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Perceptions of the Andean condor in the urban population of Ecuador

Percepciones del cóndor andino en la población urbana del Ecuador

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ABSTRACT

The Andean condor (*Vultur gryphus*) is an emblematic species of the Andes. It is the largest vulture in the world, and it is at the top of the food chain. His image has been present in the memorial of cultures, festivals and beliefs of Andean people and persists until now, as current symbolism of the Andean cultures. In order to evaluate the general data of the Andean condor based on urban population perspectives, surveys were used and distributed over the internet in Ecuador under a socioeconomic classification. The information was analyzed using Chi^2 tests and generalized linear models. 726 responses were obtained from people between 18 and 71 years old. All the models generated were reliable. The results show that general information such as recognizing the species, knowing its diet and perceiving that it is an endangered species, is known by the urban population. Unknown aspects of the Andean condor are its size, flight distance and the number of eggs per clutch. The Andean condor has a positive perception as a vulture, and a low percentage considers it a harmful species capable of preying live animals. Variables such as gender, outdoor activities and age proved gaps in the natural history of the Andean condor in some social

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spaces. We suggest as an alternative to completely cover the gaps, environmental education actions directed to these social spaces.

Keywords — Emblematic species, gender, generalized models, socioeconomic, urban population.

RESUMEN

El cóndor andino (*Vultur gryphus*) es una especie emblemática de los Andes. Es el ave carroñera más grande del mundo, y está en la cúspide de la cadena trófica. Su imagen ha estado presente desde tiempos inmemorables en culturas, fiestas y creencias y persiste en simbolismos y culturas actuales. Con el objetivo de evaluar los efectos socioeconómicos de la población urbana sobre información general del cóndor andino, se usó encuestas que fueron distribuidas por internet en Ecuador. Se analizó la información mediante pruebas Chi^2 y modelos lineales generalizados. Se obtuvieron 726 respuestas de personas entre 18 y 71 años. Todos los modelos generados fueron confiables. Los resultados muestran que la información general como; reconocer la especie, conocer su alimentación y percibir que está en peligro de extinción, es conocida por la población urbana. Aspectos desconocidos del cóndor andino son el tamaño de la especie, distancia de vuelo y el número de huevos por nidada. El cóndor andino tiene percepción positiva como ave carroñera y un bajo porcentaje la considera especie nociva y capaz de depredar animales vivos. Variables como él; género, las actividades al aire libre y la edad evidenciaron espacios sociales con vacíos de historia natural del cóndor andino. Sugerimos como alternativa para cubrir por completo los vacíos de historia natural, acciones de educación ambiental direccionados a estos espacios sociales.

Palabras clave — Especie emblemática, género, modelos generalizados, población urbana, socioeconómicos.

INTRODUCTION

The Andean condor (*Vultur gryphus* Linnaeus, 1758) is the largest land bird in the world (Astore, Estrada, Jácome, 2017; Houston, Kirwan, Christie, Sharpe, 2020). It is a species linked to South American history, and its image has been reflected in stories and legends, and has been kept in archaeological remains of some pre-Columbian and current traditional celebrations (Ibarra, Barreau, Massardo, Rozzi, 2012; Montealegre, 2007; Piana, 2019). Its image is a fundamental part of national symbols in five South American countries, which shows its cultural importance in today's society.

At the end of 2020, the species was declared vulnerable (VU) by the International Union for Conservation of Nature (IUCN) (IUCN, 2012). Andean condor populations have declined since the 1980s (Bruning, 1983). On Ecuador's red list, it has gone from being considered a critically endangered species (CR) (Koester, 2002) to endangered (EN) (Freile et al., 2019). The estimated population is thought to be around 100 individuals (Naveda-Rodríguez, Vargas, Kohn, Zapata-Ríos, 2016),

with few breeding pairs of nesting events (Sánchez and Gallo-Viracocha, in press), a situation that places this species below a minimum viable population and on the verge of extinction in the wild (IUCN, 2017). Furthermore, since the 2000s, the Andean condor has presented serious conservation problems such as hunting and poisoning (Koester, 2002), adding to the current habitat loss (Naveda-Rodríguez et al., 2016). Much work must still be done on these problems to confront, mitigate, and conserve the species. In fact, it is a species for which we have limited knowledge of natural history (Astudillo et al., 2016; Restrepo, Sáenz-Jiménez, Lieberman, 2019; Zambrano-Monserrate, 2020) and large gaps in our knowledge of its reproductive ecology in the wild (Lambertucci and Mastrantuoni, 2008; Lambertucci and Speziale, 2009; Restrepo-Cardona et al., 2018). This limitation has been reflected in social groups that show a lack of education and knowledge about its natural history (Castillo-Figueroa and Sáenz-Jiménez, 2019; Restrepo et al., 2019).

Studies about perceptions of the Andean condor have been carried out throughout its range of distribution (Cailly Arnulphi, Lambertucci, Borghi, 2017; Manzano-García, Jiménez Escobar, Lobo Allende, Cailly Arnulphi, 2017; Restrepo et al., 2019; Zambrano-Monserrate, 2020). These studies show negative perceptions associated with the predation of domestic animals (Cailly Arnulphi et al., 2017; Manzano-García et al., 2017) and positive perceptions associated with their scavenging diet (Restrepo et al., 2019). However, few studies have been focused on rural communities (Ballejo, Plaza, Lambertucci, 2020; Cailly Arnulphi et al., 2017; Manzano-García et al., 2017; Restrepo et al., 2019). Research about the perception of the Andean condor in urban populations showed interest in investing in conservation of the species (Zambrano-Monserrate, 2020).

Factors such as socioeconomics affect the perception of the Andean condor (Cailly Arnulphi et al., 2017; Restrepo et al., 2019). It is known that a higher level of education determines a positive perception of the species, a more significant relationship with livestock activities (Cailly Arnulphi et al., 2017), and older age in people from rural environments (Restrepo et al., 2019). On the other hand, factors such as salary income, people's relationship with animals, and the environment are determining factors in terms of paying to conserve the species, and other factors, such as age, sex, and level of education, are not (Zambrano-Monserrate, 2020). In this sense, the responses evident in previous studies are diverse, and it is essential to evaluate and determine how these socioeconomic and demographic variables (rural-urban) affect the perception of the species. Therefore, the purpose of the present study was to evaluate how socioeconomic factors affect the perceptions of the knowledge of ecological generalities of the Andean condor in the urban population of Ecuador. These results complement the information on perception and show gaps in general information regarding the Andean condor. At the same time, this will allow us to direct specific actions of environmental education by the institutions immersed in the conservation and management of the species and its habitats in the country.

MATERIALS AND METHODS

Study site and survey

The study was carried out by an online poll. Since January 2020, a survey scheme was generated. It was tested in tourists who visit the Antisana National Park (Fig. 1). A total of 70 surveys were conducted physically. They served to improve the characteristics of the questions and make them more understandable for the people. The survey was ready to be distributed in March 2020. However, due to the global pandemic of COVID-19, its physical distribution was suspended. Therefore, it was digitalized making it more amiable and with closed questions. The survey was distributed online through the Programa de Conservación del Cóndor Andino en Ecuador social networks and was accessible to all interested people for three months. Although the analysis was for Ecuador, the reach of social networks caused them to generate responses from other countries, which were not considered in the present study.

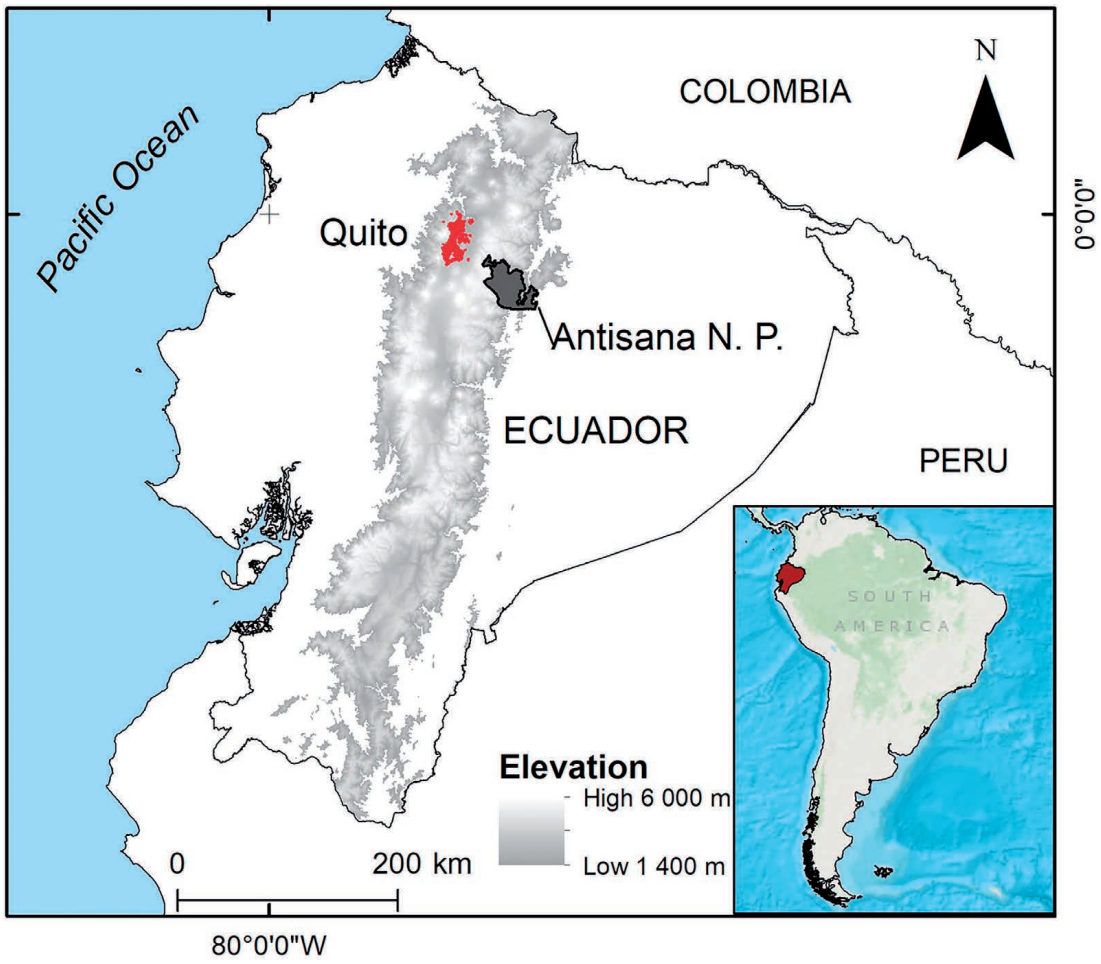

Figure 1. Study site, highlights the sierra region of Ecuador and the Antisana National Park (Antisana N. P.).

Figura 1. Sitio de estudio, destaca la región sierra del Ecuador y el Parque Nacional Antisana (P. N. Antisana).

The first part of the survey describes the respondent in terms such as education, age, economic sector, residence and empathy for nature. The second part, is about general knowledge about the Andean condor [identification, size, diet, reproduction (number of eggs per laying), flight areas, protection status and general perception (beneficial or harmful] (Table 1; Supplement 1).

Information analysis

Between May and June 2020, the survey was carried out and a total of $N = 790$ surveys were compiled. As a result of cleaning the database, a total of 726 surveys

Table 1. Variables obtained in 726 surveys of the urban population in Ecuador, 2020.
Tabla 1. Variables obtenidas en 726 encuestas de población urbana en Ecuador, 2020.

Variables	Category	Mean	N	%
Socioeconomic Variables				
Gender	Man		412	56.75
	Woman		314	43.25
Age (continuous 18-75 years old)		34.03		
Age (factor)	18-35		389	53.58
	36-55		304	41.87
	>55		33	4.55
Level of studies	University		693	95.45
	High school		33	4.55
Occupation	Employee		367	50.55
	Student		228	31.40
	Independent		113	15.56
	NA		9	1.24
	Unemployed		9	1.24
Carry out outdoor activities	Yes		578	79.61
	No		148	20.39
Answer Variables				
Identify the Andean condor	Yes		587	80.85
	No		140	19.28
Andean condor size (spread wings)	> 3 meters		447	61.57
	Wrong (<1 y >4 m) *		100	13.77
	Unknow *		179	24.66
Diet	Scavenger		631	86.91
	Predator		92	12.67
	NA		3	0.41
Flight distance	Unknow *		309	42.56
	More than 50 km		304	41.87
	Wrong (0-30 km) *		113	15.56
N° of eggs per clutch	One		499	68.73
	Wrong (2 y >3 eggs)		227	31.27
Endangered species	Yes		706	97.25
	No		11	1.52
	Unknow *		9	1.24
General perception	Beneficial		717	98.76
	Harmful		9	1.24

Legend: N = number of responses; NA = data not available; Independent = includes retirees, house workers and entrepreneurs; * grouped into a single category (unknow / wrong) by GLM.

of people between 18 and 75 years (*mean* 34.03, *SD* 10.57) were obtained for data analysis (Table 1).

The perception of Andean condor was evaluated by Chi^2 tests at urban population. It was stratified by age, level of study, occupation and whether or not they engage in outdoor activities. It can be hypothesized that general information about the Andean condor [response variables] is known without distinction of socioeconomic factors [socioeconomic variables] at urban population in Ecuador (Table 1).

To investigate the influence of the explanatory variables (socioeconomic, age, educational level, occupation, and practice or not of outdoor activities) on the response variables (perceptions), we used generalized linear models (GLM) with binomial distribution. This distribution allowed us to determine if the influence is present [1= when they answered yes to the questions about recognizing an Andean condor, as well as if they know its size, diet, movement, eggs per clutch, if it is in danger of extinction or if it is a harmful species] or absent [0= not recognizing the species, they do not know the information or classify it as a harmful species]. With the group of explanatory variables, models were generated using all possible combinations (including the null model). The significant models were selected, as were those that contained the greatest number of explanatory variables with significant weights. The GLMs were validated with likelihood ratio tests (Table 3). That information served to determine how socioeconomic factors influence the general perception of the Andean condor and its ecology.

For the general perceptions about the species in percentages [> 80% (for one of the categories)] that were well defined, statistical tests were not applied (Table 2) and it is understood as known by the population. All analyzes were carried out using R software (version 3.6.2, July 5, 2019) (R Development Core Team 2017).

RESULTS

Socioeconomic characterization

The socioeconomic information of 726 people presented a higher number of men (56.75%) who answered the survey than women (43.25%). The highest percentage of people has university educational level (95.45%); are employees (50.55%) and the (79.61%) carry out outdoor activities (Table 1).

Characterization of general information about the Andean condor

The basic information referring to the ecology of the Andean condor reflects that more than 80% of the people surveyed answered yes to the question: "Can you recognize an Andean condor?" (80.85%). The percentage was also high when answering "Do you know how an Andean condor feeds?" [scavenger (86.91%)], the people surveyed recognize the Andean condor as a species that is endangered (97.25%) and identify it as a beneficial species (98.76%). A low percentage of people do not

Table 2. *Chi²* test between socioeconomic variables and responses variables. N = number of surveys (total: 726).

Tabla 2. Prueba de *Chi²* entre variables socioeconómicas y variables de respuesta. N = número de encuestas (total: 726).

Variables	Pair of response variables: Socioeconomic / Basic information of the condor	*Chi²*	*df*	*p*
Gender	**Man - Woman** / They identify the Andean condor	28.1640	1	**0.0000**
	Man - Woman / Andean condor size	30.6820	2	**0.0000**
	Man - Woman / Diet	2.8852	1	0.0894
	Man - Woman / Flight distance	18.7620	2	**0.0001**
	Man - Woman / # of eggs	0.0000	1	1.0000
	Man - Woman / Danger of extinction	2.2336	2	0.3273
	Man - Woman / Perception (B-H)	0.0706	1	0.7904
Age	**[18-35]-[35-55]-[>55]** / Identify Andean condor	21.3470	2	**0.0000**
	[18-35]-[35-55]-[>55] / Size of Andean condor	12.4920	4	**0.0140**
	[18-35]-[35-55]-[>55] / Diet	1.2166	2	0.5443
	[18-35]-[35-55]-[>55] / Flight distance	59.1940	4	**0.0000**
	[18-35]-[35-55]-[>55] / # of eggs	3.3382	2	0.1884
	[18-35]-[35-55]-[>55] / Danger of extinction	1.6379	4	0.8020
	[18-35]-[35-55]-[>55] / Perception (B-H)	1.0206	2	0.6003
Level of studies	**High school - University** / Identify Andean condor	0.2634	1	0.6078
	High school - University / Size of Andean condor	1.6444	2	0.4395
	High school - University / Diet	1.9475	1	0.1629
	High school - University / Flight distance	0.3694	2	0.8313
	High school - University / # of eggs	0.7032	1	0.4017
	High school - University / Danger of extinction	7.0441	2	**0.0295**
	High school - University / Perception (B-H)	0.0000	1	1.0000
Occupation	**Em-Es-In-De** / Identify Andean condor	18.1090	3	**0.0004**
	Em-Es-In-De / Size of Andean condor	26.7240	6	**0.0002**
	Em-Es-In- De / Diet	12.6820	3	**0.0054**
	Em-Es-In-De / Flight distance	43.0010	6	**0.0000**
	Em-Es-In-De / # of eggs	7.4746	3	0.0582
	Em-Es-In-De / Danger of extinction	1.9607	6	0.9233
	Em-Es-In-De / Perception (B-H)	0.2802	3	0.9637
Outdoor activity	**Yes - No** / Identify Andean condor	7.7994	1	**0.0052**
	Yes - No / Size of Andean condor	21.7570	2	**0.0000**
	Yes - No / Diet	4.6714	1	**0.0307**
	Yes - No / Flight distance	29.2900	2	**0.0000**
	Yes - No / # of eggs	2.0612	1	0.1511
	Yes - No / Danger of extinction	2.6361	2	0.2677
	Yes - No / Perception (B-H)	1.2349	1	0.2665

Legend: Perception (B-H) = Beneficial-Harmful perception; NA = data not available; df = degrees of freedom; in bold, relationships with statistical significance ($p < 0.05$).

know the size [<1 and > 4 m (13.77%) of the Andean condor, another percentage is unknown (24.66%)], and the difference (61.57%) known the size. The perception of flight distances in adult condors is indicated as unknown in 42.56% and incorrectly referred to in 15.56% (0-30 km). Finally, 68.73% knew about its reproduction, nest, and egg-laying, and 31.27% did not (Table 1).

Socioeconomic perception of general information of the Andean condor

Men and women exhibited random perceptions when they were asked if they know: the number of eggs per nesting event, the diet (scavenger or predator); if it is in danger of extinction, and if the species is beneficial or harmful (Table 2).

The perceptions between men and women were not the same when they were asked if they could identify the Andean condor; women responded less correctly than expected (N = 225) than men (361) (p = 0.000) (Table 2) if the responses between both genders were the same. Neither did they when they chose the correct size of the species. A great number of correct answers were from men [more than 3 meters (288), unknown (73), wrong (51)] than women [159, 106, 49] (p = 0.000); but with a significant number of people who do not know the correct information (N = 179) or have wrong answers (100). A similar situation occurred in answers about the correct flight distance (> 50 km) [men (K = 200), women (104)] where the unknown answers [men (N = 150), women (159)] and wrong [men (62), women (51)] were major in both cases (p = 0.000).

The three age strata showed differences in their perceptions about the identification of the species; people between 18 and 55 years old responded in major numbers that they could identify the Andean condor (N = 290) (p = 0.000). Similar situation to the question about its size (N = 218) (p = 0.014) and flight area, but with the particularity that people over 55 years of age answered in less proportion than desired in an erroneous way (N = 3) and unknown (6) and those under 55 years of age answered more than expected that they were unaware (303) or wrong their answers (110) (p = 0.000). The remaining comparisons did not show differences (Table 2).

Regarding the level of education and information on, whether the species is in danger of extinction, it was greater than expected in people with higher education [yes in extinction (N = 675), no (11), unknown (7)], compared to people with secondary education [(N = 31), (0), (2)] (p = 0.000). Other general information on the Andean condor did not show differences according to the level of education (Table 2).

Taking in consideration people´s occupation related to the questions about knowing the number of eggs per nesting, if the species is in danger and if the species is beneficial or harmful, data showed random responses. The majority answered more than expected that they could correctly identify the Andean condor [N = 579 (Employee n = 310, Student 164, Independent 96, Unemployed 9)] compared to those who could not recognize them [138 (57, 64, 17.0] (p = 0.000). Similar responses were obtained in relation to its size compared to each respondents' occupation, a major number of correct responses [N = 442 (Employee 239, Student 126, Independent 73, Unemployed 4)] and a significant number of incorrect responses [99 (42, 31, 21.5)] or unknown [176 (86, 71, 19, 0)] (p = 0.000).

Responses regarding the species' diet differed according to each respondents' occupation, with a large number of responses classifying the species as scavenger [N = 631 (Employee 318, Student 187, Independent 109, Unemployed 8) versus predator [N = 921 (48, 39, 4, 1)] (p = 0.005).

Flight distance responses also differed according to the occupation, but with a higher number of incorrect answers [N = 113 (Employee 48, Student 49, Independent 14, Unemployed 2) and unknown [309 (137, 122, 38, 3)] compared to the correct answer [N = 304 (182, 49, 14, 2)] (p = 0.000).

People who do outdoor activities answered more than expected whether they could or not identify the species [if they identify (479) and they do not identify (99)], in relation to those who do not carry out outdoor activities [if they identify (107) and they do not identify (41)] (p = 0.005). People who practice outdoor activities know the correct size of the Andean condor, yet they registered a large number of unknown and erroneous responses [> 3 m (380), unknown (124), erroneous (74)] compared to those who do not practice outdoors activities [148, 55, 26, 67] (p = 0.000). In both cases, a significant number of responses were wrong (100) or unknown (179).

Regarding diet, responses if the species is a scavenger or a predator, were more than expected in persons who perform outdoor [N = 578 (carrion 511, others 65)] versus those who do not [148 (120, 27)] (p = 0.031) (Table 2).

Flight distance responses also differed between people who do outdoor activities and those who do not outdoor activities, both registered a greater number of unknown responses [K = 309 [yes (219), no (90)] and incorrect [N = 113 (yes (90), no (23)], compared to the correct answer [N = 304 [yes (269), no (35)] (p = 0.000) (Table 2).

Influence of socioeconomic factors

All the logistic models were reliable (p <0.05), but not all of the socioeconomic variables showed significance within each model. The gender variable was present in five models and age, occupation, and outdoor activities were present in three models (Table 3). The predictive variables of the logistic models that explain the species' diet, flight distance and the beneficial-harmful perception did not show significant influences on the response variables.

The identification of the Andean condor model shows that the probability of recognizing it increases by 3% as age increases (OR = 1.03497; p = 0.000) and decreases by 60% in women (OR = 0.398061; p = 0.000) (Table 3; Fig. 2). The model about its size shows the probability of referring to the correct size of the species; it was lower up to 53% in women (OR = 0.4766; p = 0.000), and increases up to 107% when people perform outdoor activities (OR = 2.0709; p = 0.000) (Table 3). The variables in the model about the number of nesting eggs of the Andean condor reflect that the probability of considering that a single egg is part of reproduction increases by 1% as age increases (OR = 1.0014; p = 0.034). Knowledge that the species is highly endangered decreases by 11% as age increases (Table 3).

The probabilities referring to the perception, if the species was beneficial-harmful and about the flight distances, did not present variables with significant effects. The models were made up of one and two variables respectively (Table 3).

Table 3. Linear Significant Generalized Models *(P <0.05)*; socioeconomic variables and their influence on the general knowledge of the Andean condor in Ecuador.

Tabla 3. Modelos lineales significativos generalizados *(P <0,05)*; variables socioeconómicas y su influencia en el conocimiento general del cóndor andino en el Ecuador.

Models	Estimate	*Std. error*	*z value*	*OR*	*p*	*p model*
Identify						
Age (continuous)	0.0344	0.0103	3.3250	1.0350	**0.0009**	**0.0000**
Gender, Woman	-0.9212	0.1986	-4.6390	0.3981	**0.0000**	
Size						
Gender, Woman	-0.7412	0.1583	-4.6810	0.4766	**0.0000**	**0.0000**
A. free, Yes	0.7280	0.1910	3.8110	2.0709	**0.0001**	
Diet						
Gender, Woman	-0.3702	0.2672	-1.3860	0.6906	0.1659	**0.0191**
O., Employee	-0.1676	1.0891	-0.1540	0.8457	0.8777	
O., Student	-0.2717	1.0947	-0.2480	0.7621	0.8040	
O., Independent	1.1240	1.1876	0.9460	3.0772	0.3439	
N. E, University	-1.3632	1.0283	-1.3260	0.2558	0.1850	
Flight distance						
Gender, Woman	-0.3778	0.2677	-1.4110	0.6854	0.1581	**0.0287**
O., Employee	-0.1181	1.0891	-0.1080	0.8886	0.9136	
O., Student	-0.2483	1.0946	-0.2270	0.7801	0.8205	
O., Independent	1.1406	1.1874	0.9610	3.1285	0.3368	
Eggs						
Age (continuous)	0.0169	0.0080	2.1100	1.0171	**0.0348**	**0.0495**
A. free, Yes	0.2078	0.1980	1.0490	1.2310	0.2940	
N. E, University	0.4216	0.3694	1.1410	1.5245	0.2537	
Extinction						
Age (continuous)	-0.1155	0.0379	-3.0510	0.8909	**0.0023**	**0.0314**
Gender, Woman	-0.8369	0.6646	-1.2590	0.4331	0.2079	
O., Employee	-12.8642	1.22E+03	-0.0110	0.0000	0.9916	
O., Student	-15.4811	1.22E+03	-0.0130	0.0000	0.9899	
O., Independent	-12.5197	1.22E+03	-0.0100	0.0000	0.9918	
Perception (B-H)						
A. free, Yes	-16.4200	1.46E+03	-0.0110	0.0000	0.9910	**0.0421**

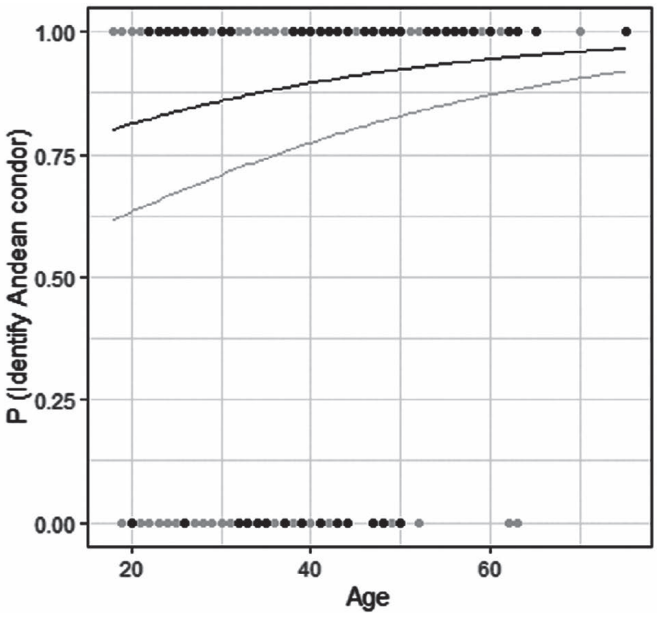

Figure 2. Logistic model that explains the probability of identification the Andean condor by the urban population in Ecuador. P = probability; gray line = women; black line = men.

Figura 2. Modelo logístico que explica la probabilidad de identificación del cóndor andino por parte de la población urbana del Ecuador. P = probabilidad; línea gris = mujeres; línea negra = hombres.

DISCUSSION

In the urban population of Ecuador, the results reflect that people have a good knowledge about the Andean condor as a species easy to recognize, with a scavenger diet, that is considered in danger of extinction and eventually a beneficial species. On the other hand, the results demonstrate gaps of information around its natural history in specific items such as the size of its wingspan, flight areas, and an essential part of its reproductive ecology, such as the number of eggs per nesting events.

The general knowledge of Andean condors in the urban population does not necessarily obey the population's education level. This variable was not a significant part of the model; all respondents showed a secondary and university education level. Although age showed a positive relationship when identifying the species, older people may recognize the Andean condor better regardless of their education. It is likely that the high level of identification is related to the presence of the species over time as an emblematic species in the Andes (Ibarra et al., 2012).

About the Andean condor's diet, a generalized knowledge was registered as a scavenger species, as it has typically been described (Donázar et al., 1999; Perrig, Donadio, Middleton, Pauli, 2017; Lambertucci et al., 2018; Pavez et al., 2019). These observations were answered mostly by people (employees, students and independent) who carry out outdoor activities. The responses on diet also included the predation of other live animals such as: rabbits (n = 45), insects or larvae (18), cows (15), deer (7), horses (3), alpacas (3) and sheep (1). Regarding the latter, little is known and sightings of predation of the species are scarce (Lambertucci, 2007). But their extensive diet is known, for the most part, to be made up of medium-sized exotic ungulates (sheep, cows), other lagomorphs (hares), some birds and plants (Lambertucci et al., 2009; Ballejo, Lambertucci, Trejo, De Santis, 2018; Duclos et al., 2020).

Other studies about perceptions and diet in rural communities show similarity to our results. However, in previous years, these rural areas got involved with environmental education programs for the benefit of the species (Restrepo et al., 2019). Despite this, young people showed less precise responses regarding its diet (Restrepo et al., 2019). The urban population, on which our research was focused on, defines variations such as gender and age that did not show effects when evaluating the species' diet. But gender was part of the model that better explained knowledge of the diet (Table 3). Other studies, in rural inhabitants, consider the Andean condor in a gradient between scavenger to predator, with main prey such as calves (newborns) and goats (Cailly Arnulphi et al., 2017; Manzano-García et al., 2017). In our results, the condor-predator characteristic was recorded marginally (12.67%) (Table 2), but not unnoticed, as there are few observations of attacks on lambs in exceptional predation events (Ballejo et al., 2020) and with previous studies (Manzano-García et al., 2017). In Ecuador, no study has described this issue and few observations record attacks on small (Koester, 2002) and dying calves as well as wild rabbits, horses and sheep as part of their diet.

The information derived directly from the diet of the Andean condor turns it into a beneficial (scavenger) or harmful species (when it attacks domestic animals) Koester, 2002; Cailly Arnulphi et al., 2017; Manzano-García et al., 2017; Restrepo

et al., 2019; Ballejo, Plaza, Lambertucci, , 2020). The study shows a positive perception as a scavenger and a low percentage considers it a harmful (predatory) species. These results are far from the perceptions of rural people in Argentina (Cailly Arnulphi et al., 2017; Manzano-García et al., 2017; Ballejo et al., 2020). A second explanation for the change that puts it into a positive perception in the urban population, is the level of education. In our study, all of the respondents have formal education (secondary and higher), and it has been proven that the Andean condor is perceived as a beneficial species as the level of education increases (Cailly Arnulphi et al., 2017). However, negative perceptions of the Andean condor as a noxious animal were detected since 2002 in Ecuador (Koester, 2002) and persist to date in the urban population. This would suggest that this pattern would be repeated in rural populations of Ecuador, therefore, studies in this sector should be expanded; due to rural populations that are in direct contact with the Andean condor and its ecosystem, now converted into grazing areas in many cases.

The perception of the Andean condor as an endangered species is high (> 90%) in all socioeconomic levels of the urban population. Another study registered similar values (94%) for Ecuador (Zambrano-Monserrate, 2020). It is likely that the results of the negative effect of age regarding the extinction of the species, could be associated with the time when the species was classified as endangered. This knowledge, if we compare it with the presence of the Andean condor in South America, is new on a time scale. In Ecuador, the species was considered in danger of extinction for more than 20 years. In 1991 it was counted only a few (75) individuals in the wild and years later it was classified as critically endangered (Koester, 2002). In recent times, information has had a greater reach due to its digitization and globalization (Devictor and Bensaude-Vincent, 2016).

The size of the Andean condor, the flight area, and the number of eggs the species lays turned out to be the least known items. There are no similar studies that describe perceptions of this type for the species. Although the information about the Andean condor's natural history in recent years has increased rapidly, especially south of its distribution in telemetry issues (Lambertucci et al., 2009, 2018; Perrig et al., 2020) and which their action and life areas are known, information regarding their reproductive ecology is still scarce (Wallace and Temple, 1988; Sáenz-Jiménez et al., 2016; Restrepo-Cardona et al., 2018). The few references mention that couples lay only one egg (Wallace and Temple, 1988; Köster, 1997; Lambertucci and Mastrantuoni, 2008; Restrepo-Cardona et al., 2018). Several studies agree that the biological and ecological information on the Andean condor in wildlife is still limited (Castillo-Figueroa and Sáenz-Jiménez, 2019; Restrepo et al., 2019; Zambrano-Monserrate, 2020). This could partly explain the lack of knowledge about the reproductive ecology of the species. We can also add that the information already generated by researchers is not being properly viewed by the general population.

In the present study, the perception about the Andean condor size increased in people who perform outdoor activities. And, as age increases, it was less known that the species only lay one egg per reproductive event. Thus, the results show social spaces [women, people who do not carry out outdoor activities, older adults (> 36 years)] where they could emphasize environmental education actions aimed at filling

information gaps. Educational actions can contribute to changing attitudes, making evident the importance of species, not only within the ecosystem but also in terms of the benefits they provide to local communities (Piana, 2014; Castillo-Figueroa and Sáenz-Jiménez, 2019).

The Andean condor in Ecuador has been threatened for more than 20 years, (Koester, 2002) and there are few efforts generated to mitigate them. Despite this, there is a positive perception and relevant knowledge about the Andean condor in the Ecuadorian urban population. Nevertheless, it is necessary to include, in an accurate way, the general information that is still missing about the species and complement it with the existing knowledge. This lack of information must be addressed with specific actions of environmental education by public and private institutions and people immersed in the conservation of the Andean condor in Ecuador.

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Study design, data collection, modeling, analysis, and writing: Freddy Gallo-Viracocha; Data collection and writing: Sandra Páramo Heredia, Alexandra Endara, Michael Vicente Riofrio, Edith Montalvo and Roberto Sánchez Mateos.

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