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Knowledge Gaps or Change of Distribution Ranges? Explaining New Records of Birds in the Ecuadorian Tumbesian Region of Endemism

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Abstract: The change in the distribution range is a common response of various species facing the effects of anthropogenic global change. We used new distribution records of birds reported during the last two decades from the Ecuadorian part of the Tumbesian region (western Ecuador and northwestern Peru) available through a bibliographic review, together with our own field data collected during 2014–2019, and generated a methodology that explored whether these new reports are likely due to knowledge gaps or changes in the distribution range. We classified the species with new records as either *Change of distribution range*, *Likely change of distribution range*, *Accidental*, *Knowledge gap*, or *Undetermined* based on information about the distribution area, species conspicuousness, and dynamics of the records in the new location. We gathered data for 46 bird species newly reported in the Ecuadorian Tumbesian region in the last two decades. Of this, 35% of species were classified as *Accidental*, 24% as *Knowledge gaps*, 22% as *Change of distribution range*, 15% as *Undetermined*, and 4% as *Likely change of distribution range*. Species classified as *Change of distribution range* were mostly aquatic. Terrestrial species were mostly classified as *Knowledge gap*, while aquatic species were mostly classified as *Accidental*. Our protocol was validated using species which are known to have modified their distribution range in the Palearctic region, all of which were correctly classified by our methodology. The proposed method was precise and easy to apply and will allow us to better understand how species respond to anthropogenic global change, especially in areas where long-term studies are scarce, such as in tropical areas.

Keywords: distribution; dry tropical forest; Ecuador; global change; species movement

1. Introduction

Anthropogenic global change is considered one of the greatest threats to biodiversity on the planet [1–4]. For instance, the current extinction rate of birds is at least 1000 times higher than the background rate of species extinctions [5]. However, species are able to develop multiple strategies in response to global change, including modifications in their distribution range [6–9]. Changes in the distribution of a species can be the result of extinction in the areas affected by strong environmental modifications, and/or movements towards areas that maintain favorable

conditions [10–12]. Quantifying the extent of the species' response to prevailing environmental conditions is essential to develop effective conservation actions [13].

Birds are considered efficient indicators of global change [14]. Several studies have shown that multiple bird species are moving towards the poles and at higher elevations, which fits the theoretical predictions of global warming effects [12,15,16]. However, most of these studies have been carried out in North America [17–21] and Europe [22–26], with hardly any such information available for the Neotropics [12,27,28], one of the most species-rich regions of the world. The scarcity of long-term studies in the Neotropical region [29] limits our capacity to understand how species are coping with the global climate change in this region [30].

The changes brought on by global warming are predicted to be less severe in tropical than temperate regions [16,31]. However, species in the tropical environments usually have higher levels of specialization, which increases their sensitivity to global warming effects [7,12,32,33]. Niche specialization is particularly high in the seasonally dry tropical forests, where species have developed unique strategies to tolerate the stressful climatic conditions [34].

Located in western Ecuador and northwestern Peru, the Tumbesian region is one of the areas with the highest concentration of endemic species in the world [35]. Unfortunately, it is also facing numerous conservation threats, as a consequence of an intense anthropogenic disturbance associated to agriculture expansion, urbanization, and tree logging [36–39]. Additionally, it is expected that the tropical dry forests of South America will be strongly affected by global warming due to the predicted reduction in precipitation [40]. This situation has prompted a surge in the interest of researchers in this region, resulting in an increase in the number of scientific studies involving several taxa. Among them, the birds have received a special emphasis [41]. For example, knowledge of distribution of birds in the Tumbesian region has increased during the last years e.g., [42–51], and reports of new records are becoming more common e.g., [42,44,52–54]. Although this seems to be an expected consequence of the increase in research, some authors suggest that these new records may be an evidence of changes in distribution ranges of species, triggered by the anthropogenic global change [20,21,55]. For instance, there are reports of the presence of aquatic birds in Ecuador in areas where they historically have never been recorded [56–62].

Based on new ornithological records reported in the Tumbesian region, we propose a methodological protocol that allows exploring to what extent records of a species in a new location can be explained by knowledge gaps, or by actual changes in the distribution range of a species. Specifically, we are interested in: (1) Generating a methodological protocol that can be used to explore the nature of new records of a species within a given region, (2) using this protocol to classify new bird records reported the last two decades in the Ecuadorian part of the Tumbesian region, and (3) evaluating if the classification of species is associated with their habitat (terrestrial or aquatic).

2. Materials and Methods

2.1. Study Area

The Tumbesian region comprises a narrow strip of land between the Pacific Ocean and the Andes, covering 87,000 km² of southwestern Ecuador and the extreme northwest of Peru. This region covers generally altitudes from sea level to 2000 m above sea level (a.s.l.), although it reaches at some points maximum altitudes of 3000 m a.s.l. [35] (Figure 1). The climate is characterized by a distinct seasonality, with a rainy season of five months (January–May), when 80% of the annual rainfall occurs, followed by a dry period that lasts for the rest of the year, with less than 10 mm monthly precipitation [63].

The Tumbesian region is one of the areas with the highest bird endemism worldwide (EBA) [64,65]. However, this region is seriously threatened, only approx. 29% of the original dry forest extent remains in the Ecuadorian part of the Tumbesian region [66].

Figure 1. Map of the Tumbesian region and the canton Zapotillo in the province of Loja, Ecuador.

2.2. Sampling and Data Collection

Through bibliographic review and field work, we collected information on new records of birds in the Ecuadorian part of the Tumbesian region in the last two decades. Bibliographic records of bird species reported for Ecuador in the Tumbesian region were compiled from the Ecuadorian Committee of Ornithological Records (CERO) [67–69], which has gathered new or unusual records of bird species in Ecuador in the last two decades. Additionally, we included publications of new records in Zapotillo canton and Loja province, resulting from our own fieldwork. Fieldwork data was part of a long-term research program, conducted in the southwestern dry forests of Ecuador starting in 2014, and includes bird studies using captures with mist nets, point count observations, and random records.

2.3. Category Assignment

After generating a database including all the new bird species records in the Ecuadorian part of the Tumbesian region for the last two decades, each species was assigned a category based on interpolating values of three indicators: *Distribution Area*, *Conspicuousness*, and *Recording Dynamics*.

Distribution Area: Evaluates two aspects of the spatial location of the new record. Unusual and abnormal records may denote changes in environmental or habitat conditions. The distribution criteria evaluates if the report is in the elevation, longitude, and latitude range known for the species. The habitat criteria assigns new reports as usual or unusual based on Ridgely and Greenfield [70] and del Hoyo et al. [71], taking into account the known type of habitat inhabited by the species.

Conspicuousness: This indicator was also based on two criteria, abundance and detectability of the species. We expected that those species naturally more abundant will be more likely to be registered than species with smaller population sizes. We classified the species as abundant or rare according to Ridgely and Greenfield [72] and McMullan and Navarrete [73]. A species was considered abundant

when in the literature reference it was classified as quite common, common, or abundant; otherwise, it was considered as rare. Additionally, detectability was assessed in relation to plumage color patterns, vocalizations, or behavior for both genders or for at least one. For example, species with intense colors are likely to have a higher detectability than species with bland or cryptic colors. Based on this, each species was classified as highly detectable or poorly detectable. We used bibliography [70,72,73] for determining levels of detectability. We assumed that, if the species is highly detectable and/or with high abundance, its *conspicuousness* increases.

Dynamic of Records: Evaluates if the records of a species in a given location are unique and scarce, or if there is a pattern of a temporary increase in the number of records. The information about dynamics of records was obtained from Ridgely and Greenfield [70,72], Freile et al. [67], Nilsson et al. [68], Ordoñez-Delgado et al. [42], Freile et al. [69], McMullan and Navarrete [73], and eBird [74]. The increase in the number of records could be associated with a process of colonization of new areas and, therefore, it would be an indication that the species is moving. However, an increase in records can also be associated with an increase in the number of studies (see Table 1 for a more specific description of each indicator).

Table 1. Description of the indicators and criteria used for the classification of the new records of birds reported in the Ecuadorian part of the Tumbesian region in the last two decades.

Indicator Criteria	Description	Groups
Distribution area		
<i>Habitat</i>	Habitat type in which the new records appear	<u>Usual</u> : When the new record appears in a habitat known to be used by the species <u>Unusual</u> : When the new record appears in a rare or unusual habitat for the species
<i>Distribution</i>	Spatial location of the new records	<u>Normal</u> : When the new record is located within latitudinal, longitudinal and altitudinal boundaries of the distribution range reported for the species <u>Atypical</u> : When new record is located at an altitude, longitude or latitude outside the boundaries of the distribution range reported for the species
Conspicuousness		
<i>Abundance</i>	Abundance of the species in the country	<u>Rare</u> : When the species is considered as unusual, rare, incidental, accidental or hypothetical for the country <u>Abundant</u> : When the species is considered as quite common, common or abundant for the country
<i>Detectability</i>	The ease with which the species can be detected and/or the possibility of misidentifications	<u>High</u> : When the species is easy to detect and/or with low probability of being confused with other species that occur in the habitat where it was recorded. A species is highly detectable when it has behaviors or colors that facilitate visualization, and is easy to observe or hear (e.g., <i>Phoenicopterus chilensis</i> , <i>Aramus guarauna</i> or <i>Elanus leucurus</i>) <u>Low</u> : When the species is difficult to detect and/or has high probability of being confused with other species that occur in the habitat where it was recorded. These are species which usually remain hidden and are difficult to observe or hear. In other cases, species with similar morphology or vocalizations occur at the location where it was recorded, and may be misidentified (e.g., <i>Calidris</i> sp. or many tiranids)
Dynamics of records		
<i>Dynamic</i>	Number of records of the species at the new location	<u>Scarce</u> : When the species has few records in the area/habitat where new records have been reported and records are not increasing over time <u>Increasing</u> : When records have been increasing in the area/habitat where the species has been found in recent years

The relationship among the proposed indicators allowed us to make a classification protocol of new records into five categories: *Change of distribution range*, *Likely change of distribution range*, *Accidental*, *Knowledge gap*, and *Undetermined*. (1) *Change of distribution range*: Species which occur in an unusual *distribution area* have a high *conspicuousness* and whose records are increasing over time. Our rationale is that if a species can be easily recorded, its possibility of not having been detected before is low. Therefore, finding it in unusual sites is a strong indication that the new record represents a change of distribution. (2) *Likely change of distribution range*: The *distribution area* and *record dynamics* indicators are the same as for the previous category, but species *conspicuousness* is low. Therefore, a species in this category may have gone unnoticed, and we cannot assure that it belongs to the category *change of distribution range*. (3) *Accidental*: In this category the first two criteria are the same as in the *change of distribution range*, which is important to ensure that this species doesn't go unnoticed, but in the criteria of *record dynamics* the records of the species in the new area are scarce and do not show an increase over time. (4) *Knowledge gap*: These are species with new records within a known distribution range. In most cases these are species with low *conspicuousness*, mainly due to both low detectability and abundance, for which they can easily go undetected for long periods. However, in some cases these species have low detectability but their populations can be abundant and their records scarce or increasing. (5) *Undetermined*: In this category we included species with records in unusual *distribution area*, low *conspicuousness*, and scarce *dynamics of records*, which can justify why they had gone unnoticed until recently. Species records within normal distribution range, with high *conspicuousness* and increasing records are very unlikely, unless they were species which were locally extinct and with a recent recolonization. Nonetheless, that is not the object of this study (see Tables 2 and 3).

Table 2. Possible combinations of criteria resulting from different indicators used to assign species into categories of new records of birds in the Ecuadorian part of the Tumbesian region in the last two decades.

Criteria		Indicator
<i>Habitat</i>	<i>Distribution</i>	Distribution area
Usual	Normal	Normal
Usual	Atypical	Unusual
Unusual	Normal	Unusual
Unusual	Atypical	Unusual
<i>Abundance</i>	<i>Detectability</i>	Conspicuousness
Abundant	High	High
Abundant	Low	High
Rare	High	High
Rare	Low	Low

Table 3. Combinations of indicators used to classify species into different categories for the new records of birds in the Ecuadorian part of the Tumbesian region in the last two decades.

Distribution Area	Conspicuousness	Recording Dynamics	Category
Unusual	High	Scarce	Accidental
Unusual	High	Increasing	Change of distribution range
Unusual	Low	Scarce	Undetermined
Unusual	Low	Increasing	Likely Change of distribution range
Normal	High	Increasing	Does not apply, unlikely
Normal	Low	Increasing	Knowledge gap
Normal	High	Scarce	Knowledge gap
Normal	Low	Scarce	Knowledge gap

After classifying the species in the categories explained above, we divided them into terrestrial and aquatic species. A Chi-Square test was used to evaluate the association between categories and habitat.

2.4. Validation

We tested the performance of the proposed methodology using two approaches. First, we used four species for which changes in distribution have been documented. For them, we followed our methodology to test if they can be correctly assigned to the category *Change of distribution range*. The species used were *Passer hispaniolensis*, *Elanus caeruleus*, *Columba palumbus*, and *Streptopelia decaocto*, which represent examples of distribution range expansion in the Palearctic region [75–78]. Secondly, we verified whether experts [42,67–69,72] had suggested possible distribution movements of the species classified as *Change of distribution range*.

3. Results

We found 46 bird species that were reported as new records in the Ecuadorian Tumbesian region in the last two decades. Regarding the classification into different categories, 35% of the species were classified as *Accidental* (16 species), 24% were classified as *Knowledge gaps* (11 species), 22% as *Changes of distribution range* (10 species), 15% as *Undetermined* (7 species), and 4% as *Likely change of distribution range* (2 species) (Table A1).

Among the new records, 18 species were new for the Zapotillo canton and were recorded during field work between 2014 and 2019 (Figure 2). Of these, nine were new records for the Loja province, Ecuador (Table A1).

Figure 2. New bird species records in the Zapotillo canton, Loja, southwestern Ecuador. The first nine species (a–i) were also new records in Loja province, South of Ecuador.

Of the new records, 80% of the species were related to aquatic ecosystems and the remaining species were classified as terrestrial. The classification in the different record categories was significantly associated with the type of ecosystem ($X^2 = 11.54$, $p_value = 0.021$). Terrestrial species were mostly classified as *Knowledge gap*, while aquatic species were mostly classified as *Accidental* (Figure 3). Of the species classified as *Change of distribution range*, most were aquatic.

Figure 3. Proportion of species linked to aquatic or terrestrial ecosystems of the 46 new records of bird species recorded for the Ecuadorian part of the Tumbesian region in the last two decades. They are classified according to five categories (Accidental, Undetermined, Change of distribution range (Change Dist.), Likely change of distribution range (Likely CD), and Knowledge gap) denoting the nature of these new records.

The four species used to validate the methodology were classified correctly as *Change of distribution range* (Table A1). In addition, for 80% of the species that were classified as *Change of distribution range*, there were clues that suggested that they are indeed expanding their distribution range.

4. Discussion

In the last two decades, new bird records have been reported in the Tumbesian region [42,67–69], a common phenomenon around the world [71]. Our classification protocol provided insights regarding the nature of these records, providing evidence of either changes in the distribution range of species or increase of ornithological knowledge for this region. The validation of our protocol suggests that using the method proposed here it is possible to correctly classify new species records in areas with limited knowledge. This is an efficient and easily applicable methodology, which can be especially useful in areas where long-term studies on biodiversity are scarce, such as the Neotropics.

In our study, 22% of the species were classified as “*Change of distribution range*”. It is noteworthy that 90% of the species classified as *Change of distribution range* were species linked to aquatic ecosystems. In recent years, numerous cases of latitudinal, longitudinal, and altitudinal movements of waterbirds have been reported, both in Ecuador [58,79,80] and in the Neotropics [55]. The movements of these species may be influenced by different events, such as the El Niño-Southern Oscillation (ENSO) phenomenon [81], the pollution of natural wetlands, or the disappearance and appearance of new artificial bodies of water [82]. The only terrestrial species classified as a change of distribution is the White-tailed Kite (*Elanus leucurus*), a raptor that is benefiting from deforestation in the Tumbesian region [83] and is expanding its range to the south, along the Pacific coast. Furthermore, there are two species (*Hydroprogne caspia* and *Limosa fedoa*) considered as *Likely change of distribution range*, since their number of records are increasing and they are present outside the usual boundaries of their distribution. However, we cannot be sure of this assignment, since they are species which can be misidentified or may have gone unnoticed, due to their low *conspicuousness* (Table A1).

In the Neotropics, and particularly in southern Ecuador, there is an important lack of information on the distributions and movements of the species [29,56,84]. We classified 24% of the species as *Knowledge gaps* (Table A1). Of these species, at least three may have been overlooked in the past (*Phaethornis griseogularis*, *Pardirallus maculatus*, and *Ciccaba nigrolineata*) [85–87]. A similar case is that

of *Phaetornis griseogularis* in Colombia [85]. Notable examples of knowledge gaps in southern Ecuador are the recent confirmation of the presence of populations of the Koepcke's Screech-Owl (*Megascops koepckeae*) in the south inter-Andean region [88], the discovery of the subspecies Red-ruffed Fruitcrow (*Pyroderus scutatus masoni*) in the southeast of Ecuador [89], and the discovery of a new species for science, the Blue-throated Hillstar (*Oreotrochilus cyanolaemus*) [90]. It is worth mentioning that the high proportion of terrestrial species classified as *Knowledge gaps* shows that there is still much to learn about the distribution of the biodiversity in the Ecuadorian tropical dry forests.

Our proposed methodology contributes to understanding the nature of new records in an area. However, the dynamics of species' movements are complex, and our method has some limitations. Firstly, although many species classified as *Change of distribution range* may be indeed expanding their distribution, our methodology did not allow us to establish which factors are determining those changes. The implementation of long-term capture-recapture studies in the region, together with the promotion of citizen science projects, is an effort that can provide valuable data to better understand the determinants of bird movements in the dry forest of Ecuador. Secondly, global changes can also modify the distribution range of a species by causing local extinctions. Future studies could incorporate analysis of consistent reductions in the number of records of a species in an area to further evaluate potential local extinction. And third, estimating how the number of studies or the number of ornithologist in an area is associated to the dynamic of records of a species could also contribute to discerning knowledge gaps from changes in distribution ranges. Due to a lack of data, it was not possible to directly incorporate such analysis in our methodology, but it could be used in areas that have systematic information about field studies.

We presented a protocol which can be used to better understand if species are moving in response to anthropogenic global change, especially in areas where historical information about biodiversity is scarce. This type of information will be key to implementing effective conservation strategies, designating potential conservation areas, and focusing our attention on the species or groups of species most vulnerable to anthropogenic global change.

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Conflicts of Interest: The authors declare no conflict of interest.

Appendix A

Table A1. Bird species reported as “new records” in the Ecuadorian Tumbesian region in the last two decades (2000–2020). In addition, there were four Palearctic species (*Passer hispaniolensis*, *Elanus caeruleus*, *Columba palumbus*, and *Streptopelia decaocto*) used to validate the methodology. The “+” indicates a new species for the Zapotillo canton and the “++” indicates new species for the Loja province.

Species	Distribution Area		Conspicuousness		Recording Dynamics		Source
	Habitat	Distribution	Abundance	Detectability	Dynamic	Category	
<i>Spatula cyanoptera</i>	Usual	Atypical	Rare	High	Increasing	Change of distribution range	[67,68]
<i>Spatula clypeata</i>	Usual	Atypical	Rare	High	Scarce	Accidental	[67,68]
<i>Netta erythrophthalma</i>	Usual	Atypical	Rare	High	Scarce	Accidental	[67]
<i>Aythya collaris</i>	Usual	Atypical	Rare	High	Scarce	Accidental	[67]
<i>Aythya affinis</i>	Usual	Atypical	Rare	High	Increasing	Change of distribution range	[67]
<i>Anas carolinensis</i>	Usual	Atypical	Rare	High	Scarce	Accidental	[69]
<i>Anas bahamensis</i> ++	Unusual	Normal	Abundant	High	Increasing	Change of distribution range	Field work
<i>Anas discors</i> ++	Unusual	Normal	Abundant	High	Scarce	Accidental	Field work
<i>Phoenicopterus chilensis</i> ++	Unusual	Normal	Rare	High	Increasing	Change of distribution range	Field work
<i>Podiceps major</i>	Usual	Atypical	Rare	High	Increasing	Change of distribution range	[67]
<i>Phaethornis griseogularis</i> +	Usual	Normal	Abundant	Low	Scarce	Knowledge gap	Field work
<i>Pardirallus maculatus</i> +	Usual	Normal	Rare	Low	Scarce	Knowledge gap	Field work
<i>Numenius americanus</i>	Usual	Atypical	Rare	High	Scarce	Accidental	[68]
<i>Limosa fedoa</i>	Usual	Atypical	Rare	Low	Increasing	Likely change of distribution range	[67,68,74]
<i>Haematopus ater</i>	Usual	Atypical	Rare	High	Scarce	Accidental	[68]
<i>Chroicocephalus cirrocephalus</i> +	Unusual	Normal	Abundant	High	Scarce	Accidental	Field work
<i>Chroicocephalus philadelphia</i>	Usual	Atypical	Rare	Low	Scarce	Undetermined	[68]
<i>Larus delawarensis</i>	Usual	Atypical	Rare	Low	Scarce	Undetermined	[68]
<i>Hydroprogne caspia</i>	Usual	Atypical	Rare	Low	Increasing	Likely change of distribution range	[67,68]
<i>Stercorarius chilensis</i>	Usual	Atypical	Rare	High	Scarce	Accidental	[69]
<i>Tringa solitaria</i>	Usual	Normal	Abundant	Low	Scarce	Knowledge gap	[42]
<i>Tringa melanoleuca</i> ++	Usual	Normal	Abundant	Low	Scarce	Knowledge gap	Field work
<i>Calidris bairdii</i> +	Unusual	Normal	Rare	Low	Scarce	Undetermined	Field work
<i>Calidris himantopus</i> ++	Unusual	Normal	Rare	Low	Scarce	Undetermined	Field work
<i>Calidris melanotos</i> ++	Usual	Normal	Rare	Low	Scarce	Knowledge gap	Field work
<i>Calidris alpina</i>	Usual	Atypical	Rare	Low	Scarce	Undetermined	[69]
<i>Phalaropus tricolor</i> +	Unusual	Normal	Abundant	High	Scarce	Accidental	Field work

Table A1. Cont.

Distribution Area			Conspicuousness		Recording Dynamics		
Species	Habitat	Distribution	Abundance	Detectability	Dynamic	Category	Source
<i>Oceanites oceanicus</i>	Usual	Normal	Rare	Low	Scarce	Knowledge gap	[67,68]
<i>Oceanodroma hornbyi</i>	Usual	Atypical	Rare	Low	Scarce	Undetermined	[67,68]
<i>Thalassarche bulleri</i>	Usual	Atypical	Rare	High	Scarce	Accidental	[69]
<i>Platalea ajaja</i>	Unusual	Normal	Rare	High	Increasing	Change of distribution range	[42]
<i>Sula leucogaster</i>	Usual	Atypical	Rare	High	Increasing	Change of distribution range	[67–69]
<i>Ardea herodias</i>	Usual	Atypical	Rare	High	Increasing	Change of distribution range	[67,68]
<i>Egretta rufescens</i>	Usual	Atypical	Rare	High	Scarce	Accidental	[67,68,73]
<i>Egretta caerulea</i> +	Unusual	Normal	Abundant	High	Scarce	Accidental	Field work
<i>Aramus guarauna</i> ++	Usual	Atypical	Rare	High	Scarce	Accidental	Field work
<i>Plegadis falcinellus</i>	Usual	Atypical	Rare	High	Increasing	Change of distribution range	[67,68,74]
<i>Eudocimus albus</i> ++	Unusual	Normal	Abundant	High	Scarce	Accidental	Field work
<i>Elanus leucurus</i> ++	Usual	Atypical	Abundant	High	Increasing	Change of distribution range	Field work
<i>Ciccaba nigrolineata</i>	Usual	Normal	Abundant	Low	Scarce	Knowledge gap	[42]
<i>Falco femoralis</i> +	Unusual	Atypical	Rare	High	Scarce	Accidental	Field work
<i>Turdus maculirostris</i> +	Usual	Normal	Abundant	Low	Scarce	Knowledge gap	Field work
<i>Stelgidopteryx ruficollis</i> +	Usual	Normal	Abundant	Low	Scarce	Knowledge gap	Field work
<i>Tumbezia salvini</i>	Usual	Normal	Rare	Low	Scarce	Knowledge gap	[67]
<i>Tyrannus dominicensis</i>	Usual	Atypical	Rare	Low	Scarce	Undetermined	[72,74]
<i>Sicalis taczanowskii</i>	Usual	Normal	Rare	Low	Scarce	Knowledge gap	[42]
<i>Passer hispaniolensis</i>	Usual	Atypical	Abundant	High	Increasing	Change of distribution range	Example, [75]
<i>Elanus ceruleus</i>	Usual	Atypical	Abundant	High	Increasing	Change of distribution range	Example, [76]
<i>Columba palumbus</i>	Unusual	Atypical	Abundant	High	Increasing	Change of distribution range	Example, [77]
<i>Streptopelia decaocto</i>	Usual	Atypical	Abundant	High	Increasing	Change of distribution range	Example, [78]

References

1. Tschamntke, T.; Klein, A.M.; Steffan-Dewenter, I.; Thies, C. Landscape perspectives on agricultural intensification and biodiversity – ecosystem service management. *Ecol. Lett.* **2005**, *8*, 857–874. [[CrossRef](#)]
2. Flynn, D.F.; Gogol-Prokurat, M.; Nogeire, T.; Molinari, N.; Richers, B.T.; Lin, B.B.; DeClerck, F. Loss of functional diversity under land use intensification across multiple taxa. *Ecol. Lett.* **2009**, *12*, 22–33. [[CrossRef](#)] [[PubMed](#)]
3. Watson, J.E.; Shanahan, D.F.; Di Marco, M.; Allan, J.; Laurance, W.F.; Sanderson, E.W.; Venter, O. Catastrophic declines in wilderness areas undermine global environment targets. *Curr. Biol.* **2016**, *26*, 2929–2934. [[CrossRef](#)] [[PubMed](#)]
4. Tapia-Armijos, M.F.; Homeier, J.; Munt, D.D. Spatio-temporal analysis of the human footprint in South Ecuador: Influence of human pressure on ecosystems and effectiveness of protected areas. *Appl. Geogr.* **2017**, *78*, 22–32. [[CrossRef](#)]
5. Pimm, S.L.; Jenkins, C.N.; Abell, R.; Brooks, T.M.; Joppa, L.N.; Raven, P.H.; Roberts, C.M.; Sexton, J.O. The biodiversity of species and their rates of extinction, distribution, and protection. *Science* **2014**, *344*, 1246752. [[CrossRef](#)]
6. Kappelle, M.; Van Vuuren, M.M.; Baas, P. Effects of climate change on biodiversity: a review and identification of key research issues. *Biodivers. Conserv.* **1999**, *8*, 1383–1397. [[CrossRef](#)]
7. Parmesan, C. Ecological and evolutionary responses to recent climate change. *Annu. Rev. Ecol. Evol. Syst.* **2006**, *37*, 637–669. [[CrossRef](#)]
8. Heller, N.E.; Zavaleta, E.S. Biodiversity management in the face of climate change: a review of 22 years of recommendations. *Biol. Conserv.* **2009**, *142*, 14–32. [[CrossRef](#)]
9. Melo, I.; Ochoa-Quintero, J.M.; de Oliveira Roque, F.; Dalsgaard, B. A review of threshold responses of birds to landscape changes across the world. *J. Field Ornithol.* **2018**, *89*, 303–314. [[CrossRef](#)]
10. Parmesan, C.; Yohe, G. A globally coherent fingerprint of climate change impacts across natural systems. *Nature* **2003**, *421*, 37. [[CrossRef](#)]
11. Root, T.L.; Price, J.T.; Hall, K.R.; Schneider, S.H.; Rosenzweig, C.; Pounds, J.A. Fingerprints of global warming on wild animals and plants. *Nature* **2003**, *421*, 57. [[CrossRef](#)] [[PubMed](#)]
12. Freeman, B.G.; Scholer, M.N.; Ruiz-Gutierrez, V.; Fitzpatrick, J.W. Climate change causes upslope shifts and mountaintop extirpations in a tropical bird community. *Proc. Natl. Acad. Sci. USA* **2018**, *115*, 201804224. [[CrossRef](#)] [[PubMed](#)]
13. Harris, J.B.C.; Sekercioglu, C.H.; Sodhi, N.S.; Fordham, D.A.; Paton, D.C.; Brook, B.W. The tropical frontier in avian climate impact research. *Ibis* **2011**, *153*, 877–882. [[CrossRef](#)]
14. Sekercioglu, C.H.; Primack, R.B.; Wormworth, J. The effects of climate change on tropical birds. *Biol. Conserv.* **2012**, *148*, 1–18. [[CrossRef](#)]
15. Chen, I.C.; Hill, J.K.; Ohlemüller, R.; Roy, D.B.; Thomas, C.D. Rapid range shifts of species associated with high levels of climate warming. *Science* **2011**, *333*, 1024–1026. [[CrossRef](#)]
16. Freeman, B.G.; Class-Freeman, A.M. Rapid upslope shifts in New Guinean birds illustrate strong distributional responses of tropical montane species to global warming. *Proc. Natl. Acad. Sci. USA* **2014**, *111*, 4490–4494. [[CrossRef](#)]
17. Beckage, B.; Osborne, B.; Gavin, D.G.; Pucko, C.; Siccama, T.; Perkins, T. A rapid upward shift of a forest ecotone during 40 years of warming in the Green Mountains of Vermont. *Proc. Natl. Acad. Sci. USA* **2008**, *105*, 4197–4202. [[CrossRef](#)]
18. Zuckerberg, B.; Woods, A.M.; Porter, W.F. Poleward shifts in breeding bird distributions in New York State. *Glob. Chang. Biol.* **2009**, *15*, 1866–1883. [[CrossRef](#)]
19. Tingley, M.W.; Koo, M.S.; Moritz, C.; Rush, A.C.; Beissinger, S.R. The push and pull of climate change causes heterogeneous shifts in avian elevational ranges. *Glob. Chang. Biol.* **2012**, *18*, 3279–3290. [[CrossRef](#)]
20. DeLuca, W.V.; King, D.I. Montane birds shift downslope despite recent warming in the northern Appalachian Mountains. *J. Ornithol.* **2017**, *158*, 493–505. [[CrossRef](#)]
21. Kirchman, J.J.; Van Keuren, A.E. Altitudinal Range Shifts of Birds At the Southern Periphery of the Boreal Forest: 40 Years of Change In the Adirondack Mountains. *Wilson J. Ornithol.* **2017**, *129*, 742–753. [[CrossRef](#)]
22. Thomas, C.D.; Lennon, J.J. Birds extend their ranges northwards. *Nature* **1999**, *399*, 213. [[CrossRef](#)]

23. Archaux, F. Breeding upwards when climate is becoming warmer: no bird response in the French Alps. *Ibis* **2004**, *146*, 138–144. [[CrossRef](#)]
24. Gregory, R.D.; Willis, S.G.; Jiguet, F.; Vorčíšek, P.; Klvančová, A.; van Strien, A.; Huntley, B.; Collingham, Y.C.; Couvet, D.; Green, R.E. An indicator of the impact of climatic change on European bird populations. *PLoS ONE* **2009**, *4*, e4678. [[CrossRef](#)]
25. Devictor, V.; Julliard, R.; Couvet, D.; Jiguet, F. Birds are tracking climate warming, but not fast enough. *Proc. R. Soc. Lond. B Biol. Sci.* **2008**, *275*, 2743–2748. [[CrossRef](#)]
26. Roth, T.; Plattner, M.; Amrhein, V. Plants, Birds and Butterflies: Short-Term Responses of Species Communities to Climate Warming Vary by Taxon and with Altitude. *PLoS ONE* **2014**, *9*, e82490. [[CrossRef](#)]
27. Pounds, J.A.; Fogden, M.P.L.; Campbell, J.H. Biological response to climate change on a tropical mountain. *Nature* **1999**, *398*, 611. [[CrossRef](#)]
28. Forero-Medina, G.; Terborgh, J.; Socolar, S.J.; Pimm, S.L. Elevational ranges of birds on a tropical montane gradient lag behind warming temperatures. *PLoS ONE* **2011**, *6*, e28535. [[CrossRef](#)] [[PubMed](#)]
29. Freile, J.F.; Greeney, H.F.; Bonaccorso, E. Current Neotropical ornithology: Research progress 1996–2011. *Condor Ornithol. Appl.* **2014**, *116*, 84–96. [[CrossRef](#)]
30. Wormworth, J.; Sekercioglu, C.H. *Winged Sentinels: Birds and Climate Change*, 1st ed.; Cambridge University Press: New York, NY, USA, 2008; pp. 42–63.
31. Giorgi, F. Climate change hot-spots. *Geophys. Res. Lett.* **2006**, *33*, L08707. [[CrossRef](#)]
32. Hermes, C.; Keller, K.; Nicholas, R.E.; Segelbacher, G.; Schaefer, H.M. Projected impacts of climate change on habitat availability for an endangered parakeet. *PLoS ONE* **2018**, *13*, e0191773. [[CrossRef](#)]
33. McCain, C.M. Vertebrate range sizes indicate that mountains may be ‘higher’ in the tropics. *Ecol. Lett.* **2009**, *12*, 550–560. [[CrossRef](#)] [[PubMed](#)]
34. Graham, C.H.; Parra, J.L.; Rahbek, C.; McGuire, J.A. Phylogenetic structure in tropical hummingbird communities. *Proc. Natl. Acad. Sci. USA* **2009**, *106*, 19673–19678. [[CrossRef](#)] [[PubMed](#)]
35. Best, B.J.; Kessler, M. *Biodiversity and Conservation in Tumbesian Ecuador and Peru*; BirdLife Internacional: Cambridge, UK, 1995.
36. Portillo-Quintero, C.A.; Sánchez-Azofeifa, G.A. Extent and conservation of tropical dry forests in the Americas. *Biol. Conserv.* **2010**, *143*, 144–155. [[CrossRef](#)]
37. Jara-Guerrero, A.; Maldonado-Riofrío, D.; Espinosa, C.I.; Duncan, D. Beyond the Blame Game: A Restoration Pathway Reconciles Ecologists and Local Leaders Divergent Models of Seasonally Dry Tropical Forest Degradation. *Ecol. Soc.* **2019**, *24*, 22. [[CrossRef](#)]
38. Tapia-Armijos, M.F.; Homeier, J.; Espinosa, C.I.; Leuschner, C.; de la Cruz, M. Deforestation and forest fragmentation in South Ecuador since the 1970s—losing a hotspot of biodiversity. *PLoS ONE* **2015**, *10*, e0133701. [[CrossRef](#)]
39. Prieto-Torres, D.A.; Nori, J.; Rojas-Soto, O.R. Identifying priority conservation areas for birds associated to endangered Neotropical dry forests. *Biol. Conserv.* **2018**, *228*, 205–214. [[CrossRef](#)]
40. Miles, L.; Newton, A.C.; DeFries, R.S.; Ravilious, C.; May, I.; Blyth, S.; Kapos, V.; Gordon, J.E. A global overview of the conservation status of tropical dry forests. *J. Biogeogr.* **2006**, *33*, 491–505. [[CrossRef](#)]
41. Escribano-Avila, G.; Cervera, L.; Ordóñez-Delgado, L.; Jara-Guerrero, A.; Amador, L.; Paladines, B.; Espinosa, C.I. Biodiversity patterns and ecological processes in Neotropical dry forest: the need to connect research and management for long-term conservation. *Neotrop. Biodiv.* **2017**, *3*, 107–116. [[CrossRef](#)]
42. Ordóñez-Delgado, L.; Tomás, G.; Armijos-Ojeda, D.; Jara-Guerrero, A.; Cisneros, R.; Espinosa, C.I. Nuevos aportes al conocimiento de avifauna en la región Tumbesina; implicaciones para la conservación de la Reserva de Biosfera del Bosque Seco, Zapotillo, Ecuador. *Ecosistemas* **2016**, *25*, 13–23. [[CrossRef](#)]
43. Benítez, V.; Sánchez, T. Evaluación ecológica rápida de la avifauna en los bosques secos de La Ceiba y Cordillera Arañitas, provincia de Loja, Ecuador. In *Biodiversidad en los bosques secos del suroccidente de la provincia de Loja: un reporte de las evaluaciones ecológicas y socioeconómicas rápidas*, 1st ed.; Vázquez, M.A., Larrea, M., Suárez, L., Eds.; EcoCiencia, Ministerio del Ambiente, Herbario Loja y Proyecto Bosque Seco: Quito, Ecuador, 2001; pp. 47–65.
44. Freile, J.F.; Bonaccorso, E.; Santander, T. First nesting report of the West Peruvian Screech-owl (*Otus roboratus*). *Ornitol. Neotrop.* **2003**, *14*, 107–111.

45. Freile, J.F.; Moreano, M.; Bonaccorso, E.; Santander, T.; Chaves, J. Notas sobre la historia natural, distribución y conservación de algunas especies de aves amenazadas del suroccidente de Ecuador. *Cotinga* **2004**, *21*, 18–24.
46. Bonaccorso, E.; Santander, T.; Freile, J.F.; Tinoco, B.; Rodas, F. Avifauna and conservation of the Cerro Negro-Cazaderos area, Tumbesian Ecuador. *Cotinga* **2007**, *27*, 61–66.
47. Aguilar, Z. *Guía de Vida Silvestre del Área de Conservación y Desarrollo: La Ceiba*; Naturaleza y Cultura Internacional: Quito, Ecuador, 2008.
48. Tinoco, B. Estacionalidad de la comunidad de aves en un bosque deciduo tumbesino en el sur occidente de Ecuador. *Ornitol. Neotrop.* **2009**, *20*, 157–170.
49. Pratolongo, F.A.; Flanagan, J.N.; Vellinga, W.P.; Durand, N. Notes on the birds of Laquipampa Wildlife Refuge, Lambayeque, Peru. *Bull. Br. Ornithol. Club* **2012**, *132*, 162–174.
50. Stager, M.; Lopresti, E.; Pratolongo, F.A.; Ardia, D.R.; Caceres, D.; Cooper, C.B.; Winkler, D.W. Reproductive biology of a narrowly endemic *Tachycineta* swallow in dry, seasonal forest in coastal Peru. *Ornitol. Neotrop* **2012**, *23*, 95–112.
51. LoPresti, E.; Angulo, F. New bird distribution records for Lambayeque, Peru: *Nomonyx dominicus* (Linnaeus, 1766) (Anatidae) and *Incaspiza pulchra* (Sclater, 1886) (Emberizidae). *Check List* **2014**, *10*, 618–620. [[CrossRef](#)]
52. Solano-Ugalde, A.; Pérez, V.; Ahlman, R. Primeros registros de la Reinita Gorrinegra (*Wilsonia pusilla*) en Ecuador. *Boletín SAO* **2007**, *17*, 59–62.
53. Athanas, N.; Davies, A.; Miller, R. Discovery of Tumbes Tyrant *Tumbezia salvini* in Ecuador. *Cotinga* **2009**, *31*, 137.
54. Pozo-Zamora, G.M.; Garzón, C.; Echeverría-Vaca, G.; León, K. Nuevos datos de distribución del colibrí Pico Lanza Frentiverde *Doryfera ludovicae* (Trochilidae) y del Pinzón Oliváceo *Arremon castaneiceps* (Emberizidae) en la provincia de El Oro, Ecuador. *Avances en Ciencias e Ingenierías* **2014**, *6*, 9–12. [[CrossRef](#)]
55. Sánchez, J.E.; Zook, J.R.; Carman, E.; Sandoval, L. Information on abundance and occurrence of two recently recorded species of ducks for Costa Rica. *Check List* **2014**, *10*, 420–422. [[CrossRef](#)]
56. Cisneros-Heredia, D.F. Notes on breeding, behaviour and distribution of some birds in Ecuador. *Bull. Br. Ornithol. Club* **2006**, *126*, 153.
57. Jahn, O.; Cosgrove, P.; Cosgrove, C.; Mueses, T.; Santander, T. First record of Brown Pelican *Pelecanus occidentalis* from the Ecuadorian highlands. *Cotinga* **2010**, *32*, 108.
58. Santander, T.; Terán, K.; Mueces, T.; Lara, A.; Llumiquinga, C.; Guevara, E. Registros inusuales de aves costeras en lagunas Altoandinas de Ecuador. *Cotinga* **2011**, *33*, 105–107.
59. Guevara, E.A.; Santander, T.; Duivenvoorden, J.F. Seasonal Patterns in Aquatic Bird Counts at Five Andean Lakes of Ecuador. *Waterbirds* **2013**, *35*, 636–641. [[CrossRef](#)]
60. Bahamonde-Vinueza, D.; Cadena-Ortiz, H.; Cajas-Bermeo, C.; Bonaccorso, E. Unusual records of *Cochlearius cochlearius* (Linnaeus, 1766) (Aves: Ardeidae) in the Andes of Ecuador. *Check List* **2014**, *10*, 687–688. [[CrossRef](#)]
61. Ordóñez-Delgado, L.; Reyes-Bueno, F.; Orihuela-Torres, A.; Armijos-Ojeda, D. Registros inusuales de aves en la hoya de Loja, Andes sur del Ecuador. *Avances en Ciencias e Ingenierías* **2016**, *8*, 26–36. [[CrossRef](#)]
62. Ordóñez-Delgado, L.; González, I.; Armijos-Ojeda, D.; Orihuela-Torres, A. Primer registro de *Ardea cocoi* (Pelecaniformes: Ardeidae) en la región Andina del sur de Ecuador. *Revista CEDAMAZ* **2017**, *7*, 10–15.
63. Holbrook, N.M.; Whitbeck, J.L.; Mooney, H.A. Drought responses of Neotropical deciduous forest trees. In *Tropical Deciduous Forests*, 1st ed.; Mooney, H.A., Medina, E., Bullock, S.H., Eds.; Cambridge University Press: Cambridge, UK, 1995; pp. 243–276.
64. ICBP. *Putting Biodiversity on the Map: Priority Areas for Global Conservation*; International Council for Bird Preservation: Cambridge, UK, 1992.
65. Stattersfield, A.J.; Crosby, M.J.; Long, A.J.; Wege, O.E. *Endemic Bird Areas of the World: Priorities for Biodiversity Conservation*; BirdLife International Conservation Series No. 7; BirdLife International: Cambridge, UK, 1998.
66. Cerón, C.; Palacios, W.; Valencia, R.; Sierra, R. Las formaciones naturales de la Costa del Ecuador. In *Propuesta Preliminar de un Sistema de Clasificación de Vegetación Para el Ecuador Continental*; Sierra, R., Ed.; Proyecto INEFAN/GEF-BIRF y EcoCiencia: Quito, Ecuador, 1999.
67. Freile, J.; Ahlman, R.; Brinkuizen, D.; Greenfield, P.; Solano-Ugalde, A.; Navarrete, L.; Ridgely, R. Rare birds in Ecuador: first annual report of the Committee of Ecuadorian Records in Ornithology (CERO). In *Avances en Ciencias e Ingenierías*; 2013; Volume 5, pp. 24–41. [[CrossRef](#)]

68. Nilsson, J.; Freile, J.F.; Ahlman, R.; Brinkhuizen, D.M.; Greenfield, P.J.; Solano-Ugalde, A. Rare birds in Ecuador: second annual report of the Committee for Ecuadorian Records in Ornithology (CERO). *Avances en Ciencias e Ingenierías* **2014**, *6*, 38–50. [\[CrossRef\]](#)
69. Freile, J.F.; Solano-Ugalde, A.; Brinkhuizen, D.M.; Greenfield, P.J.; Lysinger, M.; Nilsson, J.; Navarrete, L.; Ridgely, R.S. Rare Birds in Ecuador: Third Report of the Committee for Ecuadorian Records in Ornithology (CERO). *Revista Ecuatoriana de Ornitología*, *27*. [\[CrossRef\]](#)
70. Ridgely, R.; Greenfield, P.J. *The Birds of Ecuador. Status, Distribution and Taxonomy*, 1st ed.; Cornell University Press: Ithaca, NY, USA, 2001.
71. Del Hoyo, J.; Elliott, A.; Sargatal, J.; Christie, D.A.; de Juana, E. (Eds.) *Handbook of the Birds of the World Alive*; Lynx Edicions: Barcelona, Spain, 2019; Available online: <https://www.hbw.com> (accessed on 21 March 2019).
72. Ridgely, R.; Greenfield, P.J. *Aves del Ecuador. Guía de Campo*, 2nd ed.; Academia de Ciencias Naturales de Filadelfia. Fundación de Conservación Jocotoco: Quito, Ecuador, 2006.
73. McMullan, M.; Navarrete, L. *Fieldbook of the Birds of Ecuador Including the Galapagos Islands and Common Mammals*, 2nd ed.; Ratty Ediciones: Quito, Ecuador, 2017.
74. eBird Home Page. Available online: <https://ebird.org/home> (accessed on 10 June 2019).
75. Cramp, S.; Perrins, C.M. *The Birds of the Western Palearctic. Crows to Finches*; Handbook of the Birds of Europe, the Middle East and North Africa; Oxford University Press: Oxford & New York, USA, 1994.
76. Ballbontin, J.; Negro, J.J.; Sarasola, J.H.; Ferrero, J.J.; Rivera, D. Land-use changes may explain the recent range expansion of the Black-shouldered Kite *Elanus caeruleus* in southern Europe. *Ibis* **2008**, *150*, 707–716. [\[CrossRef\]](#)
77. BirdLife International. *European Red List of Birds*; Office for Official Publications of the European Communities: Luxembourg, 2015.
78. Bonter, D.N.; Zuckerberg, B.; Dickinson, J.L. Invasive birds in a novel landscape: habitat associations and effects on established species. *Ecography* **2010**, *33*, 494–502. [\[CrossRef\]](#)
79. Henry, P.Y. Distributional and altitudinal range extensions for birds from Ecuador. *Boletín SAO* **2012**, *20*, 89–106.
80. Félix, F.; Haase, B. A new record of the Blackish Oystercatcher, *Haematopus ater ater* (Vieillot and Oudart, 1825), in the Gulf of Guayaquil, Ecuador. *Check List* **2016**, *12*, 1857. [\[CrossRef\]](#)
81. Sandoval, L.; Acosta-Chaves, V.J.; Ocampo, D.; Mora, C.; Camacho, A.; Martinez, D.; Sanchez, C. Unusual records of waterbirds in Costa Rica: possible connection to El Niño 2015–2016. *Mar. Ornithol.* **2016**, *44*, 167–169.
82. Sandoval, L.; Martínez, D.; Ocampo, D.; Pizarro, M.V.; Araya-H, D.; Carman, E.; García-Rodríguez, A. Range expansion and noteworthy records of Costa Rican birds (Aves). *Check List* **2018**, *14*, 141. [\[CrossRef\]](#)
83. Bierregaard, R.O., Jr.; Marks, J.S.; Boesman, P.; Kirwan, G.M. White-tailed Kite (*Elanus leucurus*). In *Handbook of the Birds of the World Alive*; Del Hoyo, J., Elliott, A., Sargatal, J., Christie, D.A., de Juana, E., Eds.; Lynx Edicions: Barcelona, Spain, 2019; Available online: <https://www.hbw.com/node/52968> (accessed on 20 June 2019).
84. Bonaccorso, E.; Arzuza, D.; Buitrón-Jurado, G.; Lucía, A.; Charpentier, M.J.; Piedrahita, P.; Freile, J.F. Range extensions and other noteworthy bird records from the Ecuadorian Andes. *Bull. Br. Ornithol. Club* **2011**, *131*, 261–265.
85. Schuchmann, K.L. First record of the Grey-chinned Hermit (*Phaethornis griseogularis*) west of the Colombian Andes, with notes on the displays of the species. *Wilson Bull.* **1987**, *99*, 122–124.
86. Taylor, B. Spotted Rail (*Pardirallus maculatus*). In *Handbook of the Birds of the World Alive*; Del Hoyo, J., Elliott, A., Sargatal, J., Christie, D.A., De Juana, E., Eds.; Lynx Edicions: Barcelona, Spain, 2020; Available online: <https://www.hbw.com/node/53674> (accessed on 13 January 2020).
87. Gerhardt, R.P.; Gerhardt, D.M.; Bonilla, N.; Flatten, C.J. Black-and-white Owl. In *Neotropical Birds of Prey: Biology and Ecology of a Forest Raptor Community*; Whitacre, D.F., Ed.; Cornell University Press: Ithaca, NY, USA, 2012; p. 320327.
88. Ordóñez-Delgado, L.; Freile, J.F. First records of Koepcke's Screech-Owl *Megascops koepckeae* (Aves: Strigidae) in Ecuador. *Revista Ecuatoriana de Ornitología* **2019**, *5*. [\[CrossRef\]](#)

89. Ordóñez-Delgado, L.; Erazo, S.; González, I.; Armijos-Ojeda, D.; Rosado, D. *Pyroderus scutatus masoni* (Shaw, 1792) (Aves, Cotingidae): A subspecies of Red-ruffed Fruit crow newly confirmed for Ecuador. *Check List* **2018**, *14*, 281. [[CrossRef](#)]
90. Sornoza-Molina, F.; Freile, J.F.; Nilsson, J.; Krabbe, N.; Bonaccorso, E. A striking, critically endangered, new species of hillstar (Trochilidae: *Oreotrochilus*) from the southwestern Andes of Ecuador. *Auk Ornithol. Adv.* **2018**, *135*, 1146–1171. [[CrossRef](#)]

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