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Bird diversity at observation sites in the Province of Alto Amazonas, Loreto, Peru

Diversidad de aves en puntos de observación de la provincia de Alto Amazonas, Loreto, Perú

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ABSTRACT

The Peruvian Amazon is a vast region with an abundance of bird diversity that significantly contributes to ecosystem functioning, making it essential to understand the distribution of these birds. This study aimed to record and analyze bird diversity across various observation sites in the province of Alto Amazonas, Loreto, Peru, between October 2023 and October 2024. Surveys were conducted in nine representative localities using direct and observational methods, as well as playback techniques, supported by digital applications and specialized literature. A total of 157 bird species were identified, belonging to 23 orders and 46 families. Diversity analyses revealed that better-preserved sites, such as Mercedes, exhibited higher diversity and evenness (Shannon index up to 4.02 and Simpson index up to 0.97). In contrast, altered environments, such as the rice fields of La Florida, showed less species diversity but with an abundant population. Species fulfilling key ecological roles—such as pollinators, seed dispersers, and biological controllers—were recorded. Additionally, species of touristic interest, such as the hoatzin (*Opisthocomus hoazin*) and the horned screamer (*Anhima cornuta*), were identified. This study provides an essential foundation for future conservation efforts, environmental education, and regional ecotourism planning.

Keywords: Peruvian Amazon; birdlife; conservation; ecotourism; species richness

RESUMEN

La Amazonía peruana es un vasto lugar con abundante diversidad de aves que contribuye significativamente al ecosistema haciendo necesario conocer su distribución. Es por ello que el presente estudio tuvo como objetivo registrar y analizar la diversidad de aves en distintos sitios de observación de la provincia de Alto Amazonas, Loreto, Perú, entre octubre de 2023 y octubre de 2024. Se realizaron muestreos en nueve localidades representativas utilizando métodos de observación directa, auditiva y técnicas de reproducción de cantos (playback), apoyados por aplicaciones digitales y bibliografía especializada. Se identificaron 157 especies de aves, pertenecientes a 23 órdenes y 46 familias. Los análisis de diversidad indicaron que los sitios mejor conservados, como Mercedes, presentan mayor diversidad y equidad (índice de Shannon hasta 4.02 y Simpson hasta 0.97), mientras que los ambientes intervenidos, como los arrozales de La Florida, mostraron menos diversidad de especies, pero con abundante población. Se registraron especies con funciones ecológicas clave como polinizadoras, dispersoras de semillas y controladoras biológicas. Asimismo, se identificaron especies de interés turístico como el shansho (*Opisthocomus hoazin*) y el camungo (*Anhima cornuta*). Este estudio proporciona una base importante para futuras acciones de conservación, educación ambiental y planificación turística en la región.

Palabras clave: Amazonía peruana; avifauna; conservación; ecoturismo; riqueza de especies

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1. INTRODUCTION

Birdwatching is the act of observing and identifying birds in their natural habitats. This practice can be classified into two types: residential and tourist. Residential birdwatching is carried out within the neighborhood environment and does not involve travel; therefore, it does not have a direct economic impact on the ecotourism industry. However, it does promote nature appreciation and habitat conservation at the community level (Kurnia et al., 2021). On the other hand, birdwatching tourism is a non-destructive activity that generates income both for the residents where the activity is practiced and for tour guides. Moreover, it indirectly contributes to the discovery of new or migratory species that are occasionally observed in areas they do not usually inhabit (Motta-Sevellora, 2015).

This activity allows tourists to connect with nature while sharpening their senses and improving cognitive abilities (Hammoud et al., 2022). It has also been demonstrated that birdwatching can help alleviate stress, anxiety, and depression (Cox et al., 2017; Ratcliffe et al., 2013).

Historically, bird documentation in South America began in 1735 with the publication of "Systema Naturae" by Carl Linnaeus, which included the first classification of species from the New World. In the late 18th century, Bishop Baltazar Martínez de Compañón documented and illustrated Peruvian birds. Scientific expeditions by Humboldt, D'Orbigny, and Darwin studied new bird species in Peru during the early 19th century. The Swiss naturalist Johann Jakob von Tschudi travelled to Peru between 1838 and 1842 and published the first textbook on Peruvian fauna. Polish expeditions, such as those by Sztolcman and Jelski, described new bird species in Peru during the 19th century. Taczanowski later published the first ornithological treatise of South America, "Ornitho logie du Pérou" (1884–1886). Antonio Raimondi documented Peru's natural wealth in his work "El Perú" during the same century. In the 1960s, María Koepcke became curator of ornithology in Peru and published the country's first bird guide (Motta-Sevellora, 2015).

Just over 40 years ago, approximately 1,350 bird species were recorded in Peru; this number has since increased to over 1,800. This significant growth in recorded species highlights Peru's immense biological and ornithological potential, making it an attractive destination for birdwatchers (Motta-Sevellora, 2015). Of the 1,912 bird species found in Peru, 1,542 are residents, 119 are endemic, 138 are migratory, 84 are vagrants, three are introduced, and 26 are considered hypothetical (Plenge, 2025).

Species conservation is essential for maintaining ecosystem balance, especially bird conservation, since birds provide ecosystem services through natural processes that benefit humans (Alcamo et al., 2003). These ecosystem services include the control of insect pests in crops, the prevention of disease transmission by disease-transmitting rodents, and the removal of animal carcasses to prevent the spread of pathogens. Additionally, their feeding behaviour contributes to pollination and seed dispersal, which helps sustain healthy ecosystems (Sekercioglu, 2006; Whelan et al., 2008).

Determining bird populations and their distribution is crucial for assessing the status of bird species in a given area. It also allows researchers to identify whether certain birds are found outside their typical habitats, whether introduced species are present, and in what numbers. All of this helps to

determine if non-native bird species in the area could threaten the local ecosystem (Sekercioglu, 2006).

For this reason, a previous study was conducted in the city of Yurimaguas, specifically on the campus of the National Autonomous University of Alto Amazonas, where 58 bird species were identified, grouped into 14 orders and 28 families. Among them, the order Passeriformes was the most abundant, followed by Psittaciformes (Mori-Pezo et al., 2023).

Based on previous research, this study aimed to record and assess the diversity of birds inhabiting different sites in the province of Alto Amazonas.

2. MATERIALS AND METHODS

This study was conducted between October 2023 and October 2024 at the sites listed in Table 1. All locations are situated within the jurisdiction of the province of Alto Amazonas, department of Loreto. The province's climate is typical of a humid tropical rainforest, characterized by an average relative humidity of 85%, a mean temperature of 26°C, and an annual rainfall of 2,200 mm (Servicio Nacional de Meteorología e Hidrología del Perú [SENAMHI], 2023).

Figure 1. *Bird observation sites of the study*

Here is a brief description of the sites where the bird observations for the study were conducted:

Achual Limón: A small settlement located on the banks of the Paranapura River. It is a popular destination during the summer due to its natural beaches, among the main tourist attractions in Yurimaguas. The surrounding vegetation consists primarily of secondary forest interspersed with cultivated areas of domesticated plant species.

Apangurayacu: A picturesque locality situated along the Huallaga River, well known for its ornamental plant diversity maintained by residents. The area comprises secondary forest with fragmented remnants of primary forest.

Arrozales La Florida: A rural area characterized by extensive rice fields, located near the village of Florida and before the bridge crossing the Shanusi River. The site is mainly covered by secondary forest vegetation.

Carretera Nuevo Puerto: A paved road connecting Yurimaguas to Nuevo Puerto. The surroundings show significant anthropogenic pressure, including fragmented secondary forest and advanced deforestation along the road margins.

Mercedes: A riverside village located at the confluence of the Huallaga River and Lake Cuipari. It features a mosaic of primary and secondary forests, as well as palm-dominated floodplain forests (renacales). This ecological heterogeneity makes it one of the region's most important sites for bird diversity.

Puente Paranapura: An area located near the bridge over the Paranapura River. The site features a fragmented secondary forest and flood-prone regions on either side of the highway.

Puerto Shantivela: A popular recreational site among Yurimaguas residents, especially during the summer, due to its access to river beaches. The landscape includes fragmented patches of primary forest and small-scale agricultural plots.

Suniplaya: A riverside village along the Shanusi River, characterized by secondary forest and wetlands dominated by aguaje palm trees (*Mauritia flexuosa*). Before reaching the town, there is a bridge and a nearby lake where *Tachybaptus dominicus* was recorded.

Zapatoyacu: A riverside village located along the banks of the Huallaga River, characterized by seasonally flooded secondary forest, along with areas of permanent and temporary crops and pasturelands. Like other nearby settlements, it is a popular destination among Yurimaguas residents during the summer season, thanks to its natural beaches and scenic river landscapes.

Table 1.
Study bird observation sites, locations, and observation dates.

Sites	Location (latitude/longitude)	Observation dates
Achual Limón	-5.870414; -76.191039	15/10/2023; 11/05/2023
Apangurayacu	-5.84989; -76.12935	09/07/2023; 18/11/2023
Arrozales La Florida	-5.944931; -76.108280	12/11/2023; 13/10/2023
Carretera Nuevo Puerto	-5.854616; -76.158477	11/05/2024; 12/10/2024
Mercedes	-6.004368; -75.998885	26/10/2023; 14/11/2023
Puente Paranapura	-5.87124; -76.13209	03/02/2024; 10/02/2024; 11/02/2024
Puerto Shantivela	-5.884591; -76.134407	06/08/2024.
Suniplaya	-5.958623; -76.152322	11/11/2024
Zapatoyacu	-5.830474; -76.123105	15/09/2024.

Bird observations were conducted using direct observation, auditory detection, and playback methods at the nine observation sites. The latter involves using recorded bird calls by various individuals to facilitate species identification. It is worth noting that playback recordings are a valuable tool for detecting and identifying birds (Johnson et al., 1981). Equipment used during fieldwork included Bushnell 10x42 binoculars, a Canon Rebel T7 digital camera, and a JBL Clip 4

speaker for playback. At each site, the two observers conducted bird observations over 2–3 hours in the afternoon.

To identify and classify the birds, resources such as the "Birds of Peru" field guide (Schulenberg et al., 2010) and free applications like Merlin and BirdNet were used. Mist nets were not used to avoid disturbing the birds.

The collected data were analyzed using diversity and similarity indices with the RStudio software. The indices for each observation site were calculated: species richness (number of species), Shannon diversity index, Simpson diversity index, and Pielou's evenness. A Morisita-Horn dissimilarity matrix was computed and visualized using a heatmap to assess the similarity in species composition among sites. Additionally, a species accumulation curve was generated to evaluate sampling completeness.

3. RESULTS AND DISCUSSION

Following the bird observation study, the following list of species was obtained:

Table 2.
List of bird species recorded in nine sites of the Province of Alto Amazonas (Loreto, Peru).

Item	Order/Family/Species	International name	IUCN/ CITES	N/E/M/I	Local name	N° of sites observed
	Order Accipitriformes: Family Accipitridae					
1	*Busarellus nigricollis*	Black-collared Hawk	LC-II	N	Mama vieja	2
2	*Leptodon cayanensis*	Gray-headed Kite	LC-II	N	Gavilán	2
3	*Rostrhamus sociabilis*	Snail Kite	LC-II	N	Gavilán	2
4	*Rupornis magnirostris*	Roadside Hawk	LC-II	N	Gavilán	4
5	*Spizaetus tyrannus*	Black Hawk-Eagle	LC-II	N	Gavilán	2
	Order Anseriformes: Family Anatidae					
6	*Cairina moschata*	Muscovy Duck	LC	N	Pato común	3
7	*Dendrocygna autumnalis*	Black-bellied Whistling-Duck	LC-III	N	Pato esbelto	1
	Order Anseriformes: Family Anhimidae					
8	*Anhima cornuta*	Horned Screamer	LC	N	Camungo	2
	Order Apodiformes: Family Trochilidae					
9	*Anthracothorax nigricollis*	Black-throated Mango	LC-II	N	Picaflor	3
10	*Chionomesa lactea*	Sapphire-spangled Emerald	LC	N	Picaflor	1
11	*Florisuga mellivora*	White-necked Jacobin	LC-II	N	Picaflor	2
12	*Glaucis hirsutus*	Rufous-breasted Hermit	LC-II	N	Picaflor	1
13	*Phaethornis atrimentalis*	Black-throated Hermit	LC-II	N	Picaflor	1
14	*Phaethornis malaris*	Great-billed Hermit	LC-II	N	Picaflor	1
	Order Apodiformes: Family Apodidae					
15	*Streptoprocne zonaris*	White-collared Swift	LC	N	Golondrina	1
16	*Tachornis squamata*	Fork-tailed Palm Swift	LC	N	Golondrina	3
	Order Cathartiformes: Family Cathartidae					
17	*Cathartes aura*	Turkey Vulture	LC	N	Gallinazo	3
18	*Cathartes burrovianus*	Lesser Yellow-headed Vulture	LC	N	Gallinazo	2
19	*Cathartes melambrotus*	Greater Yellow-headed Vulture	LC	N	Gallinazo	1
20	*Coragyps atratus*	Black Vulture	LC	N	Gallinazo	5

	Order Charadriiformes: Family Recurvirostridae					
21	*Himantopus mexicanus*	Black-necked Stilt	LC	N	Playero	1
	Order Charadriiformes: Family Charadriidae					
22	*Hoploxypterus cayanus*	Pied Plover	LC	N	Playero	2
23	*Vanellus chilensis*	Southern Lapwing	LC	N	Playero	1
24	*Anarhynchus collaris*	Collared Plover	LC	N	Chorlito	2
	Order Charadriiformes: Family Jacanidae					
25	*Jacana jacana*	Wattled Jacana	LC	N	Tuki Tuki	6
	Order Charadriiformes: Family Laridae					
26	*Phaetusa simplex*	Large-billed Tern	LC	N	Rayador	3
27	*Sternula superciliaris*	Yellow-billed Tern	LC	N	Rayador	3
	Order Charadriiformes: Family Scolopacidae					
28	*Tringa solitaria*	Solitary Sandpiper	LC	N	Playero	1
	Order Ciconiiformes: Family Ciconiidae					
29	*Mycteria americana*	Wood Stork	LC	N	Cigüeña	1
	Order Columbiformes: Family Columbidae					
30	*Claravis pretiosa*	Blue Ground Dove	LC	N	Torcacia azul	1
31	*Columba livia*	Columba livia	LC	N	Paloma castilla	1
32	*Columbina minuta*	Plain-breasted Ground Dove	LC	N	Torcaza	1
33	*Columbina talpacoti*	Ruddy Ground Dove	LC	N	Urupay	8
34	*Leptotila rufaxilla*	Gray-fronted Dove	LC	N	Torcaza	3
35	*Leptotila verreauxi*	White-tipped Dove	LC	N	Torcaza	2
36	*Patagioenas cayennensis*	Pale-vented Pigeon	LC	N	Paloma	4
37	*Patagioenas plumbea*	Plumbeous Pigeon	LC	N	Paloma	2
38	*Patagioenas subvinacea*	Ruddy Pigeon	LC	N	Paloma	1
	Order Coraciiformes: Family Alcedinidae					
39	*Chloroceryle amazona*	Amazon Kingfisher	LC	N	Martín pescador	3
40	*Megaceryle torquata*	Ringed Kingfisher	LC	N	Martín pescador	5
	Order Cuculiformes: Family Cuculidae					
41	*Coccycua minuta*	Little Cuckoo	LC	N	Chiqua	1
42	*Crotophaga ani*	Smooth-billed Ani	LC	N	Vaca muchacha	8
43	*Crotophaga major*	Greater Ani	LC	N	Vaca muchacha	4
44	*Piaya cayana*	Squirrel Cuckoo	LC	N	Chicua	2
45	*Tapera naevia*	Striped Cuckoo	LC	N	Tunchi poroto	2
	Order Eurypygiformes: Family Eurypygidae					
46	*Eurypyga helias*	Sunbittern	LC	N	Tanrilla	1
	Order Falconiformes: Family Falconidae					
47	*Daptrius chimachima*	Yellow-headed Caracara	LC	N	Shiuango	4
	Order Galliformes: Family Cracidae					
48	*Ortalis guttata*	Speckled Chachalaca	LC	N	Manasho	2
	Order Gruiformes: Family Aramidae					
49	*Aramus guarauna*	Limpkin	LC	N	Ibis	1
	Order Galbuliformes: Family Bucconidae					
50	*Chelidoptera tenebrosa*	Swallow-winged Puffbird	LC	N	Golondrina	3
51	*Monasa nigrifrons*	Black-fronted Nunbird	LC	N	Monjita	4

	Order Galbuliformes: Family Galbulidae					
52	*Galbalcyrhynchus leucotis*	White-eared Jacamar	LC	N	Jacamar	9
53	*Galbula cyanescens*	Bluish-fronted Jacamar	LC	N	Jacamar	1
	Order Gruiformes: Family Rallidae					
54	*Porphyrio martinica*	Purple Gallinule	LC	N	Gallereta	1
55	*Rufirallus fasciatus*	Black-banded Crake	LC	N	Polla colorada	1
	Order Opisthocomiformes: Family Opisthocomidae					
56	*Opisthocomus hoazin*	Hoatzin	LC	N	Shansho	1
	Order Passeriformes: Family Corvidae					
57	*Cyanocorax violaceus*	Violaceous Jay	LC	N	Urraca	2
	Order Passeriformes: Family Donacobiidae					
58	*Donacobius atricapilla*	Black-capped Donacobius	LC	N		6
	Order Passeriformes: Family Furnariidae					
59	*Berlepschia rikeri*	Point-tailed Palmcreeper	LC	N	Trepa troncos	1
60	*Furnarius minor*	Lesser Hornero	LC	N	Hornero	3
61	*Metopothrix aurantiaca*	Orange-fronted Plushcrown	LC	N	Corona de felpa	1
62	*Nasica longirostris*	Long-billed Woodcreeper	LC	N	Trepa troncos	2
63	*Xiphorhynchus guttatus*	Buff-throated Woodcreeper	LC	N	Trepa troncos	2
	Order Passeriformes: Family Hirundinidae					
64	*Atticora fasciata*	White-banded Swallow	LC	N	Golondrina	3
65	*Pygochelidon cyanoleuca*	Blue-and-white Swallow	LC	N	Golondrina	1
66	*Stelgidopteryx ruficollis*	Southern Rough-winged Swallow	LC	N	Golondrina	2
	Order Passeriformes: Family Icteridae					
67	*Cacicus cela*	Yellow-rumped Cacique	LC	N	Paucar	8
68	*Cacicus solitarius*	Solitary Black Cacique	LC	N	Paucar	1
69	*Chrysomus icterocephalus*	Yellow-hooded Blackbird	LC	N	Pishcomicuna	1
70	*Gymnomystax mexicanus*	Oriole Blackbird	LC	N	Pishcomicuna	2
71	*Icterus cayanensis*	Epaulet Oriole	LC	N	Pishcomicuna	1
72	*Icterus croconotus*	Orange-backed Troupial	LC	N	Pishcomicuna	6
73	*Psarocolius angustifrons*	Russet-backed Oropendola	LC	N	Bocholocho	4
74	*Psarocolius bifasciatus*	Olive Oropendola	LC	N	Bocholocho	1
75	*Psarocolius decumanus*	Crested Oropendola	LC	N	Bocholocho	1
	Order Passeriformes: Family Fringillidae					
76	*Euphonia chlorotica*	Purple-throated Euphonia	LC	N	Dijuntillo	2
77	*Euphonia laniirostris*	Thick-billed Euphonia	LC	N	Dijuntillo	1
	Order Passeriformes: Family Passerellidae					
78	*Ammodramus aurifrons*	Yellow-browed Sparrow	LC	N	Gorrion	6
	Order Passeriformes: Family Thamnophilidae					
79	*Akletos melanoceps*	White-shouldered Antbird	LC	N	Hormiguero	2
80	*Cercomacra cinerascens*	Gray Antbird	LC	N	Hormiguero	1
81	*Cercomacroides fuscicauda*	Riparian Antbird	LC	N	Hormiguero	2
82	*Hypocnemoides maculicauda*	Band-tailed Antbird	LC	N	Hormiguero	1
83	*Myrmelastes hyperythrus*	Plumbeous Antbird	LC	N	Hormiguero	1
84	*Myrmophylax atrothorax*	Black-throated Antbird	LC	N	Hormiguero	2
85	*Taraba major*	Great Antshrike	LC	N	Hormiguero	4

86	*Thamnophilus doliatus*	Barred Antshrike	LC	N	Hormiguero	4
87	*Thamnophilus murinus*	Mouse-colored Antshrike	LC	N	Hormiguero	1
	Order Passeriformes: Family Thraupidae					
88	*Cissopis leverianus*	Magpie Tanager	LC	N		1
89	*Coereba flaveola*	Bananaquit	LC	N		1
90	*Nemosia pileata*	Hooded Tanager	LC	N		1
91	*Paroaria gularis*	Red-capped Cardinal	LC	N		1
92	*Ramphocelus carbo*	Silver-beaked Tanager	LC	N		8
93	*Ramphocelus nigrogularis*	Masked Crimson Tanager	LC	N		1
94	*Saltator coerulescens*	Bluish-gray Saltator	LC	N		8
95	*Sporophila americana*	Wing-barred Seedeater	LC	N		3
96	*Sporophila angolensis*	Chestnut-bellied Seed-Finch	LC	N		6
97	*Sporophila castaneiventris*	Chestnut-bellied Seedeater	LC	N		6
98	*Tangara mexicana*	Turquoise Tanager	LC	N		2
99	*Thlypopsis sordida*	Orange-headed Tanager	LC	N	Tangara	1
100	*Thraupis episcopus*	Blue-gray Tanager	LC	N	Suisui	8
101	*Thraupis palmarum*	Palm Tanager	LC	N	Suisui	7
102	*Volatinia jacarina*	Blue-black Grassquit	LC	N		6
	Order Passeriformes: Family Tityridae					
103	*Pachyramphus polychopterus*	White-winged Becard	LC	N		1
104	*Tityra cayana*	Black-tailed Tityra	LC	N		1
105	*Tityra semifasciata*	Masked Tityra	LC	N		3
	Order Passeriformes: Family Tyrannidae					
106	*Arundinicola leucocephala*	White-headed Marsh Tyrant	LC	N		1
107	*Attila cinnamomeus*	Cinnamon Attila	LC	N	Atila	2
108	*Camptostoma obsoletum*	Southern Beardless-Tyrannulet	LC	N		1
109	*Legatus leucophaius*	Piratic Flycatcher	LC	N		4
110	*Megarynchus pitangua*	Boat-billed Flycatcher	LC	N	Pipito	7
111	*Myiarchus ferox*	Short-crested Flycatcher	LC	N		4
112	*Myiodynastes maculatus*	Streaked Flycatcher	LC	N		2
113	*Myiozetetes granadensis*	Gray-capped Flycatcher	LC	N		3
114	*Myiozetetes similis*	Social Flycatcher	LC	N	Pipito	8
115	*Nesotriccus murinus*	Mouse-colored Tyrannulet	LC	N		2
116	*Ochthornis littoralis*	Drab Water Tyrant	LC	N		1
117	*Ornithion inerme*	White-lored Tyrannulet	LC	N		1
118	*Philohydor lictor*	Lesser Kiskadee	LC	N	Pipito	1
119	*Pitangus sulphuratus*	Great Kiskadee	LC	N	Pipito	7
120	*Poecilotriccus latirostris*	Rusty-fronted Tody-Flycatcher	LC	N		1
121	*Todirostrum maculatum*	Spotted Tody-Flycatcher	LC	N	Pipitillo	8
122	*Tyrannopsis sulphurea*	Sulphury Flycatcher	LC	N		1
123	*Tyrannulus elatus*	Yellow-crowned Tyrannulet	LC	N		8
124	*Tyrannus melancholicus*	Tropical Kingbird	LC	N	Pipito	6
	Order Passeriformes: Family Troglodytidae					
125	*Campylorhynchus turdinus*	Thrush-like Wren	LC	N		7
126	*Cantorchilus leucotis*	Buff-breasted Wren	LC	N		6
127	*Pheugopedius coraya*	Coraya Wren	LC	N		1
128	*Troglodytes musculus*	Southern House Wren	LC	N	Shicapa	5

	Order Passeriformes: Family Turdidae					
129	*Turdus ignobilis*	Black-billed Thrush	LC	N	Ucshero	8
	Order Passeriformes: Family Vireonidae					
130	*Vireo chivi*	Chivi Vireo	LC	N	Vireo	6
	Order Pelecaniformes: Family Ardeidae					
131	*Ardea alba*	Great Egret	LC	N	Garza	3
132	*Ardea cocoi*	Cocoi Heron	LC	N	Garza	2
133	*Ardea ibis*	Western Cattle-Egret	LC	N	Garza	2
134	*Butorides striata*	Striated Heron	LC	N	Puma garza	3
135	*Egretta thula*	Snowy Egret	LC	N	Garza	1
136	*Nycticorax nycticorax*	Black-crowned Night Heron	LC	N	Garza	1
137	*Pilherodius pileatus*	Capped Heron	LC	N	Garza	1
	Order Piciformes: Family Capitonidae					
138	*Capito aurovirens*	Scarlet-crowned Barbet	LC	N	Barbudo	7
139	*Eubucco richardsoni*	Lemon-throated Barbet	LC	N	Barbudo	1
	Order Piciformes: Family Picidae					
140	*Campephilus rubricollis*	Red-necked Woodpecker	LC	N	Carpintero	1
141	*Celeus flavus*	Cream-colored Woodpecker	LC	N	Carpintero	1
142	*Colaptes punctigula*	Spot-breasted Woodpecker	LC	N	Carpintero	5
143	*Dryobates passerinus*	Little Woodpecker	LC	N	Carpintero	1
144	*Melanerpes cruentatus*	Yellow-tufted Woodpecker	LC	N	Carpintero	5
	Order Piciformes: Family Ramphastidae					
145	*Ramphastos tucanus*	White-throated Toucan	LC	N	Tucán	1
	Order Podicipediformes: Family Podicipedidae					
146	*Tachybaptus dominicus*	Least Grebe	LC	N	Sachapato	1
	Order Psittaciformes: Family Psittacidae					
147	*Aratinga weddellii*	Dusky-headed Parakeet	LC	N	Perico	8
148	*Brotogeris cyanoptera*	Cobalt-winged Parakeet	LC	N	Piwicho	8
149	*Brotogeris versicolurus*	White-winged Parakeet	LC	N	Piwicho	6
150	*Forpus crassirostris*	Riparian Parrotlet	LC	N	Piwichito	5
151	*Pionus menstruus*	Blue-headed Parrot	LC-II	N	Darandaran	2
152	*Psittacara leucophthalmus*	White-eyed Parakeet	LC-II	N	Perico	3
	Order Strigiformes: Family Strigidae					
153	*Glaucidium brasilianum*	Ferruginous Pygmy-Owl	LC-II	N	Lechuza	2
	Order Tinamiformes: Family Tinamidae					
154	*Crypturellus cinereus*	Cinereous Tinamou	LC	N	Perdiz	4
	Order Trogoniformes: Family Trogonidae					
155	*Trogon melanurus*	Black-tailed Trogon	LC	N	Trogon	1
156	*Trogon ramonianus*	Amazonian Trogon	LC	N	Trogon	1
157	*Trogon viridis*	Green-backed Trogon	LC	N	Trogon	1

Note: N: native; E: endemic; M: migratory; I: introduced. IUCN: International Union for Conservation of Nature Red List; CITES: Convention on International Trade in Endangered Species of Wild Fauna and Flora.

The present study recorded 157 bird species, belonging to 23 orders and 46 families. Species frequency sightings varied considerably among the study sites (Table 2). Mercedes had the highest number of species observed in a single visit (79 species), while other sites, such as Apangurayacu and

Puente Paranapura, exhibited lower frequencies of sightings (18–23 species per visit). The diversity indices also reflected these patterns: Mercedes reached the highest Shannon diversity index (4.02) and a high Simpson index (0.97), indicating a very diverse and balanced community. In contrast, sites with lower species richness showed lower diversity values and reduced Simpson indices. Pielou's evenness was high in most locations with well-preserved vegetation (Mercedes, Achual Limón, Apangurayacu, Zapatoyacu). However, it dropped significantly in altered habitats such as the rice fields of La Florida, where a minimum evenness of 0.528 and a low Shannon index of 1.86 were recorded, despite a moderate average richness of 41 species. These patterns indicate th at areas with more forested vegetation support greater species richness and diversity, while open or disturbed areas host poorer and less balanced bird communities. Additionally, the province hosts species that fulfil fundamental ecological roles. For instance, hummingbirds (family Trochilidae, such as *Anthracothorax nigricollis*) serve as pollinators by feeding on floral nectar and transferring pollen to other plants. Likewise, frugivorous species such as the white-throated toucan (*Ramphastos tucanus*) and Amazonian trogons (*Trogon ramonianus, T. viridis*) contribute to seed dispersal by consuming fruits and subsequently excreting or regurgitating the seeds away from the parent plant (Sekercioglu, 2006; Whelan et al., 2008).

On the other hand, many recorded bird species are insectivorous or predatory, contributing to the biological control of pests. Among them, tyrant flycatchers such as *Tyrannus melancholicus* (locally known as "pipito") and others stand out for capturing flying insects, thereby reducing mosquito populations and other vectors. Small raptors, such as *Rupornis magnirostris* (roadside hawk) and *Rostrhamus sociabilis* (snail kite), prey on rodents or invertebrates. In addition, vultures such as *Cathartes aura* (the turkey vulture) and *Coragyps atratus* (the black vulture) play a crucial role in scavenging.

The study also recorded several species of high touristic value due to their rarity or charismatic features. For example, the hoatzin (*Opisthocomus hoazin*, locally known as "shansho"), the horned screamer or "camungo" (*Anhima cornuta*) and the black-bellied whistling-duck (*Dendrocygna autumnalis*) are emblematic birds of Amazonian wetlands, notable for their unique appearance and behavior. Among the rare and highly sought-after species by Amazonian birdwatchers, the following were recorded: *Coccycua minuta, Tapera naevia, Rufirallus fasciatus, Metopothrix aurantiaca, Thlypopsis sordida, Arundinicola leucocephala, Poecilotriccus latirostris, Pilherodius pileatus, Eubucco richardsoni, Celeus flavus*, and *Tachybaptus dominicus*. Their mere presence can attract specialized birdwatchers, as these species are restricted to the tropical regions of South America and are of global interest. Likewise, numerous colorful and charismatic species were detected, including multicolored hummingbirds, parrots, and parakeets (such as *Psittacara leucophthalmus*– white-eyed parakeet), as well as various tanagers and orioles with bright plumage. In addition to their ecological importance, these birds are highly valued by photographers and birdwatchers, significantly contributing to the ecotourism potential of the Alto Amazonas province.

Table 3.
Bird species diversity indices obtained in nine sites of the province of Alto Amazonas (Loreto, Peru)

Sites	Date	Richness	Shannon	Simpson	Pielou
Apangurayacu	2023-07-09	23	2.99	0.942	0.954

Achual Limon	2023-10-15	34	3.37	0.96	0.957
Mercedes	2023-10-26	46	3.64	0.97	0.951
Suniplaya	2023-11-11	37	3.19	0.939	0.884
Arrozales La Florida	2023-11-12	48	2.91	0.861	0.752
Mercedes	2023-11-14	79	4.02	0.971	0.920
Apangurayacu	2023-11-18	18	2.62	0.894	0.906
Puente Paranapura	2024-02-03	21	2.58	0.875	0.849
Puente Paranapura	2024-02-10	18	2.54	0.902	0.878
Puente Paranapura	2024-02-11	40	2.62	0.866	0.711
Achual Limón	2024-05-11	31	3.24	0.952	0.944
Carretera Nuevo Puerto	2024-05-11	40	3.23	0.929	0.876
Puerto Shantivela	2024-08-06	40	3.48	0.962	0.943
Zapatoyacu	2024-09-15	36	3.38	0.959	0.944
Carretera Nuevo Puerto	2024-10-12	40	3.56	0.967	0.966
Arrozales la Florida	2024-10-13	34	1.86	0.623	0.528

The composition of the avifauna varied significantly among sites, as evidenced by the presence of 63 species recorded exclusively at a single location (exclusive species), representing 40% of the total. The case of Mercedes, particularly noteworthy, accounted for 33 exclusive species (21% of the total), far exceeding the number found in the other localities. In contrast, sites closer to the city of Yurimaguas or those with similar habitats, such as Puente Paranapura and Apangurayacu, shared many common species and had few endemic ones.

In terms of conservation value, most of the recorded species are classified as Least Concern (LC) according to the International Union for Conservation of Nature (IUCN). Likewise, no endemic bird species of Peru were recorded in this study, which is to be expected, given that only 13 endemic bird species have been reported in the Loreto region and are typically associated with particular habitats (Salinas et al., 2021). On the other hand, human influence was evident through the introduction of species, such as the domestic pigeon (*Columba livia*), which is found in urban environments. This exotic bird often displaces native pigeons, and its presence indicates urban expansion. However, since only one exotic species was recorded, this suggests that biotic invasion in the area remains limited.

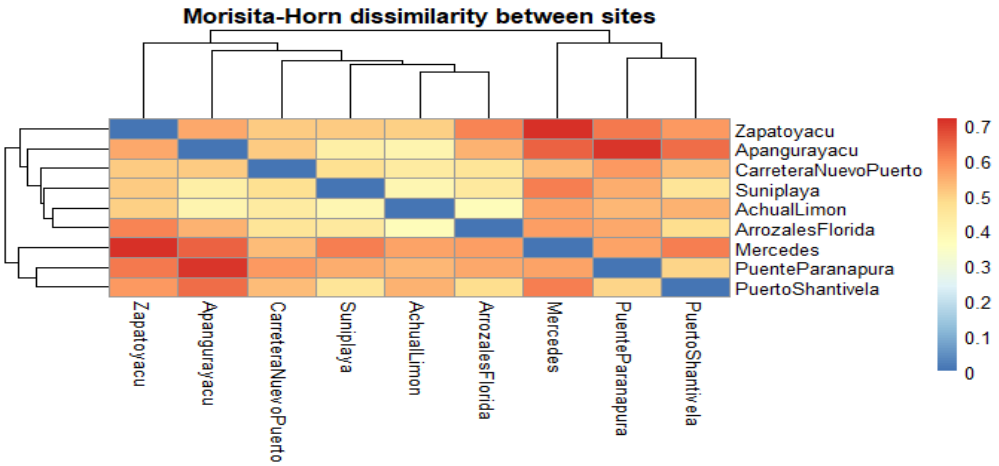

Figure 2. *Morisita-Horn dissimilarity index graph between observed sites.*

The Morisita-Horn dissimilarity matrix (Figure 2) reveals differences in species composition and relative abundance among the bird observation sites. Values range from 0 (maximum similarity) to 1 (maximum dissimilarity), with colors indicating similarity gradients: blue represents high similarity and red represents high dissimilarity. Sites with more preserved or structurally similar habitats, such as Mercedes, Puerto Shantivela, and Puente Paranapura, exhibit greater similarity. In contrast, Zapatoyacu and Apangurayacu show high dissimilarity with several sites, particularly with Mercedes. These differences may reflect variations in vegetation type, levels of human disturbance, or the surrounding landscape structure. The dendrogram above clusters sites with similar avian community patterns, reinforcing the observation that ecological structure varies according to habitat condition and spatial context.

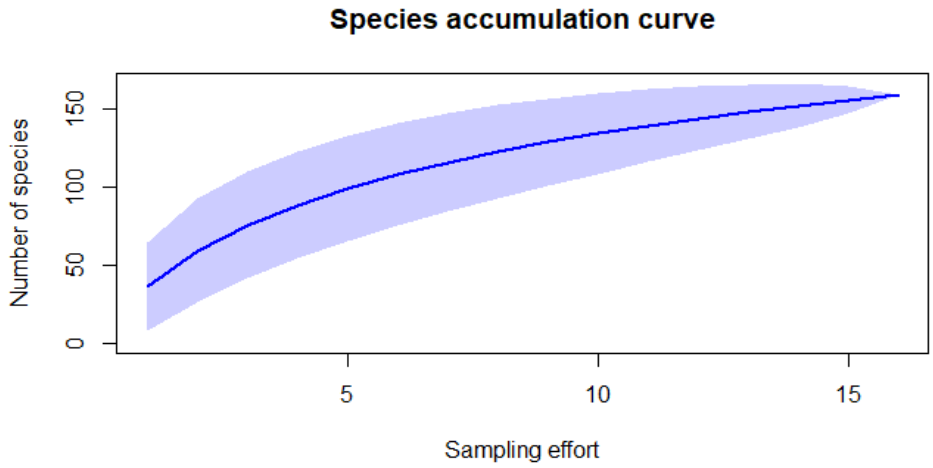

Figure 3. *Species accumulation curve based on sampling effort across bird observation sites in Alto Amazonas. The blue line represents the cumulative number of species, and the shaded area indicates the confidence interval.*

The species accumulation curve (Figure 3) exhibits an ascending trend that gradually levels off, indicating that the number of new species detected decreases as the sampling effort increases (i.e., the number of sites). This curve shape suggests that the sampling effort was sufficiently representative, as most habitat species were recorded. However, some rare or low-detectability species may not have been captured. The shaded area represents the confidence interval, which adds robustness to the analysis by accounting for expected variability in repeated sampling.

Although the study did not directly evaluate risk factors, field observations revealed that the expansion of agricultural and urban frontiers on the outskirts of Yurimaguas leads to the clearing of secondary forests and the conversion of wetlands into farmland or pasture, thereby reducing and fragmenting the available habitats for wildlife. This is supported by Alvarez Vasquez (2021), who, in a study along the Iquitos–Nauta Road (Loreto)—a forest gradient fragmented by deforestation—reported a comparable richness (161 species) and noted that disturbance reduced the abundance of many sensitive bird species. Additionally, poaching, illegal wildlife trade, pollution, and other anthropogenic activities associated with road construction and use cause shifts in bird community composition, leading to decreased density and effective diversity.

The results of the present study align with previous findings from the campus of the National Autonomous University of Alto Amazonas (Mori-Pezo et al., 2023), where 58 species were recorded. Although the number of species found in the present study significantly exceeds that figure—an expected outcome due to the broader range of habitats surveyed—specific trends remain consistent: on the university campus, the most represented families were passerines, including several parrot species, similar to what was found in our data, where Passeriformes exhibited high richness.

CONCLUSIONS

The province of Alto Amazonas hosts a remarkable diversity of birds, with 157 species recorded across various habitats in Yurimaguas. Analyses of species richness and diversity revealed that well-preserved sites, such as Mercedes, support more balanced and diverse communities, with a high proportion of exclusive species. The bird species observed fulfil key ecological functions such as pollination, seed dispersal, and biological control, and they also hold significant touristic value.

The species accumulation curve suggests that the sampling effort adequately represented the local avifauna. Although no endemic or critically endangered species were identified, the presence of disturbance-sensitive species and the potential impact of anthropogenic threats, such as habitat fragmentation and urban expansion, highlight the urgent need to implement conservation measures.

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CONFLICT OF INTEREST

There are no conflicts of interest related to the subject matter of this work.

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REFERENCES

Alcamo, J., Bennet, E. M., & Millennium Ecosystem Assessment (Program). (2003). *Ecosystems and human well-being: a framework for assessment*. Island Press. https://hdl.handle.net/10568/19290

Alvarez Vasquez, L. F. (2021). *Deforestación y pérdida de la diversidad de aves en la carretera Quistococha - Llanchama, Loreto - 2020* [Universidad Nacional de la Amazonía Peruana]. https://hdl.handle.net/20.500.12737/8006

Cox, D. T. C., Shanahan, D. F., Hudson, H. L., Plummer, K. E., Siriwardena, G. M., Fuller, R. A., Anderson, K., Hancock, S., & Gaston, K. J. (2017). Doses of neighborhood nature: The benefits for mental health of living with nature. *BioScience*, biw173. https://doi.org/10.1093/biosci/biw173

Hammoud, R., Tognin, S., Burgess, L., Bergou, N., Smythe, M., Gibbons, J., Davidson, N., Afifi, A., Bakolis, I., & Mechelli, A. (2022). Smartphone-based ecological momentary assessment reveals mental health benefits of birdlife. *Scientific Reports*, 12(1), 17589. https://doi.org/10.1038/s41598-022-20207-6

Johnson, R. R., Brown, B. T., Haight, L. T., Simpson, J. M., And, ~, & Simpson~, J. M. (1981). Playback recordings as a special avian censusing technique. *Studies in Avian Biology*, 6(6), 68–75. https://www.researchgate.net/profile/R-Johnson-4/publication/260365521_Bell's_vireo_Vireo_bellii/links/5e17f5ff4585159aa4c2ee30/Bells-vireo-Vireo-bellii.pdf

Kurnia, I., Arief, H., Mardiastuti, A., & Hermawan, R. (2021). Urban landscape for birdwatching activities. *Earth and Environmental Science*, 879, 012005. https://doi.org/https://doi.org/10.1088/1755-1315/879/1/012005

Mori-Pezo, R. R., Mendoza-Tamani, P., & Barbachán-Ruales, E. A. (2023). Aves del campus de la Universidad Nacional Autónoma de Alto Amazonas (Yurimaguas, Loreto, Perú). *Revista Peruana de Investigación Agropecuaria*, 2(2), e42. https://doi.org/10.56926/repia.v2i2.42

Motta-Sevellora, M. I. (2015). *Turismo de observación de aves en el Santuario Nacional Pampa Hermosa como modelo de desarrollo sostenible en los distritos de San Ramón y Huasahuasi* [Universidad Nacional Mayor de San Marcos]. https://cybertesis.unmsm.edu.pe/handle/20.500.12672/4377

Plenge, M. A. (2025). *List of the birds of Peru / Lista de las aves del Perú*. Unión de Ornitólogos del Perú. https://sites.google.com/site/boletinunop/checklist

Ratcliffe, E., Gatersleben, B., & Sowden, P. T. (2013). Bird sounds and their contributions to perceived attention restoration and stress recovery. *Journal of Environmental Psychology*, 36, 221–228. https://doi.org/10.1016/j.jenvp.2013.08.004

Salinas, L., Arana, A., Arana, C., Salinas, L., Arana, A., & Arana, C. (2021). Las aves del departamento de Loreto, Perú. *Revista Peruana de Biología*, 28(SPE). https://doi.org/10.15381/RPB.V28IESPECIAL.21915

Schulenberg, T. S., Stotz, D. F., Lane, D. F., O'Neill, J. P., & Parker III, T. A. (2010). Aves de Perú. *Centro de Ornitología y Biodiversidad (CORBIDI)*, 1, 1–660.

Sekercioglu, C. (2006). Increasing awareness of avian ecological function. *Trends in Ecology & Evolution*, 21(8), 464–471. https://doi.org/10.1016/j.tree.2006.05.007

Servicio Nacional de Meteorología e Hidrología del Perú [SENAMHI]. (2023). *Datos Hidrometeorológicos a Nivel Nacional*. https://www.senamhi.gob.pe/servicios/?p=estaciones

Whelan, C. J., Wenny, D. G., & Marquis, R. J. (2008). Ecosystem services provided by birds. *Annals of the New York Academy of Sciences*, 1134(1), 25–60. https://doi.org/10.1196/annals.1439.003