The first Colombian records of the Antillean Nighthawk (*Chordeiles gundlachii*), with notes on migrant *Chordeiles* in South America

Los primeros registros colombianos del Añapero caribeño, *Chordeiles gundlachii*, con notas sobre migrantes de *Chordeiles* en Sudamérica

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Abstract

The Antillean Nighthawk (*Chordeiles gundlachii*), a species very similar to the Common Nighthawk (*Chordeiles minor*), was presumed to migrate to South America following breeding in the Caribbean region. However, no concrete evidence of its presence there existed prior to 2018, when a geolocation study revealed the migration route and wintering area in western Brazil of an individual, including its possible presence in the Venezuelan-Colombian border during its fall migration. We found two misidentified specimens of this species in series of *C. minor* in two Colombian ornithological collections that definitely established its presence in Colombia. We also compare the migration paths of *C. gundlachii* with those of a similar study of the migrations of *C. minor*. We highlight the scarcity of spring specimens of both species in these collections, a pattern also evident in spatiotemporal modeling based on community science data. We suggest that further examination of series of *C. minor* in other South American collections, including genetic analyses, wider movement tracking studies, and stable isotope analyses could clarify the nonbreeding distributions of both migratory nighthawks. In addition, Antillean Nighthawk flight calls are distinctive and a good indicator of its presence thus can help to detect it and better understand its migration routes.

Key words: biological collections, Caprimulgidae, migrations, reidentifications, nighthawks

Resumen

Se presumía que el Añapero caribeño o querequequé (*Chordeiles gundlachii*), una especie muy similar al Añapero común (*C. minor*) migraba a Suramérica después de su época de cría en la región del Caribe. Sin embargo, no existía evidencia concreta de su presencia allí hasta un estudio reciente con geolocalizadores que reveló la ruta de migración y área de invernación de un individuo en el oeste de Brasil, y que posiblemente pasó cerca de la frontera colombo-venezolana durante su migración de otoño. También comparamos las migraciones de *C. gundlachii* con las de un estudio similar sobre las migraciones de *C. minor*. Encontramos dos especímenes de *C. gundlachii* en series de *C. minor* en dos colecciones ornitológicas colombianas que establecen su presencia en Colombia de forma definitiva. Resaltamos la casi ausencia de especímenes de primavera de ambas especies en el país, un patrón también evidente en modelamientos espacio temporales con base a datos de ciencia participativa. Sugerimos examinar en detalle las series de *C. minor* en otras colecciones suramericanas, así como estudios más extensos con geolocalizadores, datos genéticos y con isótopos estables para aclarar las distribuciones de ambas especies fuera de sus épocas de reproducción. Adicionalmente, la llamada en vuelo del Añapero caribeño es distintiva y un buen indicador de su presencia, lo cual puede ayudar a detectarlo y entender mejor sus rutas migratorias.

Palabras clave: Caprimulgidae, colecciones biológicas, añaperos, migraciones, reidentificaciones

Introduction

The Antillean Nighthawk (*Chordeiles gundlachii*) is well known as a breeding species in extreme southern Florida and the Bahamas (subspecies *vicinus*) and in the Greater Antilles (subspecies *gundlachii*), and apparently recently including the island of Guadeloupe of the Lesser Antilles (Kirwan *et al.* 2019). *Chordeiles gundlachii* has been known to leave these areas following breeding, but its nonbreeding routes and winter range have long remained unclear. Although it had been presumed to migrate to South America, no concrete evidence of this species there existed as of 2011 (Cleere 2011). Its plumage is very similar to that of the Common Nighthawk (*C. minor*), differing mainly in the more buffy color of its underparts, although this is often difficult to appreciate in the field, especially in view of the differences between several of the subspecies of *C. minor* and the possibility of plumage color phases in both species (Eisenmann 1962, Sibley 2000). The best field character for distinguishing *gundlachii* is the vocalizations of the breeding males (Sibley 2000), but because these are mostly given during the breeding season, this does not help much to distinguish migrants (and the fall migration period of *gundlachii* apparently coincides with that of *minor*). However, flight calls could also be informative of the presence of this species in wintering grounds: a recording by Verón (2021) provided evidence that in two successive years a *C. gundlachii* apparently wintered in northern Argentina, extending the winter range of this species some 3000 km southward. The great similarity between the two species might well have caused the occurrence of *C. gundlachii* in its migrations and wintering grounds elsewhere to have passed undetected.

By means of specimen comparisons, *C. gundlachii* may be best distinguished from the slightly larger *C. minor* by its shorter wings and tail, as given by Oberholser (1914), although he noted that identification of single specimens by plumage color could be difficult because of individual variation within each taxon as well as intergradation between adjacent subspecies in *C. minor*. The extensive data of Oberholser (1914) for *C. minor* showed that its seven then recognized subspecies fell into two distinct size groups: large (including *minor*, *hesperis*, *henryi*, *senneti*, and *howelli*), and small (*chapmani* and *aserriensis*), with the latter two approaching the smaller size of *gundlachii*. In addition, two subspecies have been described from Middle America: *neotropicalis* from southern Mexico (Selander & Álvarez del Toro 1955) and *panamensis* from Panama (Eisenmann 1962). All subspecies of *minor* as well as *gundlachii* are migratory, presumably wintering in South America, and any or all could pass through Colombia during their migrations.

In Colombia, the first possible report of *gundlachii* was by McNish (2011) on San Andrés Island. Although he included a brief description of its calls, he did not provide further data or documentation. An included photograph was not from San Andrés, but from Florida and supplied by VIREO: Visual Resources for Ornithology. More recently, sight records were reported by Donegan & Huertas (2018) on Isla Providencia and by Estela (2015a, b) on Cayo Roncador and Cayo Serranilla in September 2015. Although these records are certainly plausible, no documentation by photographs or sound recordings exists, hence the status of this species in Colombia was considered to be hypothetical (Donegan & Huertas, 2018, Avendaño *et al.* 2017).

Using a light-level geolocator for a full year, Perlut & Levesque (2020) showed the wintering area and the migratory track of an adult female *C. gundlachii*, definitely establishing the presence of this species in South America. They found that this individual left its breeding ground on

Guadeloupe Island in the Lesser Antilles on 4 Sep 2013, and after a brief excursion northwest to the Greater Antilles, arrived on Isla Tortuga off the northern coast of Venezuela for a stopover of *ca.* 60 days. Leaving Isla Tortuga, the bird flew south, then veered southwest and then southeast over the Orinoco lowlands of Venezuela; upon reaching the approximate longitude of Guadeloupe, it flew northward for *ca.* 800 km before making an about-face to fly directly southward, arriving in its wintering area in the Brazilian Amazon, *ca.* 2100 km south of its breeding area on 20 Jan 2014. The bird remained in and around the wintering area for over two months and departed on its spring migration on 1 Apr 2014, flying directly northward and arriving on Guadeloupe only *ca.* 8 days later. In July 2014 the bird was recaptured while nesting again on Guadeloupe and its geolocator was recovered. Of interest here is that upon plotting its fall migration over the Orinoco region, its closest approach to the Colombian-Venezuelan border was apparently between 50 and 100 km to the north and east of Puerto Carreño, Vichada – again, leaving this country without a definite record of *C. gundlachii*. Here we provide the first confirmation of the presence of this migratory nighthawk in Colombia, based on a revision of biological collections.

Methods and materials

Suspecting that a revision of existing specimens in ornithological collections could reveal specimens of *C. gundlachii* previously confused with the extremely similar and much more common *C. minor*, we examined and measured specimens of migratory *Chordeiles* nighthawks in two Colombian ornithological collections. FGS measured wing and tail lengths of all specimens of *minor* (n=38) in the collection of the Instituto de Ciencias Naturales, Universidad Nacional de Colombia (hereafter ICN). The majority of these had been identified as *C. m. minor*, but several were assigned to four other subspecies (*henryi*, *sennetti*, *chapmani* and *aserriensis*). OAC also measured the specimens labeled as *minor* in the collection of the Instituto Humboldt (n=5) (hereafter IAvH-A). This investigation disclosed the presence of two specimens whose measurements appeared to correspond to those of *gundlachii*. The first specimen (ICN 8051) is an adult male taken by Olivares and Martínez on 16 Nov 1958 at Villavicencio, Department of Meta; its measurements are wing, 171 mm; tail, 87.5 mm. The smaller size of this specimen was not immediately evident because it had been prepared with the wings pulled downward. However, because these nighthawks have a tuft of white feathers just distal to the carpal joint, it was easy to locate the joint for measuring the wing. Both of these measurements are smaller than the minimum values for *C. minor* given by Oberholser (1914). The second specimen (IAvH A-96), also an adult male, was taken by L. Quintero near Plato, Department of Magdalena on 12 October 1963, with a wing of 172 mm and a tail of 94 mm, equal to the minimum values taken by Oberholser for *minor*.

We compared our measurements against the extensive data of Oberholser (1914) for the larger subspecies of *minor*, pooled by randomly selecting ten specimens from each subspecies (*minor*, *hesperis*, *senneti*, *howelli*, and *henryi*) because their measurements were all similar and much larger than measurements of *gundlachii*. We compared independently the measurements of the two smaller subspecies of *minor* as well as those given by Selander & Álvarez del Toro (1955) and Eisenmann (1962) for the two more recently described subspecies of Middle America (Table 1). For these comparisons, we computed the Cohen's *d* standardized effect size for one-sample (Cohen

Table 1. Measurements of wing chord lengths and tail lengths of specimens of *Chordeiles minor* and *C. gundlachii*; the measurements of the sexes are combined, because the respective means were similar; we also include immatures as well as adults, because these were not always distinguished in all sources. The data are given as range, mean, sample sizes and standard errors.

Group measured	Wing measurements in mm.	Tail measurements in mm.
C. minor: all large subspecies.[1]	184-215; mean *ca.*196; n>>100[1]	105-118; mean *ca.*111; n>>100[1]
C. m. chapmani[1]	170-192; mean 182,15; n=40; SE=0.837	99-110; mean 182,15; n=40; SE=0.837
C. m. aserriensis[1]	179-185.5; mean 182.75; n=20; SE=0.561	94.5-106; mean 101.56; n=20; SE=0.667
C. m. neotropicalis[3]	193.7-196.9; mean 195.3; n=7; SE=1.61	103-112; mean 106.75; n=7; SE=1.32
C. m. panamensis[4]	172-187; mean 179.72; n=7; SE=2.38	95-99; mean 96.50; n=7; SE=0.48
C. g. vicinus[1]	160.5-184.5; mean 171.68; n=20; SE=1.622	91-103; mean 96.75; n=20; SE=0.832
C. g. gundlachii[1]	159-175.5; mean 169.09; n=29; SE=0.923	88-100.5; mean 94.03; n=29; SE=0.609
Data sources[1] = Oberholser 2014; [2]= present study; [3]= Selander & Álvarez del Toro 1955; [4]= Eisenmann 1962		

1988, Lakens 2013), with the formula: $d_i = \frac{\bar{x}_i - \mu_j}{s_i} * K$ where $\bar{x}_i$ is the mean of each group measured i, μ_j ,is the value of each putative *gundlachii* specimen, s_i is the standard deviation for each group measured i, and a correction factor for small sample bias $K = \left(\frac{n_i - 3}{n_i - 2.25}\right) * \sqrt{\frac{n_i - 2}{n_i}}$ where n_i is the number of samples in each group measured i. The values of each of our putative *gundlachii* specimens (μ_j) are centered at d_i =0; d_i >0 values indicate species larger than our Colombian putative *gundlachii* specimens, while values d_i <0 indicate species smaller than these two specimens. We estimated the confidence intervals for three significant levels (80, 95, and 99.9%) around each d_i weighted by the sample size and standard error as follows: $CI_i = d_i \pm t_\alpha * SE_i$,where t_α reflects the critical value for t distribution at each different α significant level (0.2, 0.05, and 0.001), and SE_i the standard error of each group measured. All computations were made with R (R Core Team 2020), and we create the figures with the package ggplot2 (Wickham 2016); the code is given in https://github.com/OACColombia/ChordeilesCOL.

Results

Upon the comparison of morphometric measurements, we confirmed that the two specimens taken in Colombia indeed corresponded to *C. gundlachii* (Figs. 1, 2; Table 1). Their wing and tail lengths were more similar to the mean of *C. gundlachii* (dashed lines in Fig. 3) than the mean of all *C. minor* subspecies (dotted line in Fig. 3). This indicates that our specimens are much smaller than any other subspecies of *minor* in the data given by Oberholser (1914), in all cases falling outside of the 99.9% confidence intervals (Fig. 3). Although this difference in wing measurements is also reflected in the two recently described subspecies of *minor*, the small sample size (n=7) of both generated large confidence intervals, which made it impossible to obtain more rigorous separation of our two putative *gundlachii*. Confidence intervals for *C. m. panamensis* wing measurements overlapped with the effect size in both specimens (CI range at 99.9% for wing: -5.9 to 8.0 for ICN-8501 and -6.0 to 8.7 for IAvH-A-96), but tail measurements distinguish our specimens from *panamensis* at a 95% level of significance (CI range at 95% for tail: 6.0 to 4.1 for ICN-8501 and 0.4 to 2.3 for IAvH-A-96). Our specimens were also smaller than *neotropicalis* at confidence intervals of 95% level of significance for wing and tail.

We also noted in the ICN specimen the well-marked buffy color of the underparts (Fig. 1),

Figure 1. *Chordeiles* specimens in the ICN collection: ventral, lateral and dorsal views. Taxa, from left to right: ICN 8051, *C. gundlachii;* ICN 8068, 21308: two *C. m. minor*, illustrating intraspecific variation; ICN 8091, *C. m. aserriensis*; and ICN 8086, *C. m. chapmani* (the latter two being the two small races of *C. minor*). Note the overall more buffy to brownish coloration of *gundlachii,* with underparts narrowly barred with brown and the buffy ground color extending to the tail coverts which are white in all races of *minor*). All races of *minor* shown are more gray to blackish above, especially *chapmani*, which is more heavily barred below; *aserriensis* is notably pale, especially below. Also note that the specimen of *gundlachii* was prepared with the wings pulled down rather than folded in the natural position (note the displacement of the white tuft near the carpal joint and the white bar of the primaries compared to the specimens of *minor*), and that this displacement makes the specimen appear considerably larger, and thus more easily confused with *minor*.

extending to the abdomen and undertail coverts, again consistent for *gundlachii*. The breast of the IAvH-A specimen was more whitish, passing to paler buff on the abdomen and undertail coverts (Fig. 2). This difference might indicate that they pertain to different subspecies (see Oberholser 1914), although comparisons with series of both would be necessary to confirm this. In both, the dark barring below was more fuscous, unlike the sharp black of barring in *minor* and the upperparts were paler, less black than those of *minor* (Figs. 1, 2). However, we did not detect the ruddier tones of any described subspecies of *minor* or *gundlachii* in our specimens, suggesting that postmortem fading of these tones might be widespread in our collections of both species, hence we hesitate to ascribe subspecies to our specimens of *gundlachii*.

Moreover, we recently located an additional specimen at Museo de La Salle (MLS), Bogota, with color patterns that are much closer to *C. gundlachii* than to *C. minor*, as it had been identified. It is an unsexed individual collected by L. Ordoñez on 29 Oct 1972 in Bogota, Colombia (MLS 8095). Further comparisons and measurements of this specimen are needed to conclusively establish its identity.

Discussion

For the present, the specimen records showed here definitely establish the presence of the Antillean Nighthawk in Colombia during its fall migration. Clearly, many questions remain. Several are suggested by a comparison of the results of Perlut and Levesque (2020) with those of a similar study of the satellite tracking of the migrations of a group of five *C. minor* by Ng *et al.* (2018) over a route of *ca.* 10,000 km between central Canada and southeastern Brazil. For both fall and spring migrations, these five *C. minor* individuals followed a nearly straight line between the breeding and wintering areas, with only minor deviations, mostly in fall, when four birds crossed the Caribbean, from south-central USA to a landfall in northern Colombia, while one detoured to Yucatán and reached Colombia via Panama. Their spring migration was more direct and only briefly crossed extreme northern Colombia. In

Figure 2. Two *Chordeiles* specimens in the IAvH collection, ventral and dorsal views: left IAvH-A 96, *C. gundlachii*; right, IAvH-A 3867, *C. minor* for comparison; again, note the more buffy tones below of *C. gundlachii*.

each, the velocity over ten-day intervals was relatively constant, indicating at most brief stopovers in route. The wintering area of these birds was *ca.* 700 km east of that of the *C. gundlachii* tracked by Perlut and Levesque. Most striking was the difference in fall migrations: that of *gundlachii* involved an initial move northward to the Greater Antilles, then a lengthy stopover and after flying southeast, an apparent false start northward followed by an about-face to continue directly south to its winter home. Could this apparent confusion result from the breeding area of this bird being a recent displacement of at least 300 km southeast of the historical breeding range of its population (depending upon which island was inhabited by its source population)? What part does genetic background play in the choice of migration routes? Do the populations of *gundlachii* breeding on different islands as well as the different subspecies of *minor* follow different routes? Do the differences in wintering areas between the *C. minor* and *gundlachii* indicate that different *Chordeiles* taxa (including the different subspecies of *minor*) have in effect divided the continent into taxon-specific wintering areas? Answering such questions will surely require more intensive tracking of different populations of both species, but information from museum specimens, especially from South American collections, could be important.

A search for specimens of *gundlachii* in South

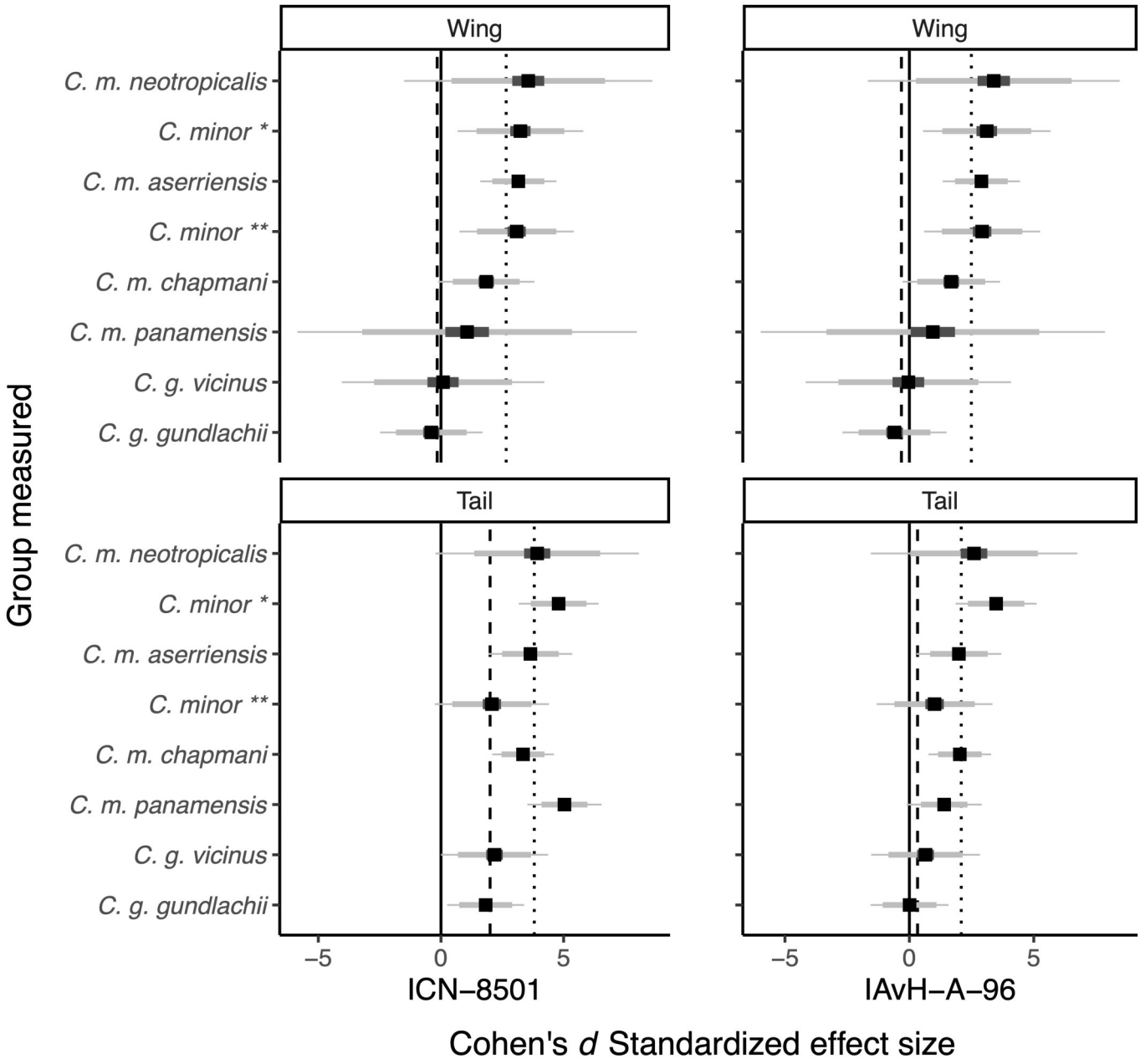

Figure 3. Forest plot of the estimated effect size (Cohens' *d* standardized effect size) for different groups of subspecies of *Chordeiles minor* and *C. gundlachii* measured. Vertical solid line (*d* = 0) represents each specimen of *gundlachii* (ICN-8501 and IAvH-A-96); dotted lines, the overall mean effect sizes for *C. minor* (wing: 2.57, 2.49; tail: 3.80, 2.09), and dashed lines overall mean effect sizes for *C. gundlachii* (wing: -0.125, -0.32; 2.00, 0.33). The black square indicates mean effect size, for each species, and error bars around each mean represent confidence intervals for different levels of significance in each group measured: dark gray (80%), middle gray (95%), and light thin gray (99.9%). Group *C. minor* * represents all large subspecies in Oberholser (1914), while *C. minor* ** represents all ICN and IAvH-A specimens measured.

American collections in the Global Biodiversity Information Facility (GBIF 2017, 2022) and Vertnet (2020) came up blank: apparently there are none (were those we found the first to be recorded?). Given our experience, we encourage the curators of collections in South America to examine the *C. minor* in their collections in search of overlooked specimens of *gundlachii* identified as *minor*, for which the criteria applied here might be helpful. Also, in such collections, were the specimens of *minor* identified to subspecies? Dates and localities of such specimens might add

information regarding wintering areas of its various subspecies. Phylogeographic and stable isotope studies of specimens could permit ubications of at least the molting areas of specimens if they were collected in breeding areas (for which curators of North American collections might add more pieces to resolve this puzzle). These questions might be best answered by more extensive work with geolocators, genetic sampling (Ruegg *et al.* 2020), and stable isotope analyses (Gómez *et al.* 2021), whereas sound recordings of flight calls could more steadily help filling the gap of wintering and migration of these nighthawks throughout South America. Verón (2021) reported records of *C. gundlachii* in northern Argentina identified by flight calls in December and January in two successive years, thus extending the winter distribution of this species *ca.* 500 km to the south.

Finally, the dates and localities of the two *gundlachii* specimens we report are also of interest. Both were taken during the fall migration period. That from Villavicencio might indicate that it was following a route south along the eastern base of the Eastern Andes. The IAvH specimen was presumably following the Magdalena valley southward, thus both birds were possibly avoiding higher, montane elevations, and their dates also coincide with those found for *minor* in its fall migrations. Nearly all of the specimens of *C. minor* in our collections were taken during their southward migrations, the only exceptions being one taken in Bogota by unidentified collectors on 10 May 1969 (ICN 19684), and one taken by K. von Sneidern in June 1993 at El Tambo, Cauca Department (ICN 29989) that possibly was a late spring migrant. Upon reviewing the records of *C. minor* in eBird, we found various records in Amazonia in January (subspecies not identified), then an absence of records between February and April. The scarcity of spring migrants might be explained by the route and date of the northbound female tracked by Perlut & Levesque (2020), which flew directly from its winter home to its breeding area in only eight days, apparently not deviating from this route to avoid mountainous areas. Thus, if *minor* does likewise as the birds tracked by Ng *et al.* (2008) suggest, the time window for collecting specimens in spring is much narrower. Spatiotemporal modelling of both species based on eBird data highlight the few records during spring migration in the tropics (Fink *et al.* 2022, Angelozzi-Blanco 2021). Again, further details of the specific movements of these fascinating animals remain to be resolved, both by specimens and by additional techniques.

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