING, 8-11 JUNE	M+	ABC, ABC SUM 1974-1996, NAB VOL 48, No. 3, VOL 49, No. 1, PUB
1994	HUACHUCA	4	WINTER, SPRING, SUMMER, FALL	2	M	RAMSEY CANYON, MILLER CANYON, SCHEELITE CANYON	COCHISE - AZ	SPORADICALLY THROUGHOUT THE PERIOD	M+	ABC 1974-1996 Summary, NAB VOL 48, No. 2, No. 3 and No. 5
1994	MOGOLLON RIM	1	SUMMER	1 / 1	UNK	UPPER BARBERSHOP CANYON, UPPER CHEVELON CANYON	COCONINO - AZ	5 JUNE (BARBERSHOP) AND 18 JUNE (CHEVELON)	SGL DAY OBS X 2	AZBBA and T. CORMAN, pers. comm.
1995	HUACHUCA	3	SPRING, SUMMER, FALL	1	M	SAWMILL CANYON, MILLER CANYON, RAMSEY CANYON	COCHISE - AZ	1 MAY - 14 OCT	M+	ABC, ABC SUM 1974-1996, NAB VOL 49, No. 3 and No. 5; VOL 50, No. 1
1995	CHIRICAHUA	1	WINTER	1	M	RUCKER CANYON	COCHISE - AZ	12 DEC	M+	NAB VOL 50, No. 2, PUB
1995	MOGOLLON RIM	1	FALL	2	M,F	CHRISTOPHER CREEK	GILA - AZ	27 OCT - 11 NOV	M+	ABC, ABC SUM 1974-1996, NAB VOL 50, No. 1
1996	SUPERSTITION	2	WINTER AND SPRING	1	F	PINTO CREEK, NEAR HAUNTED CANYON	GILA - AZ	1 JAN - 14 MAR	M+	ABC, ABC SUM 1974-1996, NAB VOL 50, No. 2
1996	HUACHUCA	1	FALL	1	UNK	MILLER CANYON, CARR CANYON	COCHISE - AZ	23 AUG - 4 SEPT	M+	NAB VOL 51, No. 1
1996	CHIRICAHUA	1	WINTER	1	M	RUCKER CANYON	COCHISE - AZ	29 JAN - 25 FEB	M+	PUB
1997	HUACHUCA	1	WINTER	1	UNK	SAWMILL CANYON	COCHISE - AZ	27 JAN	SGL	NAB VOL 51, No. 3
1999	CHIRICAHUA	1	FALL	1	M	IDLEWILD CAMPGROUND, CAVE CREEK	COCHISE - AZ	10-28 NOV	M+	ABC, ABC SUM 1996-1999, NAB VOL 54, No. 1

Table 1 (continued)

YEAR	RANGE	# of SEASONS in YEAR	SEASONS	MAX # REPORTED AT ONE SIGHTING*	GENDER	LOCATIONS CITED	COUNTY - STATE	DATE RANGE	# REPORTS	SOURCES
1999	HUACHUCA	2	FALL AND WINTER	1	M	MILLER CANYON	COCHISE - AZ	14-20 DEC	M+	ABC, ABC SUM 2000-2004
2000	CHIRICAHUA	2	WINTER, SUMMER	1	M	CAVE CREEK, UPPER BEAR CANYON - LOWER PORTAL PEAK	COCHISE - AZ	CONTINUED FROM NOV 1999 - 2 JAN	M+	NAB VOL 54, No. 2 and No. 4, PUB
2002	MOGOLLON RIM	1	FALL	1	M	SNAKE CREEK NEAR JCT BLACK RIVER	GREENLEE - AZ	24 AUG	SGL	ABC, ABC SUM 2000-2004, NAB VOL 57, No. 1
2005	CHIRICAHUA	1	FALL	1	UNK	SOUTH FORK	COCHISE - AZ	11 OCT 2005	M+	ABC, ABC SUM 2005-2009, NAB VOL 60, No. 1, PUB
2007	SANTA RITA	1	FALL	1	UNK	MADERA CANYON CARRIE NATION TRAIL	SANTA CRUZ - AZ	28 OCT - 17 DEC	M+	ABC, ABC SUM 2005-2009
2008	SANTA RITA	1	WINTER	1	UNK	MADERA CANYON AGUA CALIENTE TRAIL	SANTA CRUZ - AZ	2 FEB	SGL	ABC ADDENDUM
2009	CHIRICAHUA	2	SPRING, SUMMER	1	M	CHIRICAHUA NAT. MONUMENT, ECHO PARK TRAIL	COCHISE - AZ	31 MAY - 6 JUNE	SGL	ABC, ABC SUM 2005-2009, PUB
2013	SANTA RITA	1	FALL	1	F	MADERA CANYON CARRIE NATION TRAIL	SANTA CRUZ - AZ	OCT 28-NOV 7	M+	ABC, ABC SUM 2010-2014
2015	SANTA RITA	1	SPRING	1	UNK	GARDNER CANYON	SANTA CRUZ - AZ	17 APRIL	SGL	ABC, ABC SUM 2018-2020
2020	CHIRICAHUA	2	SUMMER, FALL	2	M, F	HERB MARTYR (MAIN FORK CAVE CREEK), RUCKER CANYON, CAVE CREEK CANYON, SOUTH FORK	COCHISE - AZ	8 JUNE - 25 NOV	M+	ABC, ABC SUM 2018-2020
2020	PINOS ALTOS	1	FALL	2	F, UNK	PINOS ALTOS MTNS. LITTLE CHERRY CREEK, MILL CANYON	GRANT - NM	20 AUG - 25 OCT	M+	NAB online (FALL 2020: New Mexico), S.WILLAMS III pers. comm.

TOTAL OCCURRENCES

66

Sources:

ABC: 26 Accepted Eared Quetzal reports to the Arizona Bird Records Committee

ABC SUM: Arizona Bird Committee Summary Reports published in Western Birds

NAB: North American Birds

PUB: Publications, see references

Max Number reported*: Number associated with single record, if multiple locations could total more, 1991 summaries suggest 8-12 birds present in the region that year

July** Date correction on record that had been reported in June

METHODS

Historic detections of Eared Quetzal in the United States were mapped and documented using data from 5 primary sources: Arizona and New Mexico state rare bird record committee reports; summaries for Arizona and New Mexico in *American Birds* and *National Audubon Society Field Notes*; *North American Birds* (NAB); *Arizona Breeding Bird Atlas*; published professional books and articles; and eBird's dataset (eBird 2020). The geographical areas where Eared Quetzals were detected were mapped using locations and dates from the original Arizona Bird Committee (ABC) records as the primary framework for the U.S. sightings map and seasonal occurrence summary. New Mexico map locations came from coordinates in eBird and locations such as drainages or campgrounds named in NAB. The number of years with occurrences was tallied for each geographic area (Table 2). Documentation for each occurrence was reviewed and checked using data cross-referenced between the 5 primary sources. An occurrence was defined as the presence of one or more Eared Quetzals during a season, documented with one or more sightings, for a distinct geographic area. Seasons were assigned as defined by NAB (Winter—December-February; Spring—March-May; Summer—June-July; Fall—August-November). The percentage of occurrences in each season was assessed (Table 3).

Table 2. Number of years during each decade that Eared Quetzals occurred in mountain ranges of Arizona and New Mexico

Decade	Total years with occurrences	# Years in Chiricahuas	# Years in Huachuclas	# Years in Santa Ritas	# Years in Superstitions	# Years in Animas	# Years in Mogollon Rim	# Years in Sierra Ancha	# Years in Pinos Alto
1970-1979	3	3	1	0	0	1	0	0	0
1980-1989	6	5	2	0	0	0	0	0	0
1990-1999	9	8	8	1	1	0	3	1	0
2000-2009	6	3	0	2	0	0	1	0	0
2010-2019	2	0	0	2	0	0	0	0	0
2020 / 2021	1	1	0	0	0	0	0	0	1
Total by Location	27	20	11	5	1	1	4	1	1

Table 3. Seasonal occurrences of Eared Quetzal in the mountains of Arizona and New Mexico, 1977-2021

Season	Number of Seasons with Eared Quetzal Occurrences	Percent of Total by Season
Spring	11	16.7%
Summer	14	21.2%
Fall	28	42.4%
Winter	13	19.7%

The combined sources provided additional details on seasonality, duration, and geographic extent of presence for each occurrence, which was then assigned seasonality for comparison purposes between ranges for the 27 years of documented occurrences within the 45-year period 1977-2021 (Table 4). eBird (2020) reports were most useful for records post-2000. The few pre-2000 eBird reports available provided additional details used to fill in seasonal assignment and duration. This collective review revealed spatial and temporal characteristics of each occurrence for the period 1977-2019. Reports from eBird form the bulk of data used to chronicle the 2020 occurrences along with the author's 240 hours of personal observation. The eBird records were compared using 2 methods: a download by "hotspot" and a full download for the species during this period. Personal communication with other regular quetzal observers was important to understanding the spatial dynamics of the 2020 chronology.

Table 4. Number of years and seasons during which Eared Quetzals occurred in Arizona and New Mexico mountain ranges, 1977-2021.

Years with occurrences	Chiricahuas, AZ	Huachucas, AZ	Santa Ritas, AZ	Superstitions, AZ	Animas, NM	Mogollon Rim, AZ	Sierra Ancha, AZ	Pinos Altos, NM
1977	F/W	W						
1978	F							
1979	F				SU			
1982	F							
1984		F						
1985	F							
1986	SP							
1987	F							
1989	SU	F						
1990	SP/F							
1991	SU/F	F/W	F					
1992	SP/F	SP/SU/F/W				SU	SU	
1993	F	SP/SU/F/W						
1994	SP/SU	SP/SU/F/W				SU		
1995	W	SP/SU/F				F		
1996	W	F		W/SP				
1997		W						
1999	F	F/W						
2000	W/SU							
2002						F		
2005	F							
2007			F					
2008			W					
2009	SP/SU							
2013			F					
2015			SP					
2020	SU/F							F
1977 - 2021 27 of 45 Years, 66 Occurrences	20 Years, 28 Occurrences Chiricahuas	11 Years, 24 Occurrences Huachucas	5 years, 5 Occurrences Santa Ritas	1 Year, 2 Occurrences Superstitions	1 Year, 1 Occurrence Animas	4 Years, 4 Occurrences Mogollon Rim	1 Year, 1 Occurrence Sierra Ancha	1 Year, 1 Occurrence Pinos Altos

*An occurrence is defined by season with at least one sighting per season

Seasons: Winter (W) 1 December-28 (29) February

Spring (SP) 1 March-31 May; Summer (SU) 1 June-31 July

Fall (F) 1 August-30 November

RESULTS

Part 1: Patterns of Occurrence, 1977-2021

Eared Quetzals have been reported in 27 of the 45 years, 1977-2021, north of the U.S. border at mountain locations in Arizona and New Mexico, with at least 66 documented occurrences in 6 Sky Island ranges north of Mexico (Chiricahua, Huachuca, Santa Rita, Sierra Ancha, and Superstition in Arizona and Animas in New Mexico) as well as several locations along Arizona's Mogollon Rim and the adjacent highlands in New Mexico (Figures 3 and 4, Tables 2 and 4). Sightings were reported in more years in the Chiricahua and Huachuca mountains in Cochise County than any other locations (Table 2). The decade of the 1990s had 40 occurrences; far more than any other decade (Table 2). The farthest sighting north of the United States border was at Chevelon Canyon in June 1994 on the Mogollon Rim in Coconino County, 325 km north of the Arizona-Sonora border (Figure 3).

During this period, Eared Quetzals were present in the United States in all 4 seasons with most occurrences in fall (Table 3). Eared Quetzal sightings were reported in 4 seasons for 3 locations: the Chiricahua, Huachuca, and Santa Rita ranges, while other areas had more limited seasonality (Table 4). Eared Quetzals were reported only during summer and fall in the Sierra Anchas and highlands of both the Mogollon Rim and Pinos Altos areas. The winter/spring seasons reported for the Superstition Mountains were of one wintering individual that extended into early March. The Animas Mountains, with one summer record, lack public access so birding records there are fewer and may not accurately record frequency.

Part 2: Patterns of Occurrence, 2020

Occurrences in 2020 in Arizona and New Mexico were observed by more people and for a longer duration than were past sightings in the region. The male and female in Arizona from June to November were uncharacteristically tolerant of human activity, allowing extended observation on 104 of 134 days known to be present there (Table 5).

The Arizona Chiricahua Mountains occurrences spanned 5 distinct time periods. There were 4 periods of consistent sightings in varied sections of 2 different drainages, a 5-week gap with no sightings suggesting use of more remote terrain, and an unsettled 2-week period in which sightings were wide-ranging across multiple drainages (Table 5).

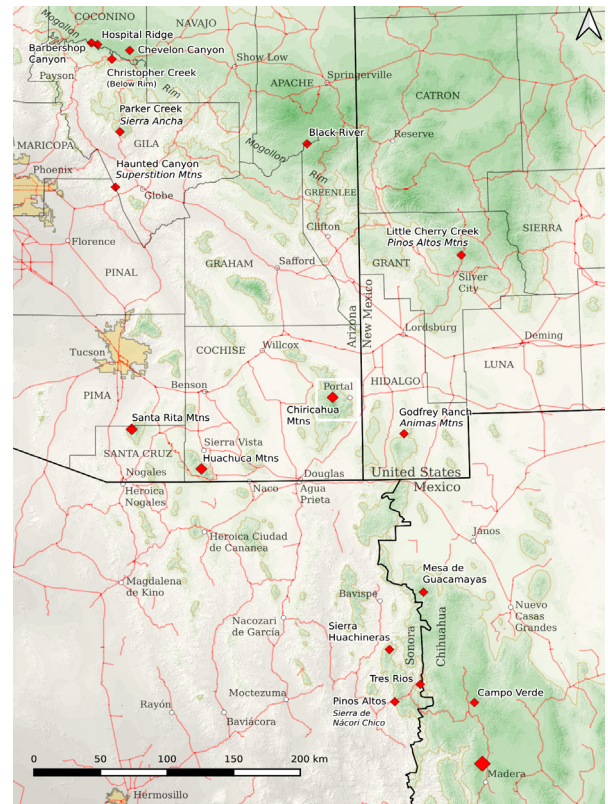


Figure 3. Locations of Eared Quetzal sightings in Arizona and New Mexico, 1977-2021. Locations in Mexico represent the northernmost range of quetzals in Mexico.

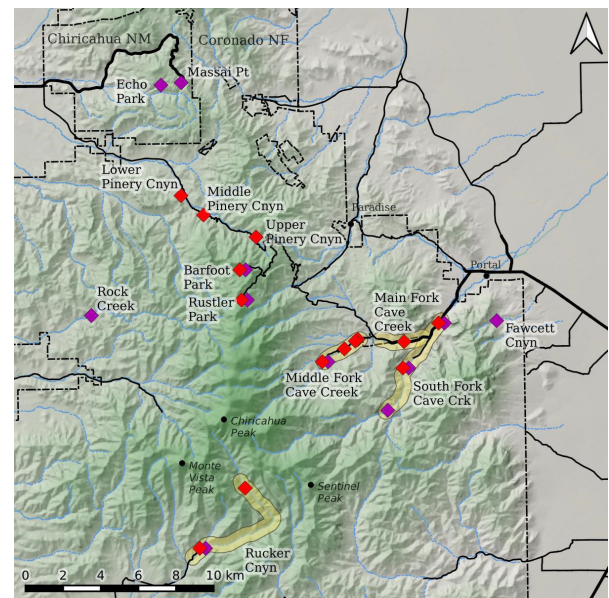


Figure 4. Eared Quetzal sightings in Arizona's Chiricahua Mountains in 2020 (red) and historical (purple) locations.

Single-drainage use ranged from 9 to 61 days. S. O. Williams III (pers. comm.) described similar gaps in sightings in New Mexico, indicating that the birds there also moved between 2 adjacent drainages. He described as especially striking their disappearance from Little Cherry Creek after 2 October, only to be found again (by accident) in Mill Creek Canyon 8 October, and not reported back in Little Cherry Creek until about 24 October.

Table 5. Number of days Eared Quetzals were reported on eBird for the 2020 occurrences, and number of eBird lists and observers during observation periods at various locations in the Chiricahua Mountains of Arizona and in the Pinos Altos area of New Mexico in 2020. Information of quetzal gender is provided where available.

Location	First Sighting	Last Sighting	Duration in Days	Number of Days Observed Within Duration	Percent of days Observed Within Duration	Gender observed # of days (% total days observed)	# of eBird lists / # of Observers
Arizona, Chiricahua Mountains, Herb Martyr Road	8 Jun ^a	3 Jul	26	11	42%	Male only 8 (73%), Female only 1 (9%), not noted 2 (18%)	125/233
Arizona, Chiricahua Mountains, High Country	9 Aug ^b	22 Aug	14	8	57%	Lone birds, gender uncertain; female on August 10	6/11
Arizona, Chiricahua Mountains, Rucker Canyon	16 Aug	7 Sept	23	17	74%	Male and female together all days	153/270
Arizona, Chiricahua Mountains, Main Fork Cave Creek (FS42)	15 Sep	15 Nov	62	61	98%	Male with Female 48 (79%), Male only 11 (18%), gender not noted 2 (3%)	500 +/1000 +
Arizona, Chiricahua Mountains, Stewart CG to South Fork	17 Nov	25 Nov	9	7	78%	Lone Male only	38/55
New Mexico, Pinos Altos Mountains, Little Cherry Creek	20 Aug	25 Oct	85	8	9%	One documented female with gender of second bird undetermined	24/28

^a Period of the Arizona occurrence may have begun 1 June, report based on vocalization heard by a local cabin owner at the site of first encounter (C. Bradley pers. comm.)

^b Sightings overlap for 3 geographic areas 16-22 August. Barfoot Park to Rucker Canyon is 15 km. South Fork to Barfoot Park is 9 km.

The mid-August 2020 sightings in Arizona's Chiricahua Mountains high country along the crest trail showed more mobility than in other weeks the quetzals were present, and during this period birds were less tolerant of disturbance. Observers described quetzals they encountered as elusive and flighty, at times heard only, behavior more typical of the species. Mid-August sightings were of lone birds, and the high degree of mobility across several drainages was accompanied by frequent vocalization. In contrast, first in Rucker Canyon and then Cave Creek Canyon, late-August through November movement for an associated male and female was less mobile, settling into a single drainage with birds becoming increasingly tolerant of humans.

Along the main fork of Cave Creek Canyon, the quetzals frequented a paved-road area along a riparian zone continuously for 61 days despite local home construction and the continual presence of observers along the public roadway. On one side of this linear drainage, the birds would frequently rest and bathe undisturbed along the creek using a strip of private land with limited access and little disturbance. They moved 4 km up and down the canyon on a regular feeding circuit, sometimes traveling this route multiple times a day. Activity took on a pattern of feeding by the public roadway or up the canyon hillsides with periods of rest in the private land riparian corridor. Their tolerant behavior seemed quite remarkable and not at all typical to those familiar with the species in Mexico (Lammertink et al. 1996; S. Williamson and N. Snyder pers. comm.). Observers in Rucker Canyon reported that when feeding, the male and female moved 4-5 km up and down that drainage on 17 days of sightings there.

Arizona – Further Detail on Patterns of Spatial Movement and Habitat Use

Arizona 2020 sightings occurred in the Coronado National Forest in the Chiricahua Mountains in multiple drainages, several of which had previous historic sightings but no reports of quetzals for a decade (Figure 4, Table 1). The intensity of observation and the long duration of presence in Arizona offered this author and others the chance to analyze seasonal movement over time and space for 2 seasons in one of the largest Sky Island ranges north of Mexico. From June to November, 2 Eared Quetzals moved extensively between drainages in the range, at first as lone birds, then as associated birds. Movement patterns during the 2 seasons the birds were present can best be placed in 5 segments of time and location with one gap in sightings between them (Table 5).

1. June Herb Martyr (8 June-3 July 2020 Segment):

In June 2020, an immature male Eared Quetzal molting into adult plumage was observed regularly during a 3-to-4-week period along a 4-km stretch of the Herb Martyr Road that runs parallel to the main fork of Cave Creek in the Chiricahua Mountains. From 8 June through 16 June, this male in molt was repeatedly seen along the road and creek between Herb Martyr Campground and the Southwestern Research Station (SWRS) with sightings noted on 7 of 9 days (Figure 5, Table 5). It tolerated multiple observers while feeding mainly on caterpillars in pine-oak habitat adjacent to Cave Creek. The following 3 days the male was not seen, and then on 19 June a lone female was reported near the Crystal Cave trailhead 1 km up the Herb Martyr Road from the SWRS. Despite considerable searching, no individuals were reported again for 5 days, until a single bird identified as a female was reported on 24 and 25 June. Two reports on 2 and 3 July were also of single birds but did not indicate gender. These 2 birds were not reported together.

Gap - (4 July-8 August 2020): For over 5 weeks no Eared Quetzals were reported, despite numerous birders looking for them throughout multiple drainages of the Chiricahuas. Due to this gap in time and a change in location when the birds were next sighted, the relationship of the June–July summer lone birds to the later August–November period of 2 birds associated together, a male and female (a possible pair), remains inferred. Identification by photographs to match up individuals between the June and subsequent fall sightings is complicated as the male was molting and its appearance changed. The ABC considered these reports at different times and locations to be of the same 2 birds (Rosenberg and Rademaker 2021).

2. Mid-August Time of High Mobility at Variable Locations (9-22 August 2020 Segment): Mid-August reports occurred over a wide area within the Chiricahuas, from the South Fork of Cave Creek on the east side of the range, to Pinery Canyon on the west side, and both Barfoot and Rustler parks along the crest between them. All sightings outside of Rucker Canyon for this period were of lone birds, while the Rucker sighting first noted on 16 August was a probable pair. When mapped, sightings for this period (Figure 4) suggest either extensive roaming or the presence of one or more additional birds. On 9 August, a lone Eared Quetzal was photographed in the South Fork of Cave Creek Canyon (D. Jasper pers. comm.). On 10 August, multiple observers reported and photographed a female Eared Quetzal at Barfoot Park at about 0900 that was making loud and frequent calls, including the tremolo song-call. Reports of sightings or vocalizations on 3 continuous mornings were reported from South Fork, 14 August (0810),



Figure 5. Eared Quetzal (male) showing almost completed molt, Cave Creek Canyon, Chiricahua Mountains, Cochise County, 25 October 2020. Photo by Peg Abbott

15 (0945), 16 (0815), and one was reported as heard-only by the author the afternoon of 17 August (1705) giving a tremolo song-call. These reports are without gender identification but suggest site fidelity at South Fork for at least 4 days by a lone bird. Dates for this lone bird in South Fork overlap with the start date of the Rucker Canyon segment when at 1530 on 16 August an observer noted 2 birds, a possible pair, and documented them with a recording from Rucker Canyon that includes the tremolo song-call. The distance from the South Fork of Cave Creek Canyon to Rucker Canyon is approximately 16 km as the quetzal flies. Reports at Pinery Canyon on 15 August and in a nearby location on 20 August fall on either side of the first Rucker Canyon report. Loud vocalizations reported by multiple observers from both Barfoot and Rustler parks about an hour apart on the morning of 22 August are also between the dates of the first 2 Rucker Canyon sightings. These reports suggest an active time of unsettled movement, possibly repeated movements back and forth between major drainages by the same individuals not yet associated and calling loudly. Rucker Canyon sightings beginning 16 August were of a closely associated male and female while other locations overlapping in time were of lone individuals. This segment is within the timing of the monsoon-associated breeding season in core parts of this species' range in Mexico (Taylor 1994, Johnsgard 2000, González-Rojas et al. 2008).

3. August / September Rucker Canyon (16 August-7 September 2020 Segment). Following the 16 August sighting, no further quetzals were reported from Rucker Canyon until the following weekend on 23 August, when the same observer reported 2 birds at the same location she had seen them 16 August, feeding on chokecherry (*Prunus virginiana*). Multiple observers then recorded the 2 quetzals together daily for the next 16 days, noting a male in molt from immature to adult plumage and a female. The birds seemed tightly bonded and were described as near to each other and highly vocal. The tremolo song-call was noted in many reports, a sound associated with pair-bonding and territoriality in this species (Taylor 1994). This behavior persisted into the first week of September with the birds roaming up and down a 5-km stretch of riparian vegetation with running water in steep-walled Rucker Canyon, with the last sighting on the morning of 7 September. Birders continued to search in Rucker after that date without success.

4. September to November – Return to Cave Creek (15 September-15 November 2020 Segment). On 15 September, a male and female Eared Quetzal were photographed and reported feeding along the main paved section of Forest Service Road 42 near the SWRS by 2 observers. They were presumed to be the same 2 birds reported from Rucker Canyon based on photographs of the male. Eared Quetzals have 3 pairs of outer rectrices that show extensive white in adult birds; in this male the amount of wear and molt sequence was helpful to distinguish this individual. For several weeks the upper right tail rectrix was a bright white emerging feather that stuck out to the side like a thumb, a distinctive marker even when viewed from a distance. The presumed pair remained in a well-watered stretch of Cave Creek for over 2 months, remaining highly visible almost daily despite construction, traffic, and growing crowds of birders. For this 2-month period, 2 birds were noted together 79% of the time that the female was known to be present. The birds were found frequently due to their almost constant vocalizations. Both birds emitted most often the “wEEE-k” locational calls, “kac-ka-kac” movement calls, and squeal-chuck calls described by Taylor (1994). On occasion both were observed giving the tremolo song-call. The male roosted in the same alligator juniper (*Juniperus deppeana*) close to the main road at a driveway junction and bridge for at least 5 of the 8 weeks. The female roosted at first about 100 m away, and then joined the male in the same tree for the final 2 weeks before she disappeared (Figure 6). Photo documentation indicates that they fed mainly on fruit of



Figure 6. Eared Quetzal (female) in Cave Creek Canyon, 28 October 2020. Photo by Peg Abbott

the abundant netleaf hackberry (*Celtis reticulata*), supplemented with caterpillars and moths, occasionally large aquatic insect larvae, and other fruits. The pair persisted through an October snowfall accompanied by nighttime temperature of -3°C (Figure 7). The female disappeared suddenly on 5 November and was not seen again. Food shortage may have been a factor as the hackberries were notably dried out and dwindling in number by this time. Predation was another possibility as a Cooper's Hawk (*Accipiter cooperii*) had been frequenting the area and was observed by the author using some of the same creek-side perches used by the quetzals when they were bathing. A Great Horned Owl (*Bubo virginianus*) and 2 Sharp-shinned Hawks (*Accipiter striatus*) were also in the area. After several days of being highly vocal, particularly at the roost site, the male quieted down but remained in this section of the drainage for another 10 days and was last seen there 15 November.

5. Stewart Campground, Vista Point and South Fork Cave Creek (17-25 November 2020).

After being undetected for a day, the lone male was rediscovered on 17 November farther downstream in a new section of the Cave Creek drainage feeding on ripe Arizona madrone (*Arbutus arizonica*) berries. It visited several mature madrone trees across from Stewart Campground, in Madrone Canyon above Vista Point, and along several kilometers of the South Fork of Cave Creek beyond the hikers' trailhead. During this period, the male was noticeably less vocal and more mobile, and he became more wary and elusive. The final day of reported Eared Quetzal sightings in 2020 was 25 November of the male 1.5 km above the South Fork trailhead. He was feeding on fruits of an Arizona madrone tree with a dozen or more American Robins (*Turdus migratorius*) and a Red-naped Sapsucker (*Sphyrapicus nuchalis*). Fruit was sparse on the madrones, and both Cooper's Hawk and Northern Goshawk (*Accipiter gentilis*) were seen hunting this drainage during the 9 days the male used the area. No further sightings occurred later that winter nor were Eared Quetzals verified in 2021.

New Mexico – Further Detail on Spatial Patterns and Habitat Use

In New Mexico, the 2020 Eared Quetzal sightings occurred in the Gila National Forest in the Pinos Altos Mountains near Silver City, Grant County. This was the first time this species was documented with photos and videos in the state. The only other state record was a previous documented sighting from the Animas Mountains in June 1979 that lacked photo confirmation (Witzeman et al. 1979). The New Mexico 2020 sightings were in or near the Little Cherry Creek and Mill Canyon drainages, the latter more difficult to access due to private land adjacency. The New Mexico Bird Records Committee (NMRBC) accepted reports range from 20 August to 25 October (S. O. Williams III pers. comm.). Two individual Eared Quetzals were noted; reports often described one seen and one as heard-only (Baumann and VanBuskirk 2020). The first bird seen on 20 August was a female with continued presence verified by multiple photos; the second bird encountered later was of unknown gender, pending further review. Details of the New Mexico sequence of sightings will be available in the next NMRBC report (S. O. Williams III pers. comm.).

DISCUSSION

Multiple occurrences of Eared Quetzal in the United States, 66 spread over 4 seasons of 27 of the past 45 years, shows that long-distance flights across the border have happened multiple times, and patterns of frequency suggest they will continue. As the Sky Islands in both countries contain similar Madrean habitat and radiate from the Sierra Madre



Figure 7. Eared Quetzal (female) the morning after a snowfall, 27 October 2020. Photo by Bob Rodrigues

core in a stepping-stone distribution with distances between them ranging from 90-215 km (Figure 2), Eared Quetzal movement along them is certainly plausible. In the United States, Eared Quetzals frequent the same habitat described by Lammertink et al. (1996) as they do in Mexico, preferring mature riparian vegetation in rugged canyons with flowing streams, often adjacent to oak-pine woodland (Taylor 1994). Quetzals have occurred in different ranges in the same season and year, but we lack data on how long they persist in any known area, if they move between ranges, if they return to Mexico and if so, do the same individuals return?

While we lack evidence of movement between Sky Island ranges or the adjacent highlands by known individuals, patterns of movement within the Chiricahua, Huachuca, and Santa Rita mountains over the 45-year period show that Eared Quetzals move extensively and use multiple drainages within single seasons and between seasons. Marshall (1957) describes similar mobility for this species, noting 3-km movements while feeding in Mexico.

In trying to interpret patterns of movement, the lack of marked birds or use of tracking devices on these Eared Quetzals makes connecting spatial and temporal patterns difficult. Until data from tracking devices are available, interpretation of occurrences in Arizona and New Mexico as continuing birds across multiple locations and years should be expressed with caution, as some seasons are documented by a single record and some sequential seasons have only one to few sightings and little photo documentation. Some important records lack gender designation, noting only quick looks with confirmation by distinctive vocalizations.

During the 1990s Eared Quetzal occurrences were especially numerous and extended beyond the Huachuca and Chiricahua ranges to farther north locations of central Arizona's Sierra Ancha and Mogollon Rim area in 1992, 1994, 1995, and 2002 (Rosenberg and Witzeman 1998, Corman 2005, Rosenberg and Rademaker 2021). This region of Arizona is much less visited by birders than in southeastern areas, so most of the few detections were by researchers and biologists working there. Corman (2005) suggests that several of the occurrences into the mid-1990's may be linked to the unprecedented 1991 influx of this species. With 40 occurrences and 2 nestlings in that decade, questions emerge. Were these reports of the same birds wandering or were they separate individuals?

In the frequently birded larger sky islands, seasonal occurrences over time could suggest a trend towards possible range expansion. Eared Quetzal occurrences in the 1970's in the Chiricahuas and the 1990's in the Huachucas each contain a pattern of sightings over multiple seasons and years that have been interpreted and accepted by reviewers as continuing birds (Tables 1 and 4). Occurrences in multiple but not all sequential years in the 1980's in Cave Creek Canyon in the Chiricahuas have also been described as continuing birds despite long temporal gaps (Witzeman et al. 1978, 1979, 1980; Morse 1987; Rosenberg and Witzeman 1998; Taylor 2010).

One very important behavioral aspect of these quetzals is that they are typically quite timid, often moving significant distances upslope or up canyon when they detect a person's presence. This can greatly hamper relocating individual birds on subsequent days. This may help explain why many U.S. records pertain to single-day detections. Also, up until recent years, their varied calls were not well known by most of the birding community, so many distant calling individuals may not have been properly identified, particularly during the first 30+ years.

Repeated sightings in 27 of 45 years suggest more than random wandering. Two patterns of movement have been described in Mexico, where several authors have noted seasonal movements across geography timed with breeding, and movement along elevation gradients in relationship to winter food availability (Collar et al. 1992, Lammertink et al. 1996, González-Rojas et al. 2008, Contreras-Martinez et al. 2020). Howell and Webb (1995) describe Eared Quetzal as a year-round resident on its core range in Mexico, spanning 1,500 km between the states of Chihuahua and Michoacán. Recently, however, Contreras-Martinez et al. (2020) conducted surveys at 2 reserves in Jalisco that determine the species occurs there only in the nonbreeding season, November to March. Using these data and a review of historical occurrences in Jalisco and Michoacán, they conclude that in the southern part of its range in Mexico, Eared Quetzals move north and northwest to breeding areas, suggesting that at least a portion of the population migrates.

Howell et al. (2014) suggest that a portion of the Mexican population of Eared Quetzal may be migratory, and that U.S. sightings may be the result of an “overshoot” as birds migrate north and northwest from southern areas of their range to breed in northern sections of Mexico. The map of sightings (Figure 2) shows that U.S. occurrences line up with these trends north and northwest from known breeding areas in Mexico. Furthermore, many U.S. sightings fall within the July-October monsoon season preferred for breeding (González-Rojas et al. 2008), at least suggesting the potential for future range expansion.

Evidence of these 2 patterns of quetzal movement, migration to breeding areas and elevational movement to lower elevation in response to winter food abundance, can be inferred from the Arizona and New Mexico occurrences. For migration north and northwest, the Animas, New Mexico sighting is intriguing because the range sits in a direct north-south line between the core breeding area in Chihuahua, Mexico, and the Pinos Altos Mountains of New Mexico with the Burro Mountains as a possible stepping-stone on the route between them. The single-day sighting in the Animas Mountains (13 June 1979) occurred at a time when this species in Mexico would be moving north to nesting areas. Northwest-trending movement would also reach documented sighting areas in Arizona’s Sky Island and Mogollon Rim locations. For winter movement to lower elevation, the Christopher Creek sighting on the Mogollon Rim at approximately 1,828 m in November 1995 may have been linked to observations during winter and spring of 1996 along Pinto Creek (near Haunted Canyon) in Gila County at approximately 914 m elevation in the Superstitions. If so, this would be a pattern similar to winter movements to lower elevations in Mexico (González-Rojas et al. 2008, Contreras-Martinez et al. 2020).

Behavior of the Arizona birds in 2020, which persisted for several months along a well-used recreation corridor of Coronado National Forest, suggests that some Eared Quetzals may be able to tolerate more human activity than previously known. The return of the “mystery bird” caused a spike in visits to the Sky Islands and adjacent highlands. Nearly 1,000 unique observers of the quetzal submitted eBird reports for the 2 states. This author and other regular quetzal observers, residents of the nearby community of Portal, estimate that 20-40 people per day were present for most of the 60+ days along the Cave Creek paved road from mid-September to mid-November; residents endured traffic congestion and problems with parking as cars protruded onto the winding road (L. Conrad, C. Comeau, and L. Jakse, pers. comm.). An estimated 60 observers saw the New Mexico birds (S. O. Williams III, pers. comm.).

SUMMARY

A first record of Eared Quetzal in the United States, with a possibility of an undetected nest, stunned the birding world and caused a sensational spike in visitation to the area. More than 800 people arrived in subsequent weeks to witness this remarkable addition to the nation’s avifauna (Zimmerman 1978). Zimmerman (1978) noted that in 1977 few observers had ever seen the species even in Mexico, as its Sierra Madre stronghold was so remote, rugged, and rarely accessed that only a few ornithologists and intrepid birders had ever seen the species. Zimmerman was able to get the second-known recording of the species from one of the Cave Creek Canyon quetzals in 1977. He speculated on the status of Eared Quetzal as an immigrant or vagrant and noted historic sightings in Chihuahua at Colonia Garcia, the Upper Rio Gavilan, and Arch Valley, 152-217 km from the U.S.-Mexico border (Zimmerman 1978).

Morse (1987), a Portal resident, analyzed the decade of intermittent sightings in the 1980s that followed this possible family group’s arrival, and he speculated that this event indicated possible colonization. His synopsis was insightful but did not unravel the questions about the species’ status despite the additional decade of sightings. The 1990’s held 40 occurrences including a failed nest attempt, but frequency then declined, with only 2 occurrences 2010-2019.

In 2020, observers hailed the return of the “mystery bird”. For the first time in 4 decades Eared Quetzals could be seen in highly accessible areas. As multiple appearances occurred in 2 states, the discussion about the status of this species was renewed. While New Mexico’s quetzals were characteristically wary, Arizona’s birds were remarkably

tolerant. Visible from a paved road much of the time, they provided spectacular flight shows while feeding (Figure 8). In all her years of seeing quetzals in Arizona and in Mexico, Williamson (pers. comm.) noted that she had never seen this species before while having her feet on pavement.

Despite hundreds of hours of observation during the 2020 season, we have not answered the question about the Eared Quetzal's status, nor can we predict the occurrences of the next decades. No sightings are under review for 2021 (G. Rosenberg and S. O. Williams III pers. comm.). Eared Quetzal occurrences over the past 45 years can be mapped with intriguing patterns of geographic use on U.S. terrain, but more questions than answers remain. What were the individuals' relationships to each other? How many birds were present? Where were they during their 5-week absence in the Chiricahuas? Was a pair bond formed or was a breeding attempt made during that time? Further study using solar-powered transmitters is needed to learn more about Eared Quetzal movements. Until then, Dale Zimmerman's question first posed in 1978 of Eared Quetzal status in the United States, immigrant or visitor, remains pertinent today.



Figure 8. Eared Quetzal (male) in flight, showing extensive molt. Herb Martyr Road, Chiricahua Mountains, Cochise County. 17 June 2020. Photo by Peg Abbott


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