CEIBA
A Scientific and Technical Journal
Published by Zamorano

Vol. 58, No. 2, 2025
Julio – Diciembre

Investigación original

Declines and turnover in resident birds during a decade in the Yeguare Valley, central Honduras

Oliver Komar
okomar@zamorano.edu
Profesor Pleno
Centro Zamorano de Biodiversidad, Departamento de Ambiente y Desarrollo
Universidad Zamorano
Honduras

Historial del artículo:
Recibido Enero 17, 2024. Aceptado Septiembre 14, 2025. Publicado Diciembre 31, 2025.

Cómo citar: Komar, O. (2025). Declines and turnover in resident birds during a decade in the Yeguare Valley, central Honduras. *Ceiba, 58*(2), 160-180. https://doi.org/10.5377/ceiba.v58i2.21689

Declives y recambio de aves residentes durante una década en el valle de Yeguare, centro de Honduras

Resumen. Se investigaron los cambios poblacionales en 109 especies de aves residentes entre 2011 y 2020 en los paisajes agrícolas del Valle de Yeguare, en el campus de la Universidad Zamorano. Varios observadores introdujeron conteos de aves en la base de datos eBird en tres «puntos calientes» (*hotspots*), lo que dio como resultado 1,833 conteos de aves, más del 75 % de los cuales fueron aportados por un solo observador (el autor). El análisis de los resúmenes de datos en línea de eBird mostró que siete especies residentes (6.4 %) experimentaron descensos significativos y convincentes en su abundancia a lo largo de la década. En 2020, tres parecían haberse extinguido localmente: el Milano Cola Blanca (*Elanus leucurus*), el Periquito Barbilla Anaranjada (*Brotogeris jugularis*) y la Chipe Cola Abanico (*Basileuterus lachrymosus*). Por el contrario, diez especies que eran escasas o inexistentes al comienzo de la década aumentaron notablemente. Cinco de ellas solo se mantuvieron durante unos años antes de volver a disminuir y es posible que también se hayan extinguido localmente. De las cinco especies restantes que aumentaron, tres llegaron después del primer año del estudio y persistieron hasta 2020: el Gavilán Ala Rufa (*Parabuteo unicinctus*), el Carpintero de Robledal (*Melanerpes formicivorus*) y el Halcón Murcielaguero (*Falco rufigularis*). Estas especies pueden contribuir al recambio en la comunidad. El número total de especies residentes registradas cada año se mantuvo estable (104 ± 2 especies), con tres especies perdidas y tres ganadas. Dado que el paisaje y el clima cambiaron poco durante el período de estudio, es posible que haya múltiples factores que expliquen los patrones observados. La mayoría de las especies en declive eran insectívoras, lo que sugiere que la reducción de las presas insectívoras desempeñó un papel importante. Solo una especie residente en el área de estudio—el Perico Frente Anaranjada (*Eupsittula canicularis*)—es vulnerable a nivel mundial, pero no mostró ninguna tendencia significativa durante la década.

Palabras clave: comunidades aviares, declives aviares, poblaciones de aves, ciencia ciudadana, eBird

Abstract: I investigated population changes in 109 resident bird species from 2011 to 2020 in agricultural landscapes of the Yeguare Valley, on the Zamorano University campus. Multiple observers entered bird counts in the eBird database across three "hotspots," resulting in 1,833 bird counts, more than 75% of which were contributed by a single observer (the author). Analysis of online eBird data summaries showed that seven resident species (6.4%) experienced significant and convincing declines in abundance over the decade. By 2020, three appeared to be locally extirpated: White-tailed Kite (*Elanus leucurus*), Orange-chinned Parakeet (*Brotogeris jugularis*), and Fan-tailed Warbler (*Basileuterus lachrymosus*). In contrast, 10 species that were scarce or absent at the start of the decade increased notably. Five of these occurred for only a few years before declining again and may also have become locally extirpated. Of the remaining five increasing species, three arrived after the first study year and persisted through 2020: Harris's Hawk (*Parabuteo unicinctus*), Acorn Woodpecker (*Melanerpes formicivorus*), and Bat Falcon (*Falco rufigularis*). These species may contribute to community turnover. The total number of resident species recorded each year remained stable (104 ± 2 species), with three species lost and three gained. Because the landscape and climate changed little during the study period, multiple factors may underlie the observed patterns. Most declining species were insectivores, suggesting that reductions in insect prey played an important role. Only one resident species in the study area—the Orange-fronted Parakeet (*Eupsittula canicularis*)—is globally vulnerable but showed no significant trend during the decade.

Keywords: avian community, avian declines, bird populations, citizen science, eBird

Introduction

Biodiversity is in crisis worldwide, with widespread declines and local extirpation of species. Many bird species of temperate North America (some of which migrate annually to Central America) have been declining over several decades (Rosenberg et al., 2019). In both North America and Europe, bird species breeding in agricultural landscapes have presented alarming declines, attributed to modern agricultural practices, and increased toxicity of insecticides (Donald et al., 2001; Rigal et al., 2023; Stanton et al., 2018), among other reasons. The population status and trends for non-migratory, resident birds in Central American agricultural landscapes is not as clear. Can the biodiversity crisis be detected locally, in the avian community of the Zamorano University campus of central Honduras? Unfortunately, few long-term studies have documented population dynamics in resident birds in Central America.

Local extinction and turnover in bird communities have been studied at just a few sites in Central America, and none in Honduras. One such study site is Barro Colorado Island in Panama, a small, forested island which was isolated from extensive forest with the flooding of the Panama Canal. The local resident bird community subsequently lost nearly 40% of its species, for a variety of reasons but mostly attributable to fragmentation (Robinson, 2001). At the La Selva Biological Station, in Costa Rica, some adjacent agricultural landscapes have been abandoned and are reverting to forests, reducing fragmentation, and permitting recovery of some forest birds at the station. An analysis of 23 years of Christmas Bird Counts at La Selva detected more increases (32% of species) than declines (22% of species) in the resident bird community (Boyle & Sigel, 2015). Nonetheless, some species disappeared during the study, and the authors reported five local extirpations (2.5% of the species studied); they did not report colonization by new species (turnover).

Although there are few long-term avian population studies in Central America, the eBird project may provide a passive solution, driven by effort-based data collected by tens of thousands of observers, at thousands of birding destinations registered as hotspots in the eBird data interface. The use of observations from non-standardized counts from bird observers to evaluate dynamic changes in bird communities is not new (e.g., Clark 2017; Fink et al., 2023; Horns et al., 2018; Patten et al., 2010; Sullivan et al., 2009). The present study used eBird data from multiple observers at several hotspots within a particular region, the Zamorano University campus in the Yeguare Valley, to evaluate if long-term changes occurred in local bird populations.

Study area

The Yeguare Valley is located about 30 km east of the Honduras capital, Tegucigalpa, in the Yeguare River watershed, which is a branch of the much larger Choluteca River watershed, on the Pacific slope. The field work was carried out close to the coordinates 14°N, 87°W, in the San Antonio de Oriente municipality of the Francisco Morazán department (Figure 1). The valley measures approximately 46 km^2, of which approximately 20% is part of the Zamorano University campus while the rest belongs to private landholders. Most of the valley is used for cattle grazing and farming, including corn, sorghum, sugar cane, watermelon, beans, and a variety of other legumes, fruits, and vegetables. The valley floor lies in the range of 750 to 800 masl, in the Mesoamerican Dry Forest Ecoregion. The slopes on the hillsides adjacent to the valley, above 800 masl, are part of a distinct ecoregion, Mesoamerican Pine-oak Forests. The mountains on the east and west sides of the valley rise steeply to about 2000 masl, where there are small patches of cloud forest (Mesoamerican Montane Forests Ecoregion). Additional ecosystems present include the Yeguare River itself and its tributaries (intermittent or permanent streams), aquaculture and artificial farm ponds or water treatment ponds, riparian strips, and scrubby (second growth) dry upland areas in the valley. Since 2017, a nature trail (the Zamorano *ecosendero*) opened, facilitating bird observations in 3 km of riparian strips. Specific areas on the Zamorano University campus and properties, where observations were carried out frequently, are presented in Figure 2.

Methods

Bird counts

Multiple observers carried out 1,833 bird counts in the Yeguare Valley during the 2011–2020 decade (Figure 3). These counts were reported on eBird.org and included effort information (time and distance) and counts or estimates of individuals present for all species observed. The counts were registered for three eBird hotspots: (1) Zamorano Univ.--Campus Farms and River 740-815 masl (https://ebird.org/hotspot/L1190987); (2) Zamorano Univ.--Finca Agroecológica Santa Inés (https://ebird.org/hotspot/L3806187); and (3) Zamorano Univ.--Masicarán

Figure 1. Location of the Yeguare Valley in south-central Honduras, inside the hollow circle indicated by the arrow (map source: Google Earth)

.

Dry Forest Reserve 790-940 masl (https://ebird.org/hotspot/L1111837). Any eBird data reported outside the hotspots were excluded from this study (including data reported from the same general locations but registered to a location distinct from the hotspots).

The bird counts were carried out on transects of variable length and position, including several transects repeated multiple times, in all weeks of the calendar year (Table 1). Dividing the calendar year into 48 weekly periods (7 days each, except for the fourth week of each month, which varies from 7 to 10 days), an average of 39 bird counts for each weekly period were reported during the decade, beginning in February 2011 and ending in January 2021. The maximum number of bird counts for a weekly period was 60, while the minimum was 19.

Efforts on bird counts varied greatly but generally included more than one hour of observation; a few counts were only 15 minutes, while the longest efforts were close to 10 hours. Distance traveled during counts also varied greatly, from stationary counts (point counts) to circuitous transects of close to 12 km. While effort for individual counts varied greatly, the variation was reasonably spread out over time and seasons, and biases that may come from this variation would likely be consistent across all species.

The multiple observers who contributed count data had variable experience in bird identification, although generally novices were accompanied by experienced bird observers. Three quarters (75%) of all counts were made by one experienced observer (the author), who had already logged over 15 years of field experience in bird identification in the region before the start of this study. The author provided to the database 1,238 counts (of 1,660) from the main campus hotspot, 150 counts (out of 156) from the agroecological farm, and all 17 counts from the Masicarán dry forest reserve. Unusual or rare species were invariably documented with text descriptions, photographs, and/or audio recordings, and the reports were vetted by experienced, volunteer eBird reviewers. Only validated eBird records are considered in this analysis.

Definition of residency for birds

Species were considered "resident" when they were present during their full breeding season, with active reproduction (nesting) taking place in the study area. While this excludes most migratory species, some reproductive residents may in fact be migratory birds and are only seasonally present. Only three species seem to fit this

Figure 2. Satellite view of the Yeguare Valley and Zamorano University campus, with typical transects where bird counts were conducted marked in blue, for (A) Campus, farms, and river, including the campus nature trail; (B) Masicarán dry forest reserve; and (C) Santa Inés Agroecological Farm. (Image sources: eBird.org, Google Earth)

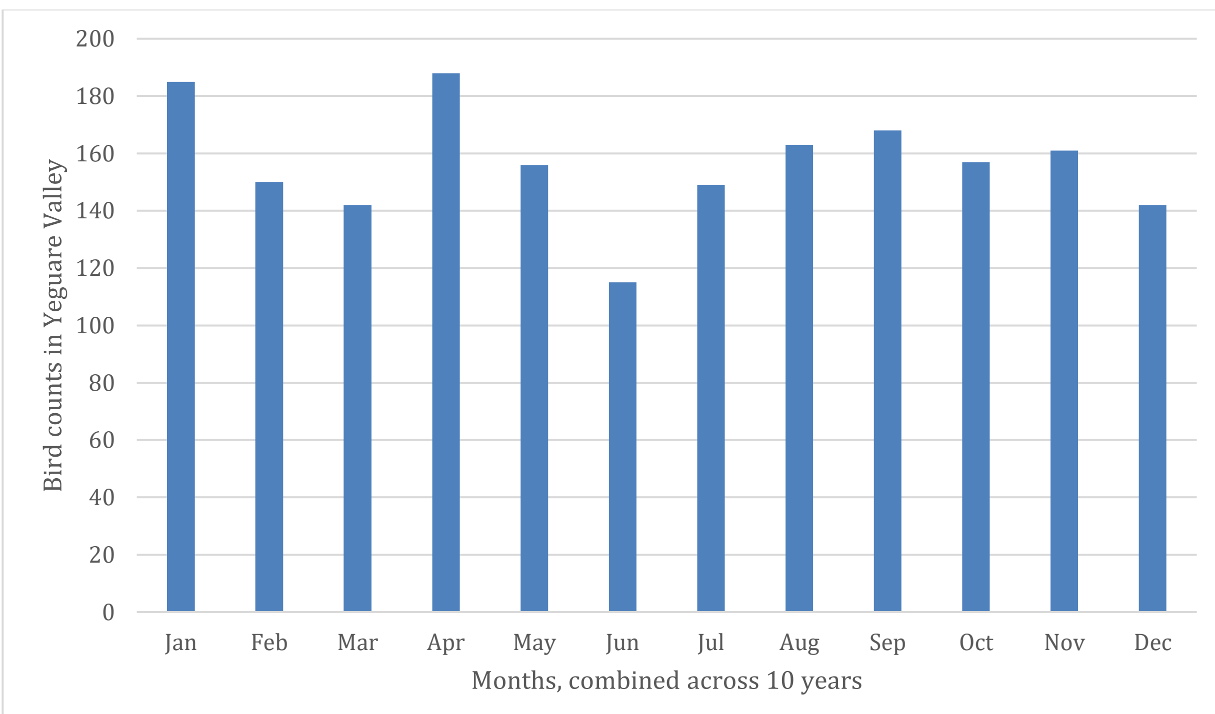

Figure 3. The quantity of bird counts available on eBird.org for three hotspots combined, in the Yeguare Valley, by monthly periods, from February 2011 to January 2021.

Table 1. Quantities of total bird counts per year over 10 years, 2011–2020 from three locations in the Yeguare Valley of Honduras, considered for this study.

Locality	'11	'12	'13	'14	'15	'16	'17	'18	'19	'20	Total
Zamorano Univ.--Campus, Farms, and River	71	117	80	115	134	128	104	216	313	382	1,660
Zamorano Univ.--Finca Agroecológica Santa Inés	0	0	0	0	1	42	45	32	26	10	156
Zamorano Univ.--Masicarán Dry Forest Reserve	1	0	1	3	3	4	0	2	2	1	17
Combined	72	117	81	118	138	174	149	250	341	393	1,833

pattern in the Yeguare Valley, all in the Tyrannidae: Brown-crested Flycatcher (*Myiarchus tyrannulus*), Sulphur-bellied Flycatcher (*Myiodynastes luteiventris*), and Fork-tailed Flycatcher (*Tyrannus savana*). Other "breeding visitors" of Honduras (per Dubon et al., 2024), such as Plumbeous Kite (*Ictinia plumbea*), Swallow-tailed Kite (*Elanoides forficatus*), Piratic Flycatcher (*Legatus leucophaius*), and Yellow-green Vireo (*Vireo flavoviridis*) do not breed in or even visit the Yeguare Valley with regularity.

A few species included in this analysis as residents have not actually been observed to breed, and this may indicate that they are breeding either at the margins or outside the margins of the study area. Nonetheless, they appear to use the study area for foraging year-round or nearly so. Examples include Red-billed Pigeon (*Patagioenas flavirostris*), Turkey Vulture (*Cathartes aura*), White-tailed Hawk (*Geranoaetus albicaudatus*), Short-tailed Hawk (*Buteo brachyurus*), Zone-tailed Hawk (*Buteo albonotatus*), White-fronted Parrot (*Amazona albifrons*), and Green (Red-throated) Parakeet (*Psittacara holochlora rubritorquis*).

Excluded from this study are 131 migratory, non-breeding visitors to the Yeguare Valley. Although most of these species are long-distance migrants, coming from as far away as northern Canada, some of the regular migrants are considered breeding residents in nearby areas of Honduras and may in fact be altitudinal or intra-tropical migrants. Examples of such species that are indeed regular visitors in the Yeguare Valley, but not as breeding residents, are Green-breasted Mango (*Anthracothorax prevostii*), Azure-crowned Hummingbird (*Saucerottia cyanocephala*), Western Cattle Egret (*Bubulcus ibis*), Northern Rough-winged Swallow (*Stelgidopteryx serripennis*), Elegant Euphonia (*Chlorophonia elegantissima*), and Black-headed Siskin (*Spinus notatus*). These species can be seasonally abundant, but absent during certain times of the year, and they were not considered as residents for this study.

Also excluded are 47 vagrant species (wanderers) that were observed but did not establish a resident, breeding population in the valley. Many such species may be locally resident in other areas of Honduras but were seen only occasionally in the Yeguare Valley during the decade. Examples include White-necked Jacobin (*Mellivora florisuga*), Roseate Spoonbill (*Platalea ajaja*), Pearl Kite (*Gampsonyx swainsonii*), Southern Lapwing (*Vanellus chilensis*), Ivory-billed Woodcreeper (*Xiphorhynchyus flavigaster*), Streak-headed Woodcreeper (*Lepidocolaptes souleyetii*), Yellow-throated Euphonia (*Euphonia hirundinacea*), Long-billed Gnatwren (*Ramphocaenus melanurus*), and Black-striped Sparrow (*Arremonops conirostris*). Some of these species were represented by a single individual, and were present for sometimes just a day, a few days, or a few weeks. Some, like the Lesser Roadrunner (*Geococcyx velox*), Plain Chachalaca (*Ortalis vetula*), Lineated Woodpecker (*Dryocopus lineatus*), and Black-vented Oriole (*Icterus wagleri*), are residents in the pine-oak woodlands just above the valley floor but were excluded from the present study. All were recorded on 1% or less (average annual frequency) of the bird counts considered for the study.

Population trends

I screened for possible declines and increases by inspecting chronological data downloaded from eBird.org. I considered average annual frequencies, averaged over full year periods, for each resident species. Average annual frequencies are proportions of bird counts throughout each year with a species present, without considering actual relative abundance based on bird counts. The frequencies are provided for each week and then averaged over the whole year. Variation in frequencies on a weekly basis, or a monthly basis, is very high, but much of the variation is reduced by using an annual average.

I also screened average counts for each species (the number of individual birds counted on a bird list reported to eBird, averaged from the sum of all lists reported in a week); they were averaged for all counts in a week, and then averaged again over an entire year. They are different from average frequencies in two important ways. First, they consider the actual numbers of individual birds. Second, they are only calculated for bird counts with the species present. This is important, because it avoids some bias caused by shifting effort to habitats where a species is not located. The average counts have not been adjusted for effort.

The data was available online through the eBird bar chart function, combining three hotspots mentioned earlier, and setting the time frame to individual years. I obtained the annual average frequencies by downloading data directly from the user interface into a text file and then opening the text files for each year in Microsoft Excel, where I assembled the data presented in Annex 1. Data for weekly average counts was also available through the same bar chart function, but first opening data for individual species of interest, and then downloading the abundance data for the period 2011 to 2020 one species at a time. eBird restricts this type of download to periods of five years, therefore for each species two five-year data downloads were accessed.

When the annual average frequencies for 2020 compared to 2011 for any given species showed a strong (>25%) negative difference, I examined those species further. I did not use a lower threshold because all species combined presented an apparent 12.5% negative difference, that I attributed to biases in observer behavior or abilities (for example, reporting shorter observation periods with smaller species lists in 2020 compared to 2011 could generate an overall negative trend). Once I selected a species for further analysis, I compared average counts per species for 2020 vs. 2011, and this time, selected species with >10% lower average counts (not frequencies) as possible candidates for a declining population trend. To further analyze that hypothesis, I tested the abundance trend, using non-transformed data, by linear regression. The regression lines and statistics (R^2, F, and P) were provided by Microsoft Excel, adding trendlines to linear graphs and using the LINEST function. *Alpha* level was 0.05, for accepting a linear regression as significant. Data transformations (to increase linearity) were considered but were not necessary. For positive trends, I followed a similar process. When annual average frequencies for 2020 vs. 2011 showed >12.5% increase, I examined those species further. I used linear regression on annual average counts to determine if trends increased significantly over the decade. This method is conservative and could overlook some non-linear increases. It is robust, also, to the possibility of declining count lengths (due to changes in observer behavior mentioned in the previous paragraph), which should have led to lower average counts. Observed increases are therefore likely indicators of even larger increases in the overall population.

Species turnover

Turnover is the dynamic change in natural communities, caused by loss (local extinction or extirpation) of some species and gain (colonization) of others (the term "turnover" has been used widely in ecology for over 60 years). I determined turnover by recording the years that each species was documented as a "resident" (defined above) in the study area. I considered a species to be locally extinct or extirpated if counts dropped to below two individuals per year for two or more years in a row and no breeding evidence was noted (assuming that the few observed could have been wanderers from nearby populations rather than local residents). I considered that a species had colonized the valley if it were absent or locally extirpated (according to the above definition) in two or more continuous years but then were observed more frequently in one year or if evidence of breeding were noted. Evidence of breeding included nest building or presence of local juveniles (fledglings unable to fly large distances).

Other methodological issues

Global threatened status is based on the IUCN Red List (IUCN, 2023). Nomenclature and taxonomy are based on Clements et al. (2023).

Results

Over the past decade, a total of 109 resident bird species were detected regularly in the Yeguare Valley and were assumed to breed in the valley or close by. Many of them were observed nesting or caring for young. However, not all species were present every year, and some may have declined to local extinction during this decade. Resident species richness each year ranged from 102 to 106 (the mean for the decade was 104) and appears to have remained stable (Figure 4), although increasing observation effort could potentially have masked declining species richness. The abundance of each species varied greatly, with some far more abundant than others. A sense for the relative abundance of each can be derived from graphing annual average counts. However, the overall relative abundance of all species in the bird community can also be captured from presence-absence data, simply comparing the average frequencies that each species was detected during bird counts (Annex 1).

Examination of species frequencies in Annex 1 provided a first glimpse of which species may have declined. Overall average frequencies (all 109 resident species combined) appeared to decline from 0.32 to 0.28 between the years 2011 and 2020, but that apparent decrease of 4 points (12.5%) may be due to changing behavior of observers. For example, I suspected that observation periods in 2020 were shorter and more frequent compared to 2011, and that would likely generate lower average frequencies even when bird populations were stable. To confirm that possible source of error, I tested the hypothesis that average effort per observation period declined over the decade. Specifically, observation periods in 2020 averaged 116 minutes and 2.3 km (author's data only, n=130), whereas for 2011, observation periods averaged 213 minutes and 3.3 km (author's data only, n=53). These differences are statistically significant (Student's t-test, one-tailed and assuming unequal variances, P<0.005 for each comparison).

Sixty resident species presented a decline of at least 25% in annual frequency. For these 60 species, many did not show declines in relative abundance, comparing average weekly counts for 2020 with 2011 abundance. For 30 species, however, that comparison presented 10% or

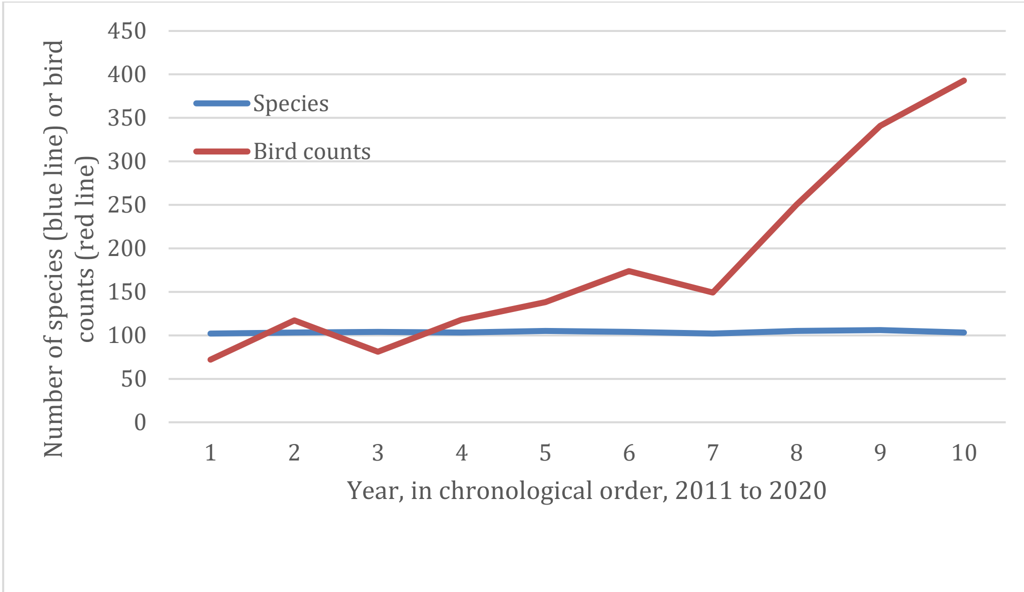

Figure 4. Over the decade, observation effort (bird counts) increased while species richness appears to have been stable.

greater declines (Table 2). I tested all species in Table 2 for significant declines over the decade using linear regressions. Ten species declined significantly; the R^2 statistics and probability values for the declines are presented in Figures 5 and 6.

Of the 10 resident species that presented significant declines, three (White-tailed Kite *Elanus leucurus*, Orange-chinned Parakeet *Brotogeris jugularis*, and Fan-tailed Warbler *Basileuterus lachrymosus*; Figure 7) were regular at the beginning of the decade but were apparently locally extirpated by the end of the decade. In the case of the warbler, locally resident populations in Honduras may be augmented in the non-breeding season by migratory visitors from the north (Fagan & Komar, 2016), and therefore the observed decline could be influenced by the decline of a migratory population. All three species are likely resident in the general region and thus dispersers may continue to be observed occasionally, or perhaps they will reestablish populations in the future.

The Least Grebe presented a 92% decline, the Bare-throated Tiger-Heron an 83% decline, the Gray-breasted Martin a 66% decline, and the Eastern Meadowlark a 62% decline (Figure 8). Those trends are supported by an independent analysis of relative abundance in eBird data in a 27 km × 27 km region that includes the Yeguare Valley, over virtually the same study period, indicating a significant decline for the meadowlark and a negative but uncertain trend for the grebe (Fink et al., 2023; the tiger-heron and the martin were not analyzed).

The remaining three putatively declining species showed proportional declines similar to the overall decline in average length of observation periods and may therefore merely represent a bias in the dataset. The Gray-crowned Yellowthroat declined by 47%, the Ferruginous Pygmy-Owl by 43%, and the Rose-throated Becard by 35% (Table 2). The independent analysis of relative abundance in eBird data, mentioned in the previous paragraph, indicated a net increase for the pygmy owl and the becard but did not analyze the yellowthroat (Fink et al., 2023).

A review of the average annual frequencies (Annex 1) suggested that 10 species were absent or scarce in 2011 but then increased during the decade, potentially providing turnover in the bird communities by replacing disappearing species. I refer to these 10 as “presumed colonizers” because they seem to be attempting to colonize the valley, yet it is too early to be sure if they succeeded and, in some cases, the data may present misleading information. Five of these species increased early in the decade but then decreased notably and could be considered failed colonizers (Figure 9). The data from average weekly frequencies and average weekly bird counts generated similar graphs for all five, and Figure 9 shows graphs for the weekly frequencies (averaged for each year). These five species (Striped Cuckoo *Tapera naevia*, Common Gallinule *Gallinula galeata*, Purple Gallinule *Porphyrio martinica*, Limpkin *Aramus guarauna*, and Fork-tailed Flycatcher *Tyrannus savana*; Figure 10) seemingly failed to colonize, although one of them, the Purple Gallinule, seemed to be on the rise again in 2020, and a juvenile observed suggested a successful nesting. The Common Gallinule and Limpkin may have disappeared completely from the valley, after several years of frequent observations. The Limpkins probably produced young in 2015 when up to four individuals were observed.

Table 2. Average weekly counts, by year, for resident species with declining trends in frequency, and lower 2020 counts than 2011 counts.

Scientific name	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	% Change
Tachybaptus dominicus	4.5	6.0	6.5	4.5	1.9	0.6	0.6	1.3	0.5	0.3	-92
Columbina passerina	0.9	1.4	0.3	0.1	0.2	1.3	1.4	1.2	0.6	0.2	-75
Leptotila verreauxi	0.9	0.9	1.0	0.5	0.7	0.9	1.2	1.1	1.1	0.7	-31
Morococcyx erythropygus	1.1	1.2	0.4	0.2	0.3	1.4	2.6	1.4	1.2	0.7	-34
Chlorostilbon canivetii	0.2	0.2	0.1	0.1	0.0	0.3	0.3	0.1	0.2	0.1	-40
Jacana spinosa	3.9	5.1	5.4	3.6	3.1	3.5	4.6	4.8	4.9	3.0	-23.4
Tigrisoma mexicanum	0.6	0.9	0.9	1.1	1.1	0.1	0.3	0.3	0.1	0.1	-83.0
Cathartes aura	3.3	6.0	3.1	1.4	2.0	2.1	2.0	2.4	1.8	2.1	-35.3
Elanus leucurus	0.6	1.5	0.7	0.7	0.1	0.1	0.5	0.1	0.0	0.0	-96.7
Geranoaetus albicaudatus	0.4	0.4	0.1	0.0	0.1	0.3	0.4	0.4	0.2	0.4	-10.3
Tyto alba	0.2	0.6	0.2	0.3	0.4	0.1	0.4	0.3	0.1	0.1	-55.6
Glaucidium brasilianum	1.3	1.2	1.3	1.0	1.3	1.0	0.9	1.1	1.0	0.7	-43.4
Eumomota superciliosa	2.8	2.6	2.5	1.9	2.5	2.2	3.0	2.7	2.2	1.6	-42.0
Megaceryle torquata	0.3	0.6	0.4	0.2	0.2	0.2	0.3	0.6	0.1	0.2	-24.5
Chloroceryle amazona	0.6	1.1	0.8	0.6	0.3	0.6	0.6	0.6	0.6	0.4	-23.3
Brotogeris jugularis	0.5	0.7	0.4	0.0	0.0	0.1	0.0	0.1	0.1	0.0	-100
Eupsittula canicularis	1.3	0.9	0.3	0.0	0.1	1.2	1.4	1.8	1.3	1.1	-10.5
Pachyramphus aglaiae	2.6	2.7	2.4	1.6	1.8	1.7	2.0	2.1	1.6	1.7	-35.1
Elaenia flavogaster	0.9	1.1	0.8	0.4	0.3	0.5	0.5	0.5	0.2	0.8	-19.4
Cyclarhis gujanensis	1.4	1.5	1.2	0.8	0.8	1.4	2.0	1.4	1.4	1.2	-16.7
Progne chalybea	3.6	5.6	4.9	3.9	3.4	6.3	1.4	0.6	1.4	1.2	-65.9
Polioptila albiloris	0.4	0.2	0.0	0.2	0.0	1.3	1.7	1.3	1.1	0.3	-35.1
Thryophilus pleurostictus	0.0	0.0	0.0	0.5	0.0	0.1	0.0	0.1	0.1	0.0	-100.0
Cantorchilus modestus	2.6	2.6	1.8	1.2	1.5	1.6	2.7	3.1	2.6	1.8	-29.0
Peucaea ruficauda	0.5	1.1	0.2	0.5	0.3	1.0	1.1	1.1	0.7	0.4	-21.7
Sturnella magna	3.5	3.4	2.3	1.6	1.9	1.7	1.6	1.3	0.5	1.3	-61.5
Icterus pectoralis	1.7	1.7	1.4	1.0	1.2	1.6	1.5	1.3	0.9	1.3	-22.5
Molothrus aeneus	26.3	26.3	15.0	20.6	35.9	20.4	29.3	28.1	12.9	16.9	-35.7
Geothlypis poliocephala	1.9	2.0	1.2	0.9	0.8	1.0	0.9	0.8	0.4	1.0	-46.8
Basileuterus lachrymosus	0.1	0.1	0.0	0.1	0.1	0.0	0.0	0.0	0.0	0.0	-100.0

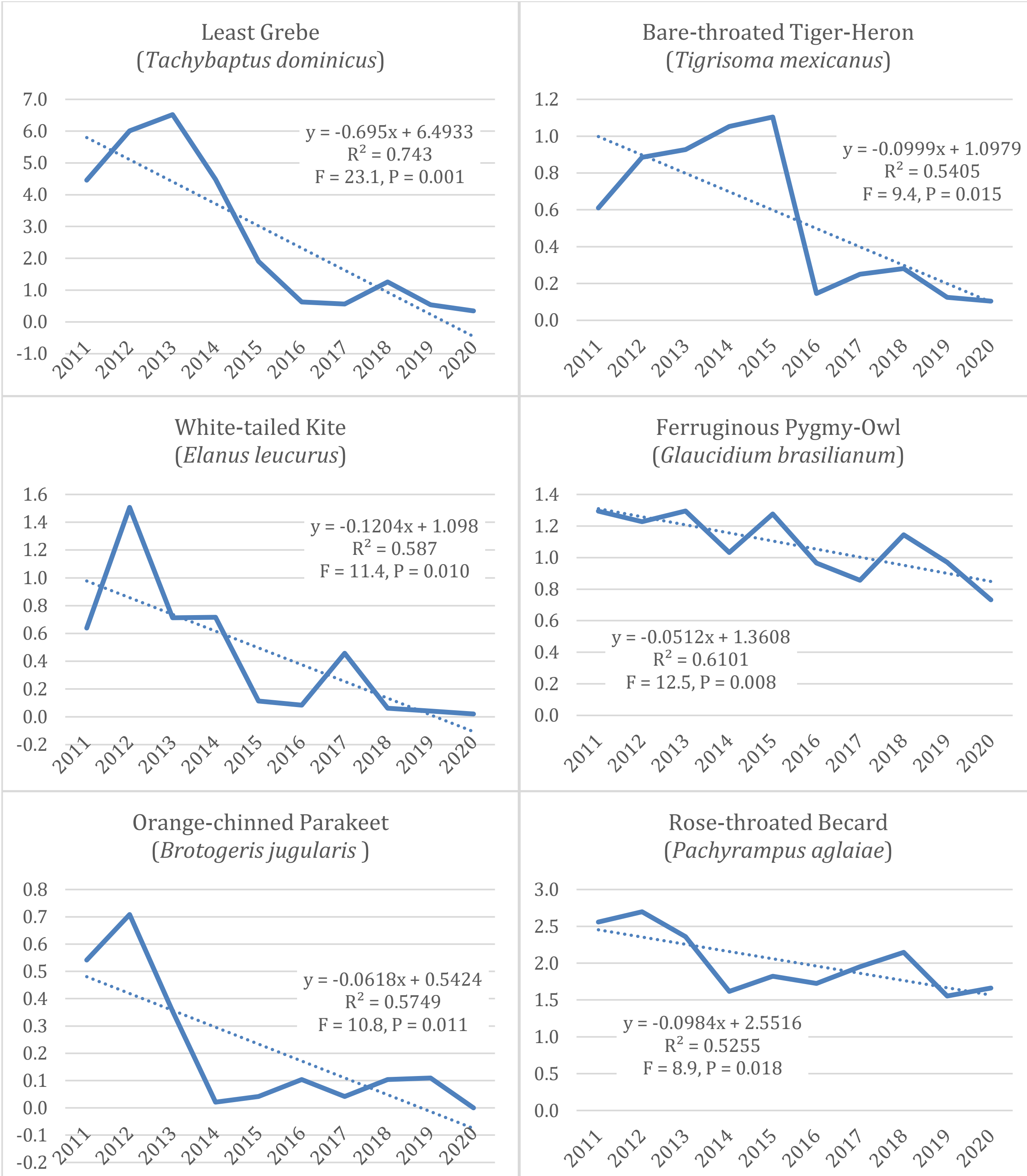

Figure 5. Linear regression results for six of the 10 species with significant declines in annual average weekly abundances (years, X axes; counts, Y axes) of bird species in the Yeguare Valley, Honduras.

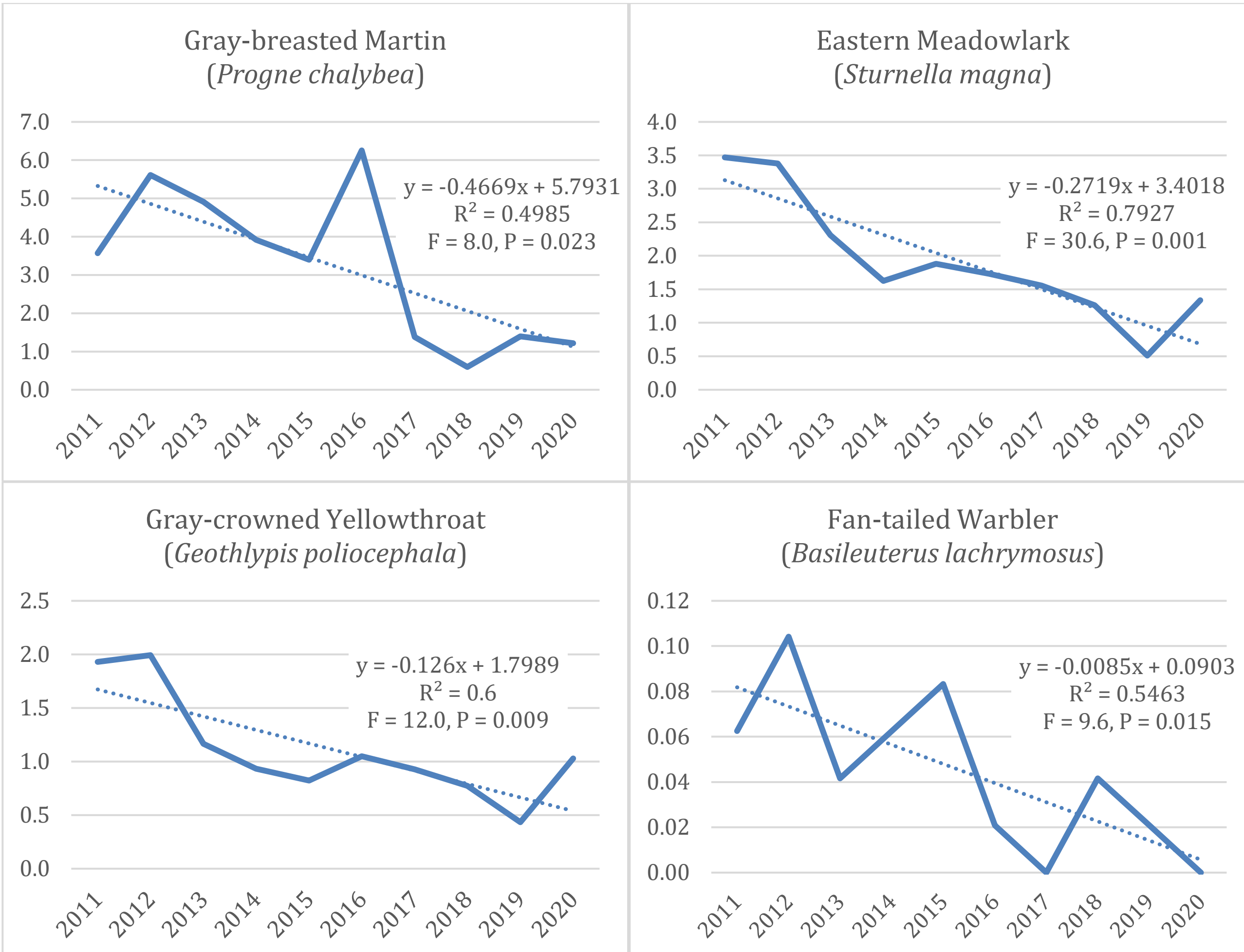

Figure 6. Linear regression results for four of the 10 species with significant declines in annual average weekly abundances (years, X axes; counts, Y axes) of bird species in the Yeguare Valley, Honduras.

Figure 7. Species extirpated from the Yeguare Valley during the decade of 2011–2020: White-tailed Kite *Elanus leucurus* (left), Orange-chinned Parakeet *Brotogeris jugularis* (center), and Fan-tailed Warbler *Basileuterus lachrymosus* (right). Photos by Oliver Komar.

Figure 8. Species that declined in the Yeguare Valley during 2011–2020: Least Grebe *Tachybaptus dominicus* (top left), Bare-throated Tiger-Heron *Tigrisoma mexicanum* (top right), Gray-breasted Martin *Progne chalybea* (bottom left), and Eastern Meadowlark *Sturnella magna* (bottom right). Photos by Oliver Komar.

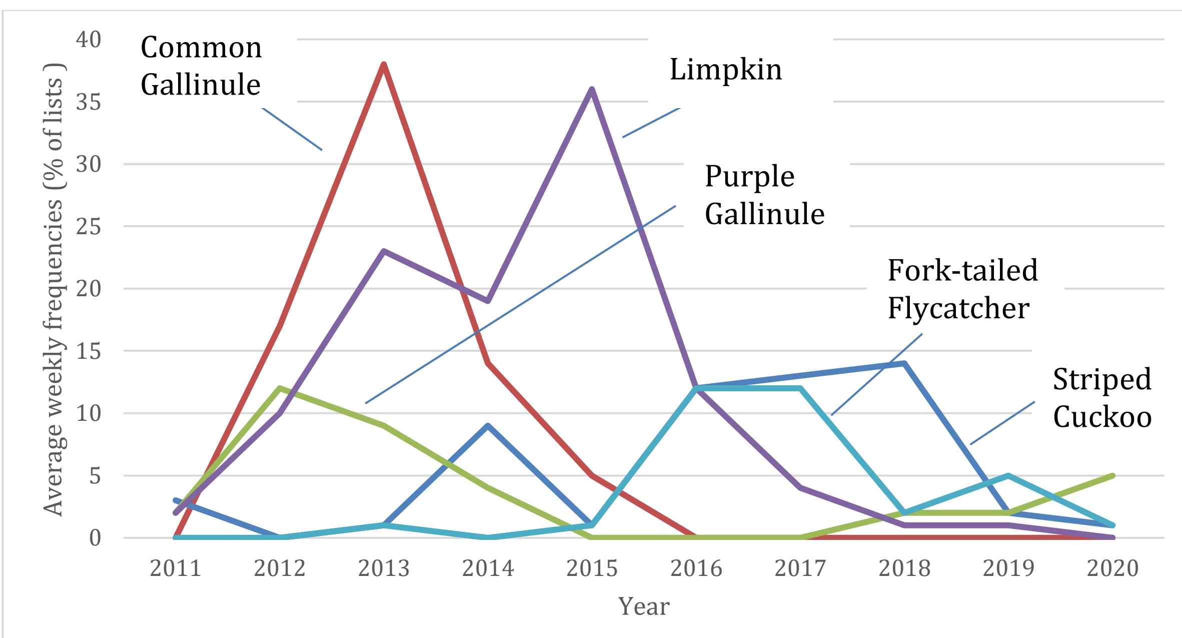

Figure 9. Line graphs of weekly frequencies, averaged by year, for five bird species that seemingly attempted to colonize the Yeguare Valley after 2011 but were extinct or nearly so by the end of the decade.

Figure 10. Species that attempted to colonize the Yeguare Valley after 2011 but failed: Common Gallinule *Gallinula galeata* (top left), Limpkin *Aramus guarauna* (top right), Fork-tailed Flycatcher *Tyrannus savanna* (bottom left), and Striped Cuckoo *Tapera naevia* (bottom right). Photos by Oliver Komar.

Another five presumed colonizers increased in observation frequency after the beginning of the decade and were still observed frequently by the end of the decade. I examined these five species further for patterns in their abundance (Table 3). The abundance also increased, and linear regressions indicated significant increasing trends in four of the five species (Figure 11). Only Harris's Hawk (*Parabuteo unicinctus*) was not significant, presumably because the assumption of normally distributed residuals was violated. Linearity improved by transforming the abundance data (square root transformation), but the null hypothesis could still not be rejected at the 0.05 level (P=0.075). Despite the non-significant linear regression, Harris's Hawk was notably absent during most of the decade, and a pair of young adults (still with some juvenile feathers) moved in during October of 2019 and stayed throughout 2020. Young were observed in 2021 and 2023, indicating local breeding, and adults and juveniles were still present at least through 2025. Bat Falcon (*Falco rufigularis*), reported throughout the year by the end of the decade, may be nesting in the mountains above the valley and only visit to hunt. Pairs have been seen in the nearby mountains whereas valley sightings have always been a single individual. The other three presumed colonizers (Lesson's Motmot, Acorn Woodpecker, and Masked Tityra) are breeding and seem to have stable or increasing populations. They may have been present, albeit in lower numbers, prior to the beginning of the study. The data in Table 3 suggest that three species, the Harris's Hawk, Acorn Woodpecker, and Bat Falcon (Figure 12), arrived in the study area during the decade.

In addition to the 10 species listed above as presumed colonizers, other species are occasionally detected and assumed to be dispersers from afar; they may also be attempting to colonize. For example, a migratory visitor has nested once, and two vagrants have visited the valley at least four and seven times, respectively, during the decade. The migratory visitor (an intra-tropical or altitudinal migrant) is the Elegant Euphonia. The euphonia is believed to be resident in the mountains near the valley.

Table 3. Average weekly counts, by year, for resident species that appeared early in the decade and increased in the Yeguare Valley, providing turnover in the bird community.

Scientific name	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Parabuteo unicinctus	0.00	0.00	0.04	0.00	0.00	0.00	0.00	0.00	0.09	0.87
Momotus lessonii	0.02	0.15	0.06	0.17	0.15	0.26	0.59	0.64	0.78	0.53
Melanerpes formicivorus	0.00	0.02	0.02	0.17	0.04	0.31	0.64	0.47	0.50	0.44
Falco rufigularis	0.00	0.00	0.00	0.02	0.00	0.00	0.00	0.11	0.06	0.21
Tityra semifasciata	0.13	0.04	0.18	0.45	0.38	0.47	0.54	0.67	0.70	0.79

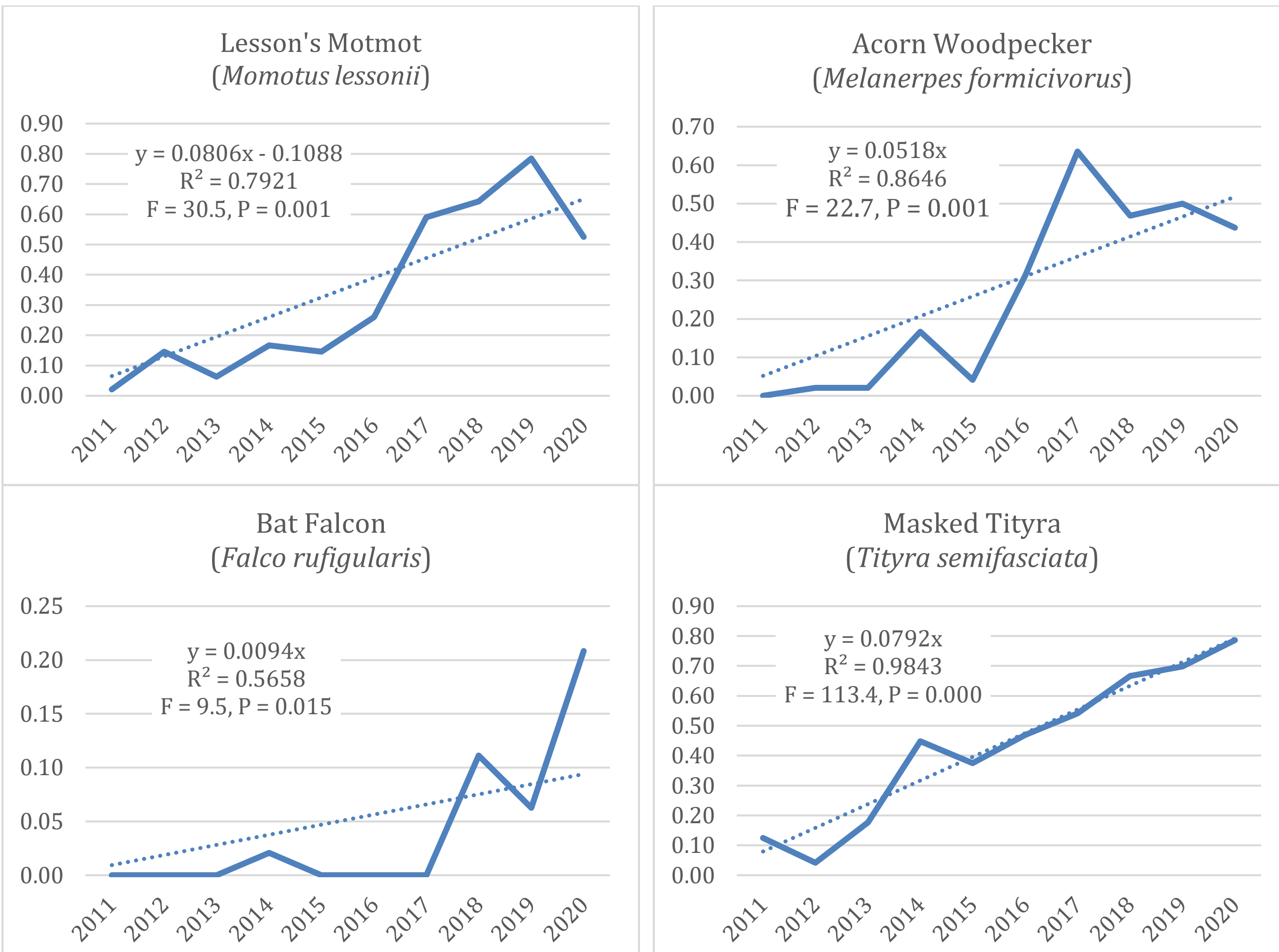

Figure 11. Significant increasing trends were found for relative abundance (average weekly counts, Y axes) of four bird species in the Yeguare Valley, during the decade (years, X axes).

In the vagrant category are Eurasian Collared-Dove (*Streptopelia decaocta*) and Crane Hawk (*Geranospiza caerulea*). The collared-dove, introduced from Europe to the Caribbean, has been expanding rapidly through Central America and is now nesting in multiple localities across Honduras (Fagan & Komar, 2016). A pair was present on campus at the time this article was in preparation, but nesting had not yet been confirmed. Two adult Crane Hawks but no juveniles were observed occasionally in the valley during 2019 and 2020 (and also in subsequent years), and they may represent a mated pair.

Discussion

The nature of eBird data presents both challenges and opportunities for data analysis and interpretation (Sánchez-Clavijo et al., 2021).

Figure 12. Three species that appeared to arrive in the study area during the decade: Harris's Hawk *Parabuteo unicinctus* (top), Acorn Woodpecker *Melanerpes formicivorus* (bottom left), and Bat Falcon *Falco rufigularis* (bottom right). Photos by Oliver Komar.

Opportunities include a large pool of data, that may be large enough to be robust to issues such as variation in observer abilities and unequal effort among observation data points. The challenges include discerning the biases in the data and using conservative analyses that are robust to those biases.

In the present study, raw data for more than half of all species indicated declines, either for frequency data or abundance data. Many of the apparent declines, however, could be explained by changing patterns of bird observation and use of eBird. Average time of observation periods became 46% shorter over the decade, leading to fewer species and lower counts per observation period, and overall declining frequencies and abundance counts. As the eBird platform gained popularity during the last decade, the number of platform users increased, and each new user may incorporate new biases into the data. Some new users were also inexperienced in bird identification and inadvertently would have decreased detections for some hard-to-identify species. After completing the present analysis, only seven species out of 60 with apparent declines were considered to present significant and real declines. While the apparent declines in 53 other species may be dismissed for the reasons stated earlier in this paragraph, it is also true that some declines may have gone unnoticed, masked by variation in the data. Similar analyses will become more reliable as larger data sets (number of eBird checklists) become available (Horns et al., 2018), for which reason the present study should be considered preliminary and repeated periodically.

Some of the variation in detection frequencies during the decade can be attributed to changing patterns of observation, even when the observers remained the same. For example, during 2012 and 2013, there were frequent visits to dry upland second-growth vegetation on the north side of the valley, and those were replaced by frequent visits to similar vegetation in the agroecological farm on the east side of the valley from 2016 to 2019. In 2020, neither area was visited frequently due in part to the pandemic that reduced academic activities with students in the field. Species that are mostly restricted to such vegetation, such as Common Ground Dove (*Columbina passerina*) and White-lored Gnatcatcher (*Polioptila albiloris*), may thus present data biased by observer behavior. Similarly, there were virtually no observations in the Masicarán dry forest reserve in 2020, which lowered relative frequencies to zero for species that are restricted to that reserve, namely Elegant Trogon (*Trogon elegans*) and Banded Wren (*Thryophilus pleurostictus*).

Possible causes for declines or increases

There were no obvious changes in the Yeguare Valley landscape, such as habitat loss, over the decade that would suggest a cause for the observed declines or increases. All of the data were collected in an agricultural landscape, including edges of small forest patches close to agricultural areas. Results might have been different if data were focused on the interiors of highly fragmented forest patches. While there may have been some increases in the use of toxic agrochemicals that might impact birds negatively, there has also been a general increase in environmental awareness that could counteract such impacts. The Zamorano University community has shifted towards environmental practices, increasing use of clean energy (solar power), composting, organic agriculture, agroecological practices, increasing research on sustainable agriculture, and generally moving towards a "greener" university with a reduced carbon footprint. This trend towards greater environmental awareness might translate into reduced threats to wild birds, which may facilitate future growth of some bird populations.

The effects of climate change over just 10 years would also be minimal and unlikely to cause significant change in bird populations. The university weather station in the Yeguare Valley indicated an increase in annual average temperature over the decade of this study of approximately 0.5°C, and no significant change in overall annual rainfall (Hernández Castro et al., 2021).

Four of the declining species have naturally low populations in the valley. These include a grebe (piscivore), a tiger-heron (piscivore), a kite (carnivore), and a parakeet (frugivore); the parakeet was at the fringe of its natural range. These species were sufficiently scarce so that their disappearances can be attributed to the Allee effect, low detectability, or just stochasticity.

The decline of the remaining species, all insectivores, is harder to explain. Was the decline due to a corresponding decline in food resources, or the ecological impact of competition or predation, or yet another reason? Insectivorous resident species are likely to have been impacted by pollution and non-point-source contamination, either directly such as by poisoning from agrochemicals, or indirectly by decreases in their prey base. The increasing use and toxicity of agricultural insecticides in many localities, and in recent decades, could lead to a decreasing supply of insects as food items (DiBartolomeis et al., 2019; Zhang, 2018). On the other hand, technical advances in precision agriculture may have reversed the trend in environmental impact of pesticides in recent years. Nonetheless, the possible overall decline of the insect food base should not be ignored. While insect population monitoring is not available for the Yeguare Valley, recent widespread declines of insect populations have been tied to climate change and modern agricultural practices (Janzen & Hallwachs, 2019; Sánchez-Bayo & Wyckhuys, 2019; Wagner, 2020), and it is likely that these declines are occurring in the Yeguare Valley as well.

Increases in predators, such as coyotes, feral or wild cats, snakes, or raptors may also have occurred, creating a trophic cascade effect impacting some insectivorous birds. In North America, raptors as a group, which include several species of avian predators, increased in recent decades (Rosenberg et al., 2019), in contrast to most other taxonomic avian groups which declined. Notably, two of the five resident species that increased in the Yeguare Valley are also raptors. The abundance of migratory, bird eating raptors such as Peregrine Falcon (*Falco peregrinus*) and Cooper's Hawk (*Accipiter cooperi*) also likely increased in the valley (migratory species were not analyzed in the present study). Increases in raptors and other predator populations may be attributed to better environmental education (less hunting, and more appreciation for the ecological value of predators), and to long-term reductions in the use of wildlife-harming pesticides, such as DDT.

There are many other possible explanations for declines that can be studied in the future. Boyle and Sigel (2015) suggested that birds of small body size are declining faster than birds of large body size. Bird declines in tropical landscapes are frequently attributed to habitat fragmentation, especially for forest understory insectivores (Cerezo Blandón et al., 2016; Şekercioğlu et al., 2002), ecological specialization (Sodhi et al., 2005; Visco et al., 2015), competition with non-native or invasive species (Clavero et al., 2009), and also to human hunting or persecution (Benítez-López et al., 2017).

Did threatened species decline?

Given that there are no large patches of natural habitat in the Yeguare Valley, there are few globally threatened resident birds in the valley. A single individual of the globally endangered Yellow-naped Amazon (*Amazona auropalliata*) was present in the valley during a few weeks in 2013, but it was probably a vagrant, or potentially escaped from captivity. The globally vulnerable Orange-fronted Parakeet (*Eupsittula canicularis*) was common in the valley in some years. Detection frequency for the parakeet in bird counts averaged 4.7% across the decade, ranging from 0 in 2014 to 18% in 2017. Abundance seems to be highly variable in the valley, and no trend was discernible. Nesting is not yet documented, but likely occurs. There is no evidence that the parakeets declined (or increased) over the decade.

In summary, the avian community of the Yeguare Valley seems to be in equilibrium; three species went locally extinct while three new species appeared during the decade, maintaining species richness of the resident bird community. The results presented herein reflect a single agricultural valley in a tropical dry forest ecosystem. Other localities or ecosystems may present different landscape dynamics, and thus present different changes in the resident bird populations. In addition to local landscape dynamics, resident bird populations may be affected by nearby landscapes, especially if they serve as sources of dispersers that could become colonizers or contribute to a rescue effect (Eriksson et al., 2014). Bird populations may also be affected directly or indirectly by climate change, although changes in temperature and rainfall patterns over a single decade are not likely to be large enough in Honduras to generate detectable changes in bird populations. Longer term studies will be needed to evaluate the effects of climate change on birds, or on the insects and plants that they depend on. The study demonstrated the potential of using eBird data for other regions of interest, or specific areas such as wildlife refuges or protected areas.

Acknowledgments

Nicholas Komar and three anonymous reviewers provided useful comments that improved the manuscript. Several observers contributed field data included in this analysis, by submitting their observations to the eBird citizen science platform; they are credited on their original data submissions. I am grateful to frequent field collaborators James Phelps, Arno Paul Stufkens, and Nic Zimmer.

References

Benítez-López, A., Alkemade, R., Schipper, A. M., Ingram, D. J., Verweij, P. A., Eikelboom, J. A., & Huijbregts, M. A. (2017). The impact of hunting on tropical mammal and bird populations. *Science, 356*(6334), 180–183. [Online]

Boyle, W. A, & Sigel, B. J. (2015). Ongoing changes in the avifauna of La Selva Biological Station, Costa Rica: twenty-three years of Christmas Bird Counts. *Biological Conservation, 188,* 11–21. [Online]

Cerezo Blandón, A., Perelman, S. B., Ramírez, M., López, A., Javier, O., & Robbins, C. S. (2016). Temporal bird community dynamics are strongly affected by landscape fragmentation in a Central American tropical forest region. *Biodiversity and Conservation, 25,* 311–330. [Online]

Clark, C. J. (2017). eBird records show substantial growth of the Allen's Hummingbird (*Selasphorus sasin sedentarius*) population in urban Southern California. *The Condor: Ornithological Applications 119*(1), 122–130. [Online]

Clavero, M., Brotons, L., Pons, P., & Sol, D. (2009). Prominent role of invasive species in avian biodiversity loss. *Biological Conservation 142*(10), 2043–2049. [Online]

Clements, J. F., Rasmussen, P. C., Schulenberg, T. S., Iliff, M. J., Fredericks, T. A., Gerbracht, J. A., Lepage, D., Spencer, A., Billerman, S. M., Sullivan, B. L., & Wood, C. L. (2023). *The eBird/Clements Checklist of Birds of the World: v2023*. [Online]

DiBartolomeis, M., Kegley, S., Mineau, P., Radford, R., & Klein, K. (2019). An assessment of acute insecticide toxicity loading (AITL) of chemical pesticides used on agricultural land in the United States. *PloS One 14*(8), e0220029. [Online]

Donald, P. F., Green, R. E., & Heath, M. F. (2001). Agricultural intensification and the collapse of Europe's farmland bird populations. *Proceedings of the Royal Society of London. Series B: Biological Sciences, 268*(1462), 25–29. [Online]

Dubón, F., Herrera, L., Juárez, R., Komar, O., Mejía, M., Rodríguez Vásquez, F., & van Dort, J. (2024). *Lista de las aves de Honduras*. Aves Honduras. Tegucigalpa, Honduras. [Online]

Eriksson, A., Elías-Wolff, F., Mehlig, B., & Manica, A. (2014). The emergence of the rescue effect from explicit within- and between-patch dynamics in a metapopulation. *Proceedings of the Royal Society B: Biological Sciences*, *281*(1780), 20133127. [Online]

Fagan, J., & Komar, O. (2016). *Peterson Field Guide to the Birds of Northern Central America*. Houghton Mifflin Harcourt, Boston.

Fink, D., Auer, T., Johnston, A., Strimas-Mackey, M., Ligocki, S., Robinson, O., Hochachka, W., Jaromczyk, L., Crowley, C., Dunham, K., Stillman, A., Davies, I., Rodewald, A., Ruiz-Gutierrez, V., & Wood, C. (2023). *eBird Status and Trends, Data Version: 2022*; Released: 2023. Cornell Lab of Ornithology, Ithaca, New York. [Online]

Hernández Castro, C. M., Henríquez, L., & Molina, J. (2021). Series de precipitación y temperatura en Zamorano: tendencias, proyección y relación con el cambio climático. Undergraduate thesis, Zamorano University, Honduras. [Online]

Horns, J. J., Adler, F. R., & Şekercioğlu, Ç. H. (2018). Using opportunistic citizen science data to estimate avian population trends. *Biological Conservation, 221,* 151–159. [Online]

IUCN. (2023). *The IUCN Red List of Threatened Species. Version 2023-1*. [Online]

Janzen, D. H., & Hallwachs, W. (2019). Perspective: Where might be many tropical insects? *Biological Conservation 233*, 102–108. [Online]

Patten, M. A., Gómez de Silva, H., & Smith-Patten, B. D. (2010). Long-term changes in the bird community of Palenque, Chiapas, in response to rainforest loss. *Biodiversity and Conservation, 19*, 21–36. [Online]

Rigal, S., Dakos, V., Alonso, H., Auniņš, A., Benkő, Z., Brotons, L., Chodkiewicz, T., Chylarecki, P., de Carli, E., Del Moral, J. C., & Domşa, C. (2023). Farmland practices are driving bird population decline across Europe. *Proceedings of the National Academy of Sciences, 120*(21), e2216573120. [Online]

Robinson, W. D. (2001). Changes in abundance of birds in a Neotropical forest fragment over 25 years: a review. *Animal Biodiversity and Conservation, 24*(2), 51–65. [Online]

Rosenberg, K. V., Dokter, A. M., Blancher, P. J., Sauer, J. R., Smith, A. C., Smith, P. A., Stanton, J. C., Panjabi, A., Helft, L., Parr, M., & Marra, P. P. (2019). Decline of the North American avifauna. *Science, 366*(6461), 120–124. [Online]

Sánchez-Bayo, F., & Wyckhuys, K. A. (2019). Worldwide decline of the entomofauna: A review of its drivers. *Biological Conservation, 232,* 8–27. [Online]

Sánchez-Clavijo, L. M., Martínez-Callejas, S. J., Acevedo-Charry, O., Diaz-Pulido, A., Gómez-Valencia, B., Ocampo-Peñuela, N., Ocampo, D., Olaya-Rodríguez, M. H., Rey-Velasco, J. C., Soto-Vargas, C., & Ochoa-Quintero, J. M. (2021). Differential reporting of biodiversity in two citizen science platforms during COVID-19 lockdown in Colombia. *Biological Conservation, 256*, 109077. [Online]

Şekercioğlu, Ç. H., Ehrlich, P. R., Daily, G. C., Aygen, D., Goehring, D., & Sandí, R. F. (2002). Disappearance of insectivorous birds from tropical forest fragments. *Proceedings of the National Academy of Sciences, 99*(1), 263–267. [Online]

Sodhi, N. S., Lee, T. M., Koh, L. P., & Dunn, R. R. (2005). A century of avifaunal turnover in a small tropical rainforest fragment. *Animal Conservation, 8*(2), 217–222. [Online]

Stanton, R. L., Morrissey, C. A., & Clark, R. G. (2018). Analysis of trends and agricultural drivers of farmland bird declines in North America: A review. *Agriculture, Ecosystems & Environment, 254,* 244–254. [Online]

Sullivan, B. L., Wood, C. L., Iliff, M. J., Bonney, R. E., Fink, D., & Kelling, S. (2009). eBird: a citizen-based bird observation network in the biological sciences. *Biological Conservation, 142*, 2282–2292. [Online]

Wagner, D. L. (2020). Insect declines in the Anthropocene. *Annual Review of Entomology, 65,* 457–480. [Online]

Visco, D. M., Michel, N. L., Boyle, W. A., Sigel, B. J., Woltmann, S., & Sherry, T. W. (2015). Patterns and causes of understory bird declines in human-disturbed tropical forest landscapes: A case study from Central America. *Biological Conservation, 191,* 117–129. [Online]

Zhang, W. (2018). Global pesticide use: Profile, trend, cost/benefit and more. *Proceedings of the International Academy of Ecology and Environmental Sciences, 8*(1), 1–27. [Online]

Annexes

Annex 1. Average weekly frequencies (% of lists with species present), by year, for 109 resident bird species from bird counts reported to eBird, for three eBird hotspots in the Yeguare Valley, combined. Species are listed in taxonomic order.

English name	Scientific name	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	Decade
Black-bellied Whistling-Duck	*Dendrocygna autumnalis*	52	69	57	59	54	30	35	39	29	35	39.6
Muscovy Duck	*Cairina moschata*	49	66	67	60	60	36	41	42	25	40	43.0
Crested Bobwhite	*Colinus cristatus*	50	56	47	40	38	45	38	37	32	39	40.1
Least Grebe	*Tachybaptus dominicus*	43	57	60	61	42	11	9	19	8	7	22.8
Red-billed Pigeon	*Patagioenas flavirostris*	8	5	4	2	3	16	20	8	4	6	7.0
Inca Dove	*Columbina inca*	69	77	67	62	54	72	81	65	64	80	71.8
Common Ground Dove	*Columbina passerina*	8	19	10	3	3	22	32	11	8	4	10.4
Ruddy Ground Dove	*Columbina talpacoti*	70	80	65	66	67	56	50	57	60	67	66.9
White-tipped Dove	*Leptotila verreauxi*	41	33	36	15	17	29	43	30	21	14	22.3
White-winged Dove	*Zenaida asiatica*	73	83	73	78	71	80	78	83	76	85	83.2
Groove-billed Ani	*Crotophaga sulcirostris*	75	81	69	65	59	72	78	63	46	66	65.1
Striped Cuckoo	*Tapera naevia*	3	0	1	9	1	12	13	14	2	1	5.5
Lesser Ground-Cuckoo	*Morococcyx erythropygus*	32	14	10	6	3	24	31	16	13	9	13.8
Squirrel Cuckoo	*Piaya cayana*	40	52	43	43	32	37	51	49	40	27	40.1
Common Pauraque	*Nyctidromus albicollis*	2	3	4	0	9	4	5	8	4	4	4.7
Plain-capped Starthroat	*Heliomaster constantii*	2	4	4	0	3	2	1	1	1	0	1.1
Canivet's Emerald	*Chlorostilbon canivetii*	4	8	11	3	0	7	8	1	3	2	4.2
Cinnamon Hummingbird	*Amazilia rutila*	48	65	55	53	35	43	53	56	44	35	48.7
Common Gallinule	*Gallinula galeata*	0	17	38	14	5	0	0	0	0	0	3.9
Purple Gallinule	*Porphyrio martinica*	2	12	9	4	0	0	0	2	2	5	2.9
Ruddy Crake	*Laterallus ruber*	22	18	18	6	8	3	19	28	9	10	12.4
Limpkin	*Aramus guarauna*	2	10	23	19	36	12	4	1	1	0	8.2
Northern Jacana	*Jacana spinosa*	56	71	74	66	50	37	34	37	26	35	40.9
Wood Stork	*Mycteria americana*	13	24	22	21	27	18	8	10	1	7	11.6
Anhinga	*Anhinga anhinga*	26	52	60	48	46	31	35	25	11	9	26.2
Neotropic Cormorant	*Nannopterum brasilianum*	31	51	63	56	48	21	33	36	20	16	32.2

English name	Scientific name	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	Decade
Bare-throated Tiger-Heron	*Tigrisoma mexicanum*	31	37	43	32	30	3	6	5	6	2	13.1
Green Heron	*Butorides virescens*	43	49	62	51	35	25	34	40	23	30	32.9
Black Vulture	*Coragyps atratus*	76	89	82	76	76	83	83	87	66	79	81.3
Turkey Vulture	*Cathartes aura*	64	63	54	41	44	61	52	51	45	46	50.2
White-tailed Kite	*Elanus leucurus*	29	51	31	16	2	4	15	1	0	1	9.2
Common Black Hawk	*Buteogallus anthracinus*	18	29	26	12	13	10	21	18	8	8	13.6
Roadside Hawk	*Rupornis magnirostris*	1	3	0	1	0	11	19	11	5	1	4.9
Harris's Hawk	*Parabuteo unicinctus*	0	0	2	0	0	0	0	0	2	21	4.2
White-tailed Hawk	*Geranoaetus albicaudatus*	12	16	5	2	3	5	11	5	3	5	5.9
Gray Hawk	*Buteo plagiatus*	21	18	28	16	19	20	33	31	33	21	26.1
Short-tailed Hawk	*Buteo brachyurus*	4	1	3	0	1	2	5	2	4	3	2.4
Zone-tailed Hawk	*Buteo albonotatus*	23	15	14	6	8	14	9	7	5	8	8.0
Barn Owl	*Tyto alba*	2	10	1	4	8	1	7	4	0	0	3.3
Pacific Screech-Owl	*Megascops cooperi*	0	1	0	4	2	0	1	8	0	0	1.6
Great Horned Owl	*Bubo virginianus*	1	0	1	2	2	1	0	0	2	0	0.8
Ferruginous Pygmy-Owl	*Glaucidium brasilianum*	42	51	47	36	38	30	26	26	23	13	28.7
Elegant Trogon	*Trogon elegans*	0	0	0	3	1	0	0	0	0	0	0.4
Lesson's Motmot	*Momotus lessonii*	1	8	1	3	3	9	17	15	19	9	10.5
Turquoise-browed Motmot	*Eumomota superciliosa*	60	78	56	55	58	58	75	63	54	44	56.2
Ringed Kingfisher	*Megaceryle torquata*	13	28	25	11	8	10	7	14	2	4	8.5
Amazon Kingfisher	*Chloroceryle amazona*	27	41	33	21	13	16	19	11	8	9	14.6
Green Kingfisher	*Chloroceryle americana*	28	42	29	20	17	15	26	22	12	13	18.2
Acorn Woodpecker	*Melanerpes formicivorus*	0	1	1	5	2	7	10	6	4	6	3.6
Golden-fronted Woodpecker	*Melanerpes aurifrons*	70	80	71	63	76	71	75	80	71	78	79.0
Collared Forest-Falcon	*Micrastur semitorquatus*	3	11	0	0	4	0	1	1	0	1	1.6
Crested Caracara	*Caracara cheriway*	55	79	61	57	52	49	58	60	45	63	57.3
Laughing Falcon	*Herpetotheres cachinnans*	3	5	10	3	10	18	23	12	6	6	8.9
American Kestrel	*Falco sparverius*	30	44	31	32	22	21	11	11	8	19	19.3
Bat Falcon	*Falco rufigularis*	0	0	0	0	0	0	2	1	1	3	1.3
Peregrine Falcon	*Falco peregrinus*	2	3	0	3	2	4	0	0	3	3	2.0

English name	Scientific name	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	Decade
Orange-chinned Parakeet	*Brotogeris jugularis*	1	5	3	0	0	0	1	2	1	0	1.3
White-fronted Amazon	*Amazona albifrons*	49	44	40	43	33	32	34	35	36	31	38.0
Orange-fronted Parakeet	*Eupsittula canicularis*	9	2	3	0	1	7	18	7	5	3	4.7
Green (Red-throated) Parakeet	*Psittacara holochlorus*	16	7	7	1	7	14	4	16	13	7	10.6
Barred Antshrike	*Thamnophilus doliatus*	40	45	32	26	20	39	58	33	24	27	30.0
Masked Tityra	*Tityra semifasciata*	6	1	6	12	9	12	16	11	9	8	9.0
Rose-throated Becard	*Pachyramphus aglaiae*	52	55	51	39	34	35	50	46	40	34	41.3
Common Tody-Flycatcher	*Todirostrum cinereum*	49	60	61	51	40	31	39	42	34	42	42.0
Yellow-olive Flatbill	*Tolmomyias sulphurescens*	26	26	21	8	9	18	42	27	20	14	18.2
Northern Beardless-Tyrannulet	*Camptostoma imberbe*	34	21	23	15	6	27	39	26	22	22	20.9
Yellow-bellied Elaenia	*Elaenia flavogaster*	37	28	21	12	5	10	14	13	4	15	13.1
Tropical Pewee	*Contopus cinereus*	18	11	11	1	2	4	19	12	9	8	8.9
Black Phoebe	*Sayornis nigricans*	11	6	5	8	4	6	13	15	12	5	8.6
Dusky-capped Flycatcher	*Myiarchus tuberculifer*	11	24	25	6	8	12	30	13	15	12	14.2
Nutting's Flycatcher	*Myiarchus nuttingi*	29	33	24	18	11	16	29	19	20	16	18.3
Brown-crested Flycatcher	*Myiarchus tyrannulus*	12	19	1	0	0	7	9	4	1	6	4.9
Great Kiskadee	*Pitangus sulphuratus*	73	86	74	68	65	75	80	79	73	81	79.4
Boat-billed Flycatcher	*Megarynchus pitangua*	64	64	47	45	42	51	62	61	65	54	60.2
Social Flycatcher	*Myiozetetes similis*	75	86	68	71	71	74	78	82	86	83	83.7
Sulphur-bellied Flycatcher	*Myiodynastes luteiventris*	29	28	23	17	17	18	20	22	24	25	23.2
Tropical Kingbird	*Tyrannus melancholicus*	72	91	76	71	73	66	59	75	68	77	76.7
Fork-tailed Flycatcher	*Tyrannus savana*	0	0	1	0	1	12	12	2	5	1	3.1
Rufous-browed Peppershrike	*Cyclarhis gujanensis*	53	41	39	23	17	38	56	38	21	18	29.5
White-throated Magpie-Jay	*Calocitta formosa*	16	21	24	29	21	26	31	26	16	12	21.0
Gray-breasted Martin	*Progne chalybea*	49	68	55	45	41	32	25	14	9	17	27.5
White-lored Gnatcatcher	*Polioptila albiloris*	6	5	0	3	1	20	29	12	10	3	8.2
Rufous-naped Wren	*Campylorhynchus rufinucha*	74	79	72	72	64	79	86	78	79	88	83.5
Banded Wren	*Thryophilus pleurostictus*	2	0	1	3	1	1	0	1	0	0	0.8
Cabanis's Wren	*Cantorchilus modestus*	57	61	55	42	38	34	52	56	40	39	44.0

English name	Scientific name	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	Decade
Tropical Mockingbird	*Mimus gilvus*	10	15	20	9	20	16	8	6	7	16	11.6
Clay-colored Thrush	*Turdus grayi*	72	90	76	81	81	81	86	85	88	89	89.2
House Sparrow	*Passer domesticus*	60	73	63	53	57	38	39	34	19	38	41.2
Scrub Euphonia	*Euphonia affinis*	70	63	58	55	53	68	69	77	72	71	71.6
Lesser Goldfinch	*Spinus psaltria*	36	39	36	27	31	21	30	23	21	29	25.9
Stripe-headed Sparrow	*Peucaea ruficauda*	7	7	4	4	2	15	16	11	4	4	6.9
Eastern Meadowlark	*Sturnella magna*	59	72	57	52	44	29	27	21	12	19	31.1
Yellow-billed Cacique	*Amblycercus holosericeus*	26	39	30	16	16	22	42	26	20	13	21.7
Streak-backed Oriole	*Icterus pustulatus*	41	45	42	23	31	33	43	36	42	30	35.5
Spot-breasted Oriole	*Icterus pectoralis*	47	43	43	31	25	44	46	37	18	25	30.7
Altamira Oriole	*Icterus gularis*	47	48	37	27	32	32	33	34	32	27	33.6
Bronzed Cowbird	*Molothrus aeneus*	58	64	53	49	43	39	43	39	21	29	38.4
Melodious Blackbird	*Dives dives*	60	82	59	57	64	71	79	80	79	79	78.3
Great-tailed Grackle	*Quiscalus mexicanus*	72	89	79	75	72	73	67	69	67	78	77.6
Gray-crowned Yellowthroat	*Geothlypis poliocephala*	51	60	37	38	26	25	24	17	7	20	24.6
Fan-tailed Warbler	*Basileuterus lachrymosus*	2	6	3	3	2	1	0	1	0	0	1.2
Chestnut-capped Warbler	*Basileuterus delattrii*	11	12	2	4	6	27	47	23	17	12	15.8
Blue Grosbeak	*Passerina caerulea*	18	24	18	18	14	20	20	16	8	21	16.1
Blue-gray Tanager	*Thraupis episcopus*	45	46	47	40	37	32	35	50	50	48	46.1
Yellow-winged Tanager	*Thraupis abbas*	38	43	36	27	34	30	35	39	38	29	35.8
Blue-black Grassquit	*Volatinia jacarina*	61	69	47	47	44	53	47	49	34	47	47.2
Morelet's Seedeater	*Sporophila morelleti*	44	48	37	32	34	32	32	43	25	42	37.2
Black-headed Saltator	*Saltator atriceps*	46	52	43	36	38	40	50	49	48	37	45.5
Cinnamon-bellied Saltator	*Saltator grandis*	64	71	63	53	62	60	71	71	70	67	67.6
SPECIES COUNT		**102**	**103**	**104**	**103**	**105**	**104**	**102**	**105**	**106**	**103**	**109**
Bird counts (lists)		**72**	**117**	**81**	**118**	**138**	**174**	**149**	**250**	**341**	**393**	**1833**