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AVIFAUNA IN THEBOLIVAR RUTA DEL HIELERO, CHIMBORAZO FAUNA PRODUCTION RESERVE, ECUADOR.

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Abstract
The study examines the diversity of birds in the Ruta del Hielero of Bolivar, Ecuador, evaluating the abundance, diversity and conservation status of birds in this little-studied region. Using the strip transect method, 5 transects were drawn where 279 sightings of 32 species belonging to 6 orders were recorded, Apodiformes representing the highest number of families, Trochilidae showing the highest number of species. All species are native, and a representative species of the site is Oreotrochilus chimborazo because of its abundance. All inventoried individuals are listed as Least Concern (LC), according to the IUCN Red List, and are under regulation in Appendix II of CITES, it was also determined that the route exhibits medium levels of diversity in most of the areas studied, according to the Shannon-Wiener diversity index, revealing a significant richness in the area studied. The results highlight the importance of conserving this unique ecosystem and suggest that the information collected may be crucial for future conservation and sustainable development strategies in the region.

Keywords: Birds, conservation, diversity, endemism.

I. INTRODUCTION

According to Sitanggang et al., (2020), birdwatching, stands out as one of the most promising charms as it allows the contemplation of a wide variety of birds with captivating colors and fascinating behaviors in their natural environment. In addition, both the chromatic attributes and the sounds, shapes and behaviors of these birds are extremely attractive (Moss, 2004;Aditya et al., 2020), one avenue for progress in this area is to assess the diversity and unique value of the bird community. The uniqueness of birdlife can be established by comparing the frequency of sightings, conservation status, and endemicity (Sulistiyowati & Buot, 2016; Prawiradilaga, 2019).
Ecuador has gained worldwide recognition for being one of the countries with the greatest diversity of bird species (Ridgely & Greenfield, 2003). This biological abundance, together with political-historical factors, has meant that, from the years prior to independence to the present, in the context of the late eighteenth and early nineteenth centuries (Tufiño, 1999), this country has become an attractive destination for researchers of natural life in general (Whymper, 1982) and, specifically, for those interested in its avifauna (Jardine, 1849). Although there is considerable knowledge about the avifauna in Ecuador (De Vries, 2002; Ridgely & Greenfield, 2001), it is important to note that many of the species lists available in the region are mostly unpublished and lack an assessment within a scientific context (Freile et al., 2017; Hollamby, 2012).
The foothills of the western Andes in Ecuador have been designated as an endemic area for birds. (Sattersfield et al., 1998), and are home to a considerable number of bird species of limited distribution, with at least 30 species having been identified. (Ridgely & Greenfield, 2006),

including several globally threatened species, with at least eight of them listed. (Freile & Santander, 2005)In this context, a government protected area stands out: the Chimborazo Fauna Production Reserve. However, there is a paucity of specific ornithological studies within this reserve. (Freile et al., 2005).

This article presents the results of records and observations of the diversity and abundance, as well as the conservation status of birds based on the Red Lists of the International Conservation Union (IUCN) and the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES). These data come from an ornithological expedition carried out on the Sara Kapak Ñan Route, known for being an ancient ancestral road that crosses the province of Bolívar in Ecuador. This route is part of the Reserve mentioned above. To our knowledge, this study represents the first of its kind on this site. Consequently, expanding knowledge and databases on avifauna diversity could serve as an additional resource to strengthen the development strategy in this territory, transforming it into a distinctive attraction for visitors.

II. METHODOLOGY

This research was developed in the Ruta del Hielero located in the province of Bolívar, Ecuador. The study began in the high mountains, specifically in the Chimborazo Fauna Production Reserve, with geographical coordinates (1° 29'12.46" S 78°47'39.71"0) and an altitude of 4800 meters above sea level. The research extended to the community of Quindihua Central, which is located at coordinates (1°30'09.10" S 78°56'30.57"0), at an altitude of 3,526 meters above sea level (Figure 1). For the identification of the species, the transect method was used, where the birds were detected by visual and auditory recognition. Observations were made with the naked eye and with Bushnell binoculars of models 10×50, 7×42 and 10×42, in addition to using a Vanguard 15-45×60 telescope. To georeference the locations of the inventories, Global Positioning System (GPS) equipment was used, specifically a Magellan Professional MobileMapperTM CX from Magellan Navigation Inc. (Santa Clara, CA, USA) and a Garmin from Garmin Ltd. (Olathe, KS, USA), to identify the species using the Birds of Ecuador Volume I Field Guide fromRidgely&Greenfield (2006) , Bioweb and eBirdwebsites.

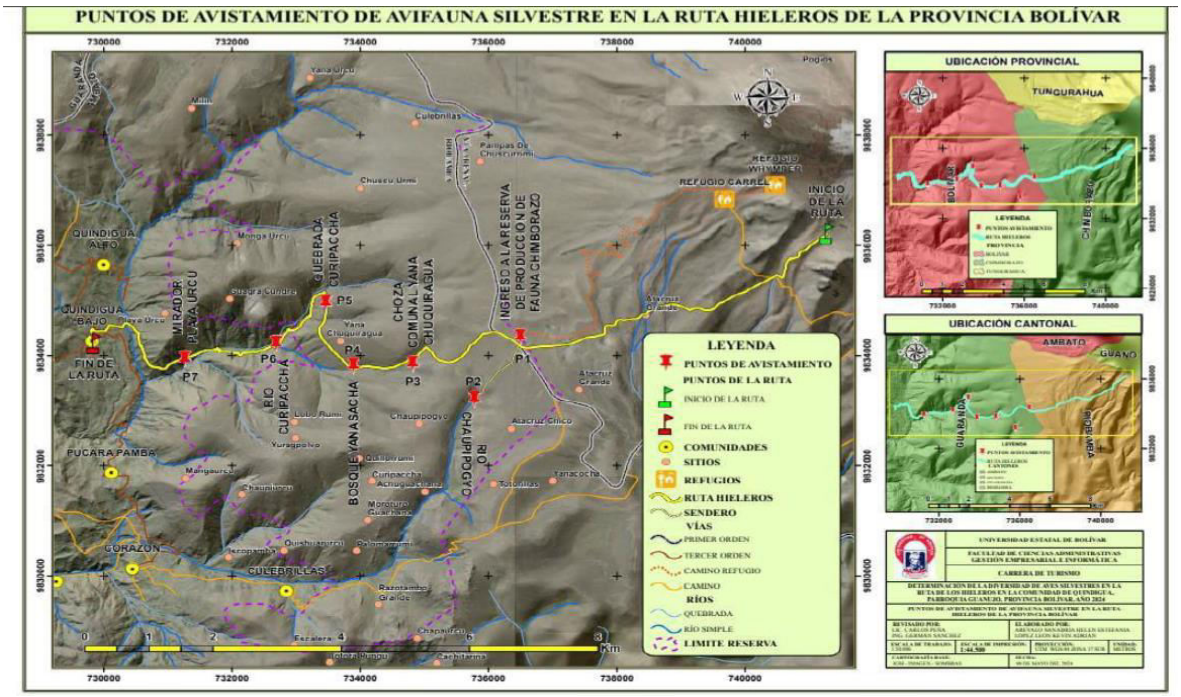

Figure 1. Map of the historic path of the hielero, the Route is highlighted from the highest area in the snow-capped Chimborazo reaching the communityofQuindigua Central.

The Chimborazo Reserve is made up of eight life zones that coincide with the páramo ecosystem, according to the classification of the Vegetation Map of the (Ministry of Environment Ecuador, 2013), . According to this ecological classification, it belongs to the dry páramo life zone of the Western Andes and is located within the upper montane humid grassland of páramo ecosystem. For this research, four types of ecosystems were analyzed. (Páramo grassland 3400-4300 masl.), Floodable páramo grassland (3300-4500 masl), Páramo evergreen forest (3200-4100 masl). Humid subnival grassland of the páramo (3400-4100 meters above sea level), the Route also extends outside the protected area, where there is an ecosystem intervened with pastures (Figure 2)

The Hielero Route is 15 kilometers long, bordering the Quindihua Alto community to the north, the Pucara community to the south, the Chimborazo Wildlife Production Reserve to the east, and the Puajaca Larcaloma community to the west (Peña et al., 2021).

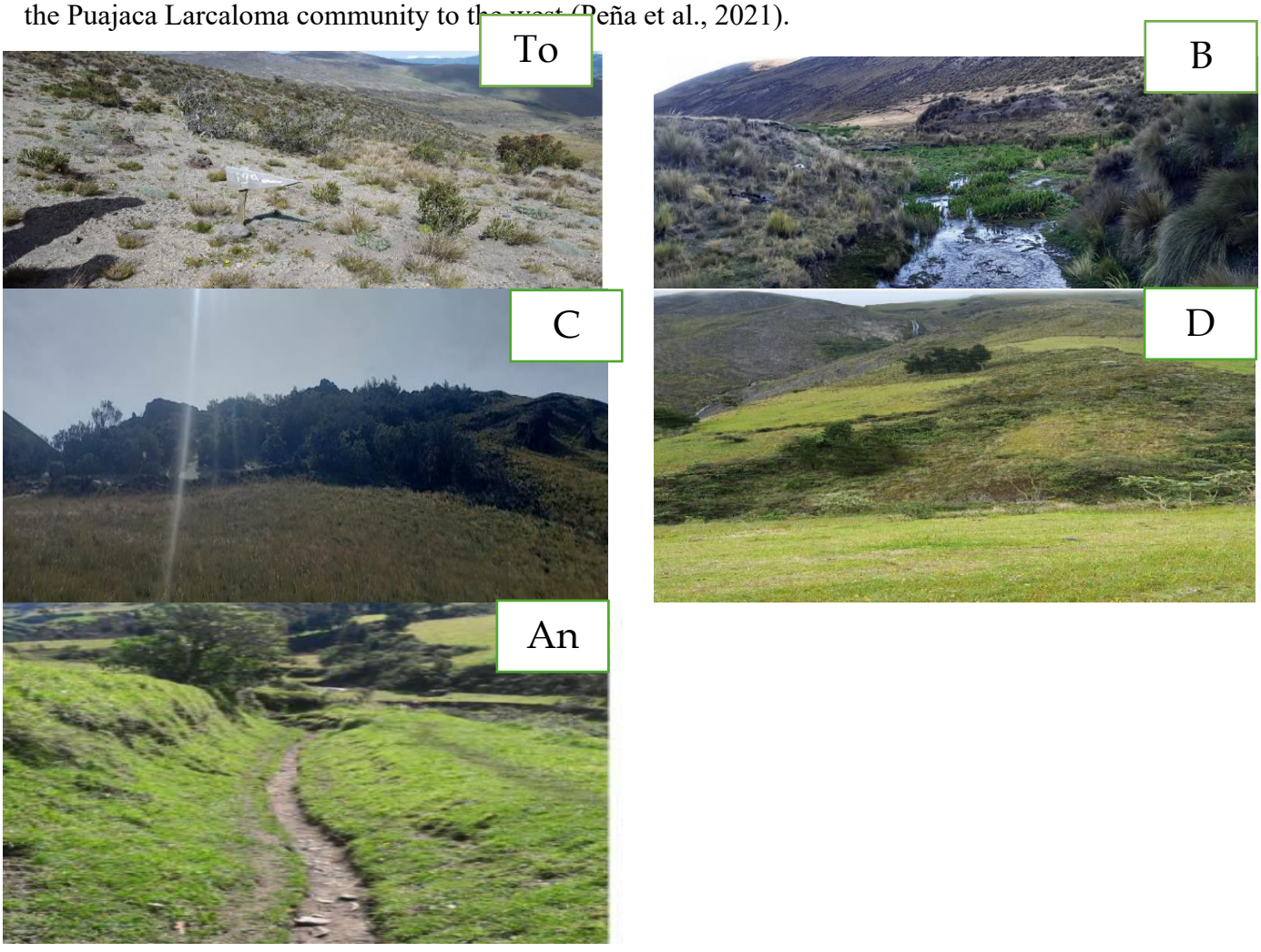

Figure 2. Important habitats for páramo birds of the Hielero Route A Grassland of the Páramo (HsSn02) B, Evergreen forest of the Páramo (BsSn01), C Subnival humid grassland of the Páramo- (HsNn01), D Upper high montane humid grassland of the Páramo (HsSn03), E grasslandecosystem.

To record the birds that inhabit the Route, the method of transects in strips was used, this approach implies that the observer records the birds sighted while moving along a straight line.

(Figure 3). The segments of this line serve as measurements, and can be 100 or 250 meters long. This technique is effective in open areas, as it allows the observer to focus on birdwatching without distractions from the surrounding terrain. It is essential that the observer completes each segment of the transient in a specific time, such as covering 100 meters in a span of 10 minutes (Ralph et al., 1996). The realization of this method requires certain equipment and a defined time.
To determine the transects or bird observation points, the following were considered: the number of species in a given space, the presence of plants with floral offerings, as well as potential ecological corridors.
To record each bird, a file was designed that contains the following data: Time of day, latitude, longitude, family to which it belongs, genus, species, number of individuals observed, observed distribution, type of habitat and altitude. Data such as the name of the observer, weather, date, start time and end time of travel were also recorded, this for each transect.
The field trips were carried out between June and August 2023, the summer season, facilitating observations. These tours were carried out both in the morning and in the afternoon, covering a schedule in the morning (06:00 to 10:00) and in the afternoon (14:00 to 18:00), which adds up to approximately 210 hours of observation in total. Collectively, we have collected data from 90 observation routes, each with a distance of 2 km, thus covering a total of 15 km.

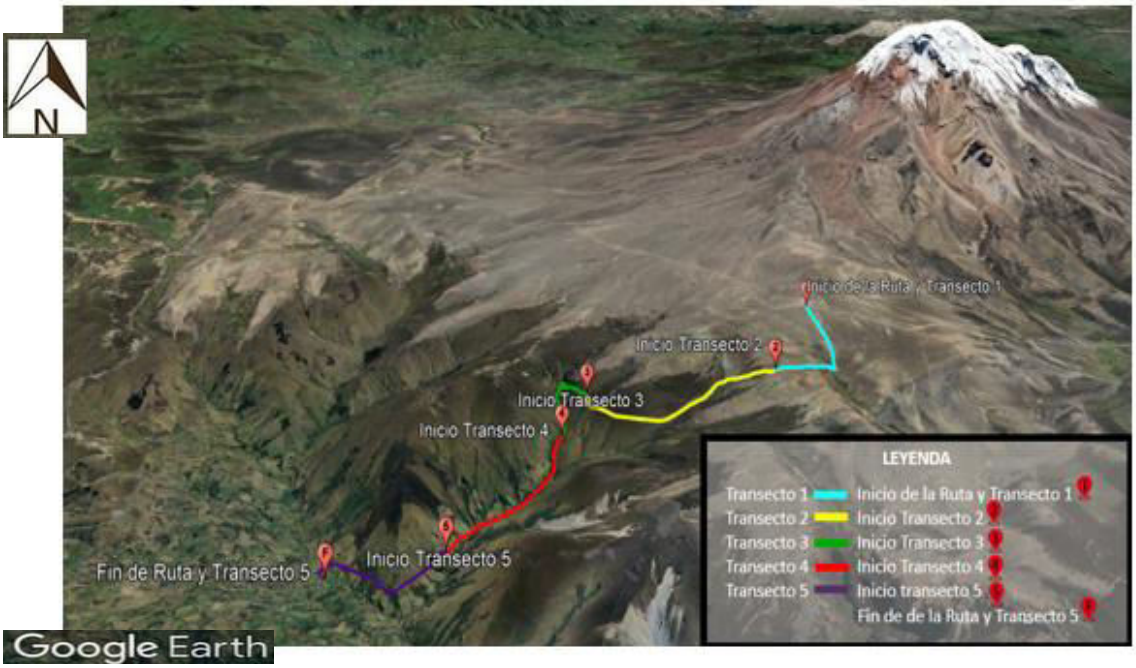

Figure 3.-The 5 transects of the Route are detailed, starting in the Chimborazo Reserve and ending in Quindihua

Once in the laboratory with the field data, the information collected and the identification of the species were confirmed, following the guidelines established in the field guide by Restall & Freile (2018) and Ridgely & Greenfield (2001). For taxonomic nomenclature, we adhere to the SACC proposal (Remsen et al., 2021). Regarding information on the conservation status, we carried out reviews using the IUCN database and CITES, as well as the Red List of Birds of Ecuador (Freile, 2019). To determine the endemism of each species and its migration, we rely on the work of Ridgely&Greenfield (2006).
The habitat description was prepared taking into account the determinations of scrubland, grassland, grassland, sand or desert (Stotz, 1996). The trophic guild was based on literature (Orians, 1969Karr, 1971; Terborgh et al., 1990; Thiollay, 1994; Robinson et al., 2000; Naka,

2004). In the determination of trophic niches, it has been considered the main food source at the family level, without taking into account specific particularities.

To determine the most abundant species on the Route, the frequency of sightings of the species in the different transects was analyzed, taking into account the previously mentioned habitats as indicators. To assess diversity, the Shannon-Wiener index, usually represented as H', was used. This index is expressed as a positive number, typically ranging from 0.5 to 5 in most natural ecosystems, although its standard value is between 2 and 3. Values below 2 indicate low diversity, while values above 3 indicate high species diversity. There is no defined upper limit, although in any case it can be determined by the base of the logarithm used. The advantage of this index lies in the fact that it is not necessary to identify all the species present; It is enough to be able to distinguish one from the other to count the individuals of each one and the total count. This index is widely used in ecological studies because of its ability to integrate two key components of diversity: species richness (i.e., the total number of species present) and the relative abundance of each species (the proportion of individuals of each species in relation to the total). The index is calculated using the formula:

$H' = -\sum(pi \log pi)$

where pi is the proportion of individuals of species **i** with respect to the total number of individuals in the sample. This approach allows capturing both the evenness (uniform distribution of species) and the dominance of some species over others. High H′ values (usually greater than 3) indicate high diversity, while values below 2 reflect low diversity, which may suggest the dominance of a few species over the rest (Shannon, 1948).

In this way, the index considers the number of species present in the study area (species richness), and the relative number of individuals of each of these species (abundance).

III. RESULTS AND DISCUSSION

In the Andes of the Bolívar province on the Hielero Route, we obtained a total of 279 records, corresponding to 5 orders, 13 families and 32 species of birds (Table 1). At the taxonomic level, the orders present are: Passeriformes, Apodiformes, Accipitriformes, Falconiformes, and Columbiformes. The families with the highest species richness were Trochilidae (n=6), Thraupidae (n=5), Furnariidae (n=4), Accipitridae (n=4), Tyrannidae (n=3), Falconidae (2) and Columbidae (n=2) and, finally, Hirundinidae, Turdidae, Parulidae, Grallariidae and Troglodytidae, Emberizidae (n=1 each).

TABLE I.
LIST OF BIRDS PRESENT ON THE ICE-COLD ROUTE GROUPED IN ORDER. FAMILY, SCIENTIFIC NAME AND ABUNDANCE.

No.	Order	Family	Scientific name	N. Individuals
1	Accipitriformes	Accipitridae	*Circus cinereus* Vieillot, 1816	2
2	Accipitriformes	Accipitridae	*Accipiter striatus* Vieillot, 1808	2
3	Accipitriformes	Accipitridae	*Geranoaetus polyosoma* Quoy & Gaimard, 1824	1
4	Accipitriformes	Accipitridae	*Geranoaetus melanoleucus* (Vieillot, 1819)	2
5	Columbiformes	Columbidae	*Columbina passerina* (Linnaeus, 1758)	7
6	Columbiformes	Columbidae	*Metriopelia melanoptera* (Molina, 1782)	2
7	Apodiformes	Trochilidae	*Colibri coruscans* (Gould, 1846)	15
8	Apodiformes	Trochilidae	*Oreotrochilus chimborazo* (DeLattre & Bourcier, 1846)	74

9	Apodiformes	Trochilidae	*Chalcostigma stanleyi* (Bourcier, 1851)	6
10	Apodiformes	Trochilidae	*Aglaeactis cupripennis* (Bourcier, 1843)	4
11	Apodiformes	Trochilidae	*Pterophanes cyanopterus* (Fraser, 1840)	2
12	Apodiformes	Trochilidae	*Patagona gigas* (Vieillot, 1824)	3
13	Falconiformes	Falconidae	*Phalcoboenus carunculatus* Des Murs, 1853	16
14	Falconiformes	Falconidae	*Falco sparverius* Linnaeus, in 1758	1
15	Passerines	Grallariidae	*Grallaria quitensis* Lesson, 1844	2
16	Passerines	Furnariidae	*Cinclodes albidiventris* Philippi & Landbeck, 1861	8
17	Passerines	Furnariidae	*Cinclodes excelsior* Sclater, PL, 1860	16
18	Passerines	Furnariidae	*Leptasthenura andicola* Sclater, PL, 1870	2
19	Passerines	Furnariidae	*Astheneswyatti*(Sclater, PL &Salvin, 1871)	5
20	Passerines	Tyrannidae	*Mecocerculus leucophrys* (Orbigny & Lafresnaye, 1837)	6
21	Passerines	Tyrannidae	*Muscisaxicola maculirostris* d'Orbigny & Lafresnaye, 1837	2
22	Passerines	Tyrannidae	*Muscisaxicola alpinus* Jardine, 1849	8
23	Passerines	Hirundinidae	*Orochelidon murina* Cassin, 1853	31
24	Passerines	Troglodytidae	*Troglodytes solstitialis* Sclater, PL, 1859	1
25	Passerines	Turdidae	*Turdus fuscater* d'Orbigny & Lafresnaye, 1838	10
26	Passerines	Thraupidae	*Diglossa humeralis* Fraser, 1840	5
27	Passerines	Thraupidae	*Phrygilus unicolor* (d'Orbigny & Lafresnaye, 1837)	3
28	Passerines	Thraupidae	*Rhopospina alaudina* (Kittlitz, 1833)	2
29	Passerines	Thraupidae	*Catamenia inornata* (Lafresnaye, 1847)	10
30	Passerines	Thraupidae	*Catamenia homochroa* Sclater, PL, 1859	19
31	Passerines	Emberizidae	*Zonotrichiacapensis*(Statius Müller, PL, 1776)	8
32	Passerines	Parulidae	*Myioborus melanocephalus* (Tschudi, 1844)	4

Source: Field Data

Among the most abundant species on the Route are the*Oreotrochiluschimborazo* (74 individuals), *Notiochelidon murina* (31 individuals), *Catameniahomochroa* (19 individuals), as well as Cinclodes*excelsior*and *Phalcoboenuscarunculatus*, both (16 individuals).

Regarding feeding patterns, thirteen species that feed on insects were identified, these being *Grallariaquitensis, Cinclodesalbidiventris, Cinclodesexcelsior, Leptasthenuraandicola, Astheneswyatti, Mecocerculusleucophrys, Muscisaxicolamaculirostris, Muscisaxicolaalpinus, Orochelidon murina, Troglodytessolstitialis, Turdusfuscater, Zonotrichiacapensis and Myioborusmelanocephalus*; seven of them feed mainly on nectar: *Hummingbirdcoruscans, Oreotrochilus Chimborazo, Chalcostigmastanleyi, Aglaeactiscupripennis, Pterophanescyanopterus, Patagona gigas and Diglossahumeralis*; five predators including *Circuscinereus, Accipiterstriatus, Geranoaetuspolyosoma, Geranoaetusmelanoleucus* and *Falco sparverius*; four species are seedlings, such as *Phrygilus unicolor*, *Rhopospinaalaudina, Catameniainornata and Catameniahomochro*a; two are classified as granivorous, namely, *Columbina passerina and Metriopelia melanoptera;* and only one feeds on carrion, and someinsects*Phalcoboemuscaruncuñatus*.

Omnivorous birdssuch as *Turdusfuscater* have frugivoroustendencies and predation while *Zonotrichiacapensis* has a dietthat combines insectswith a large amount of plant material. It is clear that most birds tend to eat mainly insects.

All the species inventoried are listed as Least Concern (LC), according to the IUCN Red List, eleven species listed in Appendix II of CITES, namely: *Circuscinereus, Accipiterstriatus, Geranoaetuspolyosoma, Geranoaetusmelanoleucus, Colibricoruscans, Oreotrochilus Chimborazo, Chalcostigmastanleyi, Aglaeactiscupripennis, Pterophanescyanopterus, Patagona gigas, Phalcoboenuscarunculatus and Falco sparverius*, onlythe*Circuscinereus*islisted as near threatened for Ecuador (Freile, 2019).

Trends were detected in the spatial distribution of birds along the route, with certain species being prevalent in shrubby areas, while others prefer open habitats or forest boundaries.

In relation to endemism, four species exclusive to the inter-Andean slope and valley have been identified (Ridgely 2006). The*Oreotrochilus Chimborazo* stands out as the most abundant bird, with a population of 74 individuals. It isfollowed by *Phalcoboenuscarunculatus* and *Cinclodesexcelsior*, both with 16 individuals each. On theotherhand, *Muscisaxicolaalpinus* is the least common, with only eight individuals recorded. All these species depend on the ecosystem of the slope and inter-Andean valley for their survival, highlighting their importance in this habitat.

Birds show remarkable flexibility in their movement patterns, with climatic variations, foraging, and floral availability being factors that lead them to explore a variety of habitats. Although the frequency of these explorations can vary, it is common to observe that birds usually frequent one to three types of habitats, which underscores their ability to adapt to different environments and resources.

Five habitat types were identified during the observation. The arid montane scrub was the most abundant, with 52 individuals, followed by the Arenal with little or no vegetation, where 23 individuals were counted. The Páramo Grasslands presented 21 individuals, while the Pasture and Agriculture Land registered nine individuals. Finally, a species associated with moving bodies of water was observed. Endemic species were recorded in habitats ranging from one to four types. Forexample, the*Oreotrochiluschimborazowas*sighted in allhabitatsexcepton land for pasture and agriculture. The only endemic species recorded in this type of hábitat was *Cinclodesexcelsior*. (Table 2).

TABLE II.
BIRDLIFE OF THE ROUTE WITH THE PREFERRED HABITAT AND THE MOST FREQUENTED

N.	Species	Habitats	Most frequented habitat
1.	*Oreotrochilus chimborazo*	Desert Thicket Pajonal	Desert and scrub
2.	*Colibrí coruscans*	Thicket	Thicket
3.	*Chalcostigma stanleyi*	Thicket	Thicket
4.	*Aglaeactis cupripennis*	Thicket Desert	Thicket
5.	*Patagona gigas*	Grassland Thicket	Grassland and shrubland
6.	*Pterophanes cyanopterus*	Thicket	Thicket
7.	*Cinclodes excelsior*	Pajonal Desert Thicket	Pajonal
8.	*Cinclodes albidiventris*	Pajonal Grassland	Grassland and grassland
9.	*Asthenes wyatti*	Pajonal	Pajonal

10.	*Leptasthenura andicola*	Thicket	Thicket
11.	*Accipiter striatus*	Grassland Desert	Grassland and desert
12.	*Geranoaetus melanoleucus*	Pajonal Desert	Grassland and desert
13.	*Geranoaetus polyosoma*	Pajonal	Pajonal
14.	*Circus cinereus*	Pajonal	Pajonal
15.	*Catamenia homochroa*	Thicket Pajonal Grassland Desert Thicket	Pajonal
16.	*Diglossa humeralis*	Thicket	Thicket
17.	*Rhopospina alaudina*	Pajonal	Pajonal
18.	*Catamenia inornata*	Thicket	Thicket
19.	*Muscisaxicola alpinus*	Desert Thicket Pajonal	Desert
20.	*Mecocerculus leucophrys*	Thicket Desert Grassland	Scrub, desert and grassland
21.	*Muscisaxicola maculirostris*	Thicket	Thicket
22.	*Zonotrichia capensis*	Thicket Grassland	Thicket
23.	*Phrygilus unicolor*	Thicket Desert Pajonal	Scrub, desert and grassland
24.	*Phalcoboenus carunculatus*	Desert Pajonal	Desert and grassland
25.	*Falco sparverius*	Desert	Desert
26.	*Columbine passerina*	Thicket	Thicket
27.	*Metriopelia melanoptera*	Thicket	Thicket
28.	*Orochelidon murina*	Desert Grassland	Grassland
29.	*Turdus fuscater*	Pajonal Grassland Thicket	Thicket
30.	*Myioborus melanocephalus*	Thicket	Thicket
31.	*Grallaria quitensis*	Grassland Thicket	
32.	*Troglodytes solstitialis*	Thicket	Thicket

Source: Field Data

With regard to diversity, we applied the formula to calculate the Shannon diversity index and obtained the following data (Table 3).

TABLE III.
CALCULATION OF DIVERSITY IN RELATION TO HABITAT

Habitat	Index	Diversity
Sandy area with little or no vegetation	2.01	Median
Arid montane scrub	2.42	Median
Páramo grasslands	2.42	Median
Pasture land and agriculture	1.46	Casualty
Total	**2.81**	**Median**

Source: Field Data

When applying the Shannon-Wiener index, a medium diversity was noted, as expected, since the high Andean zoogeographic floor naturally tends to present a lower diversity compared to other zoogeographic floors. However, the land habitat of pastures and agriculture showed low diversity, being the only exception.

Ecuador has a total of 1673 species confirmed and documented with evidence, while four species still require solid documentation (Sánchez Nivicela et al., 2023). These species are grouped into 92 families and 26 orders (Pontificia Universidad Católica del Ecuador, 2019). The ornithfauna of the high Andean floor is home to 140 species, which represents 8.5% of the total species recorded for Ecuador (Bayancela-Delgado & Sulay, 2021). This study documents the birds present on the Route of the Hieleros in the province of Bolívar, along with theirdiversity and abundance.

The initial part of the Route is within the Chimborazo Fauna Production Reserve, which has an endemic biodiversity that is a consequence of its privileged geographical location, Chimborazo is the area that is considered the closest point to the sun, in this area there are about 16 species of mammals (4.5% of those existing in Ecuador). 61 species of birds (4.07% of the species in Ecuador), (Beltrán, et al., 2011 cited in (Zurita et al.., 2022).

The transect that exhibited the largest number of avifauna individuals observed was Transect 5, with an altitudinal variation between 3,406 and 3,475 meters above sea level (m.a.s.l.), in which a total of 77 individuals were recorded. On the other hand, Transect 1 has an altitude ranging between 4,258 and 4,351 meters above sea level, with a total of 76 individuals sighted. It is relevant to note that bird detection varies according to multiple factors, such as the time of day, the season of the year, the intensity of the wind, the diversity of ecosystems present, noise levels and the availability of floral and food resources. Jahn (2011) points out that the presence of birds is closely linked to the degree of disturbance of habitats, as well as to the structural complexity of theupperleafstrata

On the Ruta del Hielero de Bolívar, we have documented a population of 32 resident species, with a total of 279 individuals recorded in the area. These species are classified into five orders and 13 families, highlighting the presence of the Trochilidae family with sixspecies, with*Oreotrochiluschimborazochimborazobeing*themostprominent and visible subspecies. The Chimborazo Reserve reports the presence of 61 species belonging to 28 families according to data from the Ministry of the Environment (2008). This indicates that 46% of the birdlife registered in the reserve is found on the Ruta del Hielero and is home to 13 of the 28 families documented in it. As for the orders, Passeriformes is the most representative along with Apodiformes.

When comparing our results with the study carried out in the Biosphere Reserve of the Massif of the Cajas, located in the páramos of southern Ecuador, the following data were found: 112 species of birds were identified, classified into 1 order and 32 families. Thraupidae and Trochilidae were the families with the largest number of species, and five endemic species were recorded. Among the species exclusive to the area, the presence of the Carunculated Caracara (*Phalcoboenuscarunculatus*) and (*Cinclodesexcelsior*), notable for their distinctive beak, was

documented (Astudillo et al., 2023). These findings corroborate the results of our research, where local endemic species *such as Phalcoboenuscarunculatus* and *Cinclodesexcelsiorwereidentified*.
The Trochilidae family stands out as the one that houses the largest number of individuals, representing 19% of the total number of species recorded. It is important to mention the notable presence of the endemic hummingbird "little Ecuadorianstar" (*Oreotrochiluschimborazo*), whichisfrequently observed flying and feeding on the nectar of theinflorescenceof*Chuquiragajussieui*. This bird has white plumage on the belly, green back and a purple hood that covers its entire head. It is endemic to the inter-Andean watershed and valley (Ridgely 2006) and is listed in Appendix II of CITES (Albuja et al., 2012).
The habitat of Arid Montane Shrubland registered the largest number of species (22) and the largest number of individuals (52). This result suggests that many birds depend on the floral availability of plants present in this type of habitat. Each of the identified bird species shows specific adaptations to certain altitudes. Sometimes, climatic variations, adaptations, floral availability or simply the search for food can lead species to explore various environments. However, in general, these birds tend to frequent between 1 and 3 different habitats.
The plants found in this type of habitat (scrub) are: Polylepis or Gynoxysintermixedwith*Escalloniamyrtilloides*, *Hesperomelesobtusifolia*, *Myrsine andina* and *Oreopanaxandreanus*, The shrub-herbaceous stratum is dense with: Arcytophyllum, Barnadesia, Berberis, Puya, Brachyotum. The physiology of heterogeneous vegetation in páramo habitats is important for the Andean bird community as the heterogeneity of the páramo matrix improves bird movements in the landscape of the Polylepis patches (Astudillo et al., 2018).
The Coruscans hummingbird is also among the most representative species with (Ridgely & Greenfield, 2006). This hummingbird is common in semi-cleared areas, agricultural land with scattered trees, gardens and forest edges. It is present in the central and inter-Andean valleys. It is notable as it inhabits places where endemic or native vegetation is scarce or even absent, being common to observe in urban environments.
According to Astudillo et al. (2014), species richness is not affected despite the proximity of a road in the study area. However, it highlights that there is a marked disparity in the abundance of bird groups between different habitats and transects. In addition, it indicates that shrubby patches exhibit the highest abundance of birds. Astudillo et al. (2023) also point out that the central Andean areas are ideal habitats for P. carunculatus.
Chapman (1926), cited in Astudillo et al. (2014), points out that páramos ecosystems in Ecuador exhibit similarities in species diversity across latitudes. Poulsen (1998) and Krabbe et al. (1998) showed that species richness varies little with latitude, but that composition has strong variability. On the other hand, Fjeldså (2002), Krabbe (1998), Tinoco et al. (2009) and Astudillo et al. (2014) mention that birds are closely associated with woody species and that avian diversity depends on the proportion of these in theAndeanlandscape.
When using the Shannon-Wiener index, a medium diversity was observed in general, with the exception of grassland habitat, which exhibits low diversity, as expected due to the fact that the high Andean zoogeographic floor naturally presents a lower diversity compared to other zoogeographic floors (140 species). However, the land habitat of pastures and agriculture showed low diversity. When contrasting our results with those of Bayancela (2021), it is highlighted that the data indicate a specific diversity for birds (Margalef Index = 2.25, low mean diversity) and for bird dominance (Simpson Index = 0.86; low diversity) in the ecosystem of ultra-humid subnival grassland of páramo (4400-4900 m.a.s.l.) in the Chimborazo Fauna Production Reserve (RPFCh).
Addressing these issues requires a multi-pronged approach, including refined habitat classifications, rigorous population studies, and innovative predictive models that take into account local and large-scale factors. Only through a comprehensive understanding of the

complex interaction between birds and their páramo habitats can we hope to develop conservationstrategies (Telkamp, 2024).

IV. CONCLUSIONS

In conclusion, despite being exposed to anthropic activities, it is observed that the impact on ecosystems along the Route is low, and the ornithological diversity present in this place represents a potential for the development of birdwatching. It is critical to ensure the sustainable management of these fragile and sensitive areas, as they not only provide ecosystem services, but also host endemic flora that serves as a source of food, as well as resting, sheltering, and breeding grounds for birds and otherspecies.

The purpose of this research is that the information generated contributes to decision-making on issues related to conservation, research and tourism. In addition, this site has significant value in terms of didactic and scientific utility.

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