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Common birds of Jambelí Island (Ecuador)

Aves comunes de la isla Jambelí (Ecuador)

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Abstract

Ecuador is one of the megadiverse countries and one with the highest species density worldwide, with a total of 1619 species of birds, representing 16% of the birds known in the world. **Objective:** We conducted a study of the common birds in the Jambelí Island (Ecuador), because it is part of an Important Bird and Biodiversity Area (IBA) that has been scarcely studied. **Methodology:** Census itineraries were carried out both on foot and by boat, and land uses were defined with GIS. **Results:** A total of 45 species were recorded highlighting the presence of a large population of Peruvian boobies and blue-footed boobies with more than 200 specimens of each species. **Conclusions:** We inventoried the species richness of an area considered important for the conservation of birds that has serious conservation problems, mainly the destruction of most of the mangrove forests for the construction of shrimp pools and pollution by plastic debris.

Keywords: Gulf of Guayaquil, Mangrove, Neotropic, Species inventory.

Resumen

Ecuador es uno de los países megadiversos y de los que poseen más variedad de especies por superficie, con un total de 1619 especies de aves, lo que representa 16% de las aves conocidas en el mundo. **Objetivo:** Se realizó un estudio de las aves comunes presentes en la isla Jambelí (Ecuador), porque forma parte de un área importante para las aves y la biodiversidad (IBA) que ha sido escasamente estudiada. **Metodología:** Se realizaron itinerarios de censo tanto caminando como en barca y se delimitaron los usos del suelo con SIG. **Resultados:** Se registró un total de 45 especies destacando la presencia de una gran población de piqueros patas azules y peruanos con más de 200 ejemplares de cada especie. **Conclusiones:** Se muestra la riqueza de especies de un área considerada de importancia para la conservación de las aves, sin embargo, este enclave posee graves problemas de conservación, siendo el principal la destrucción de la mayor parte del manglar para la construcción de piscinas camaroneras y la contaminación por desechos plásticos.

Palabras clave: Inventario de especies, Golfo de Guayaquil, Manglar, Neotrópico.

Introduction

Ecuador is a hotspot for conservation, one of 17 countries considered megadiverse and the first considering species richness per area (Sierra *et al*. 2002). Important steps are taken by the government regarding conservation with high proportion of protected areas covering the country's territory and support for research in these areas (ECOLAP and Ministerio del Ambiente del Ecuador 2007, Elbers 2011). It has a total of 1619 species of birds, representing 16% of the birds known in the world (Birdlife International 2017). However, this high biodiversity is threatened in turn, being one of the first eight countries world-

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wide (out of 198 countries) which is severe declines in the conservation status of birds, mammals and amphibians (Rodrigues *et al*. 2014).

Among the main causes of biodiversity loss worldwide are over-exploitation of natural resources, loss and degradation of habitat, invasive species (Kim and Byrne 2006, Butchart *et al*. 2010) and global climate change (Thomas *et al*. 2004, Bellard *et al*. 2012), which can affect marine vertebrates (Sydeman 2015).

Island systems have usually high biodiversity, as the well-known Galapagos Islands of Ecuador, but there are numerous islands near the mainland that have been little studied as is the case of Jambelí Island, which was not properly studied regarding the diversity of birds or in the identification of threats to biodiversity (BirdLife International 2017). This island is located in the Gulf of Guayaquil, the largest estuary in the South American Pacific coast and one of the areas with the largest mangrove forest left in this country (Cruz *et al*. 2003). Mangroves are the habitat for a rich and varied terrestrial and marine fauna (Nagelkerken *et al*. 2008), but are highly threatened worldwide, with a decrease of area in the last two decades of 35% (Valiela *et al*. 2001, Duke *et al*. 2007), having also declined in Ecuador mainly due to aquaculture (Twilley *et al*. 1993, Parks and Bonifaz 1994). Although there are other ecosystems, such as beach and dry scrub, which together with the mangrove allow the existence of a great variety of bird species (Orihuela-Torres 2016). The island of Jambelí is the only one inhabited within the archipelago. The objective of this study is to conduct a preliminary inventory of birds on the island of Jambelí as well as evaluating the threats to biodiversity.

Materials and methods

Study site. Jambelí Island (03°15′ N, 080°02′ W) is located in the archipelago of Jambelí in the south of Gulf of Guayaquil, several hundred meters from the coast of Puerto Bolívar and the city of Machala in the province of El Oro, Ecuador (Figure 1). It has an area of 2.419 hectares. There are three main types of natural ecosystems: sandy beaches, mangroves and dry scrub. It has a small population of 225 inhabitants, the majority living within the port of Jambelí, a place that receives tourists weekly. The annual average temperature is 25°C (PMRC 1993). It is included in the IBA (Important Bird and Biodiversity Area) ECO34 declared in 2005, with an area of 30.000 ha and an altitude between 0 and 10 m above sea level (asl) covering the entire Jambelí archipelago (Birdlife

Figure 1. Location of the Jambelí Island.

International 2017). Shrimp ponds are widespread on the island and are the cause of the destruction of a large part of the original mangrove forest.

***Data collection*.** We delimited the perimeter of the island Jambelí and calculated the area occupied by different ecosystems by georeferencing a satellite photograph of 2014 using ArcGIS 10.0 (ESRI 2010). Then we selected zones in the different habitats where transects could be made. The bird inventory was done by two people (JTP and JMS) along transects that covered all types of ecosystems of the island during six days (19-20 and 26-27 July 2014 and 24-25 January 2015), from dawn to dusk, recording all birds seen (*ad libitum*) and marking the routes with GPS (WGS84), with a total length of 13.859 m. The itineraries on the beach and in the dry scrub were performed walking, while in the mangrove were made by boat, the transects were performed once, except number 1 (6 times), number 2 (2 times) and number 5 (3 times) (Figure 2). In addition, counts were performed along the banks of a shrimp pond. Birds were identified based on the authors' experience and checked using field guides of birds of Ecuador (Ridgely and Greenfield 2001, McMulland and Navarrete 2013). Nomenclature was according to del Hoyo *et al*. (2014).

We computed a species accumulation curve using the number of days as a proxy for the inventory effort and incidence-based estimators of species richness using EstimateS 9.1 (Colwell 2009). WE computed the ICE, Chao 2, Jackknife 1, Jackknife 2 and Bootstrap estimators based on presence-absence data.

Results

A total of 859 individuals of 45 species of birds belonging to 26 families were recorded (Table 1). Of these, 22 species (592 individuals) were located on the beach, 18 (182) in the mangrove, 19 (69) in the dry scrub and 6 (16) in the shrimp ponds, i.e., some species were present in more than one ecosystem.

The two species of boobies, the Blue-footed Booby (*Sula nebouxii*) with 227 individuals and the Peruvian Booby (*Sula variegata*) with 255 were in some breakwaters built 150 m from the beach and were recorded only during fieldwork in 2014, absent in 2015. We also report the presence of dead boobies on the beach, three Blue-footed boobies, three Peruvian boobies and another booby unidentified, all of them found along a 780 m stretch of beach.

The species accumulation curve computed based on the six days of inventory did not reach a plateau (Figure 3), indicating that the existence of more species is possible. The different estimators show that we have registered more than 80% of the species expected on the island, so that there may be 10-11 more species (Table 2).

Based on the satellite images the total area of the island was calculated as 2419.58 ha which were divided into the following land use categories: shrimp

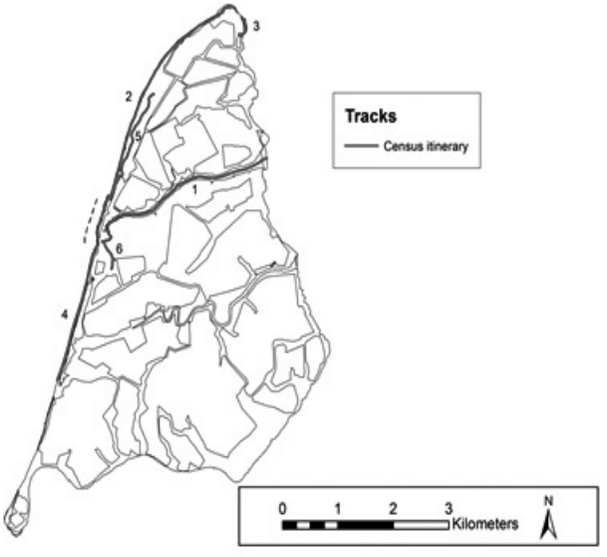

Figure 2. The location of the linear transects made on Jambelí Island.

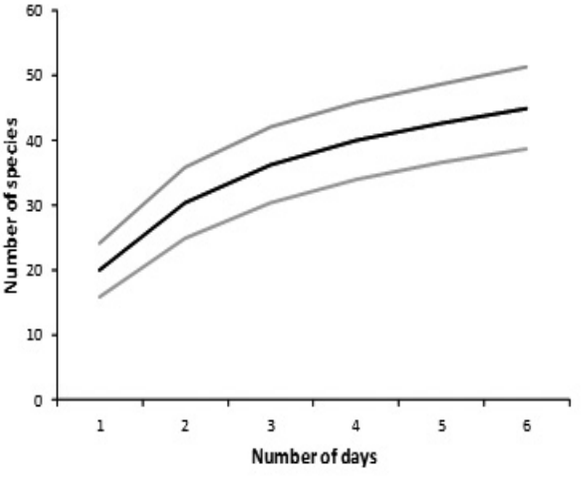

Figure 3. Species accumulation curve with 95% CI based on the number of days of inventory.

Table 1. Bird registered in different ecosystems of Jambelí island

Family/Common name	Species	M	D	B	S	
Anatidae						
White-cheeked Pintail	*Anas bahamensis* (Linnaeus, 1758)					7
Pelecanidae						
Brown Pelican	*Pelecanus occidentalis* (Linnaeus, 1766)		2	10		
Phalacrocoracidae						
Neotropic Cormorant	*Phalacrocorax brasilianus* (Gmelin, 1789)	98		6		
Sulidae						
Blue-footed Booby	*Sula neboxii* (Milne-Edwards, 1882)			227		
Peruvian Booby	*Sula variegata* (Tschudi, 1843)			255		
Fregatidae						
Magnificent Frigatebird	*Fregata magnificens* (Mathews, 1914)	2	5	7		
Ardeidae						
Yellow-crowned Night-heron	*Nyctanassa violacea* (Linnaeus, 1758)	5		1		1
Striated Heron	*Butorides striata* (Linnaeus, 1758)	2				
Cocoi Heron	*Ardea cocoi* (Linnaeus, 1766)	3				
Great Egret	*Ardea alba* (Linnaeus, 1758)	7		1		
Tricolored Heron	*Egretta tricolor* (Müller, 1776)	1				1
Snowy Egret	*Egretta thula* (Molina, 1782)	14		16		
Little Blue Heron	*Egretta caerulea* (Linnaeus, 1758)	12				1
Threskiornithidae						
White Ibis	*Eudocimus albus* (Linnaeus, 1758)	14				3
Roseate Spoonbill	*Platalea ajaja* (Linnaeus, 1758)	1				
Cathartidae						
Turkey Vulture	*Cathartes aura* (Linnaeus, 1758)		1	3		
Black Vulture	*Coragyps atratus* (Bechstein, 1783)	1	1	4		
Accipitridae						
Mangrove Black Hawk	*Buteogallus subtilis* (Thayer & Bangs, 1905)	1				
Charadriidae						
Snowy Plover	*Charadrius alexandrinus* (Linnaeus, 1758)			4		
Haematopodidae						
American Oystercatcher	*Haemotopus palliatus* (Temminck, 1820)			9		
Recurvirostridae						
Black-necked Stilt	*Himantopus mexicanus* (Linnaeus, 1758)	15				3
Scolopacidae						
Whimbrel	*Numenius phaeopus* (Linnaeus, 1758)	3		9		
Willet	*Tringa semipaltata* (Gmelin, 1789)			3		
Sanderling	*Calidris alba* (Pallas, 1764)			8		
Laridae						
Gull-billed Tern	*Gelochelidon nilotica* (Gmelin, 1789)			1		
Royal Tern	*Thalasseus maximus* (Boddaert, 1783)			2		
Columbidae						
Croaking Ground-dove	*Columbina cruziana* (Prévost, 1842)		17			
West Peruvian Dove	*Zenaida meloda* (Tschudi, 1843)		2			
Psittacidae						
Pacific Parrolet	*Forpus coelestis* (Lesson, 1847)		8			
Cuculidae						
Groove-billed Ani	*Crotophaga sulcirostris* (Swainson, 1827)			1		
Caprimulgidae						
Lesser Nighthawk	*Chordeiles acutipennis* (Hermann, 1783)		5			
Trochilidae						
Amazilia Hummingbird	*Amazilia amazilia* (Lesson, 1827)		3			
Alcedinidae						
Ringed Kingfisher	*Megaceryle torquata* (Linnaeus, 1766)	1				
Green Kingfisher	*Chloroceryle americana* (Gmelin, 1788)	1				

Table 1. Bird registered in different ecosystems of Jambelí island (continuation)

Family/Common name	Species	M	D	B	S
Picidae					
Scarlet-backed Woodpecker	*Veniliornis callonotus* (Waterhouse, 1841)		1		
Tyrannidae					
Vermillion Flycatcher	*Pyrocephalus rubinus* (Boddaert, 1783)		1		2
Hirundinidae					
Grey-breasted Martin	*Progne chalybea* (Gmelin, 1789)		7		
Troglodytidae					
House Wren	*Troglodytes aedon* (Vieillot, 1809)		3		
Mimidae					
Long-tailed Mockingbird	*Mimus longicaudatus* (Tschudi, 1844)		6		19
Thraupidae					
Blue-grey Tanager	*Thraupis episcopus* (Linnaeus, 1766)		2		
Emberizidae					
Saffron Finch	*Sicalis flaveola* (Linnaeus, 1766)	1	2		
Parrot-billed Seedeater	*Sporophila peruviana* (Lesson, 1842)		1		
Chestnut-throated Seedeater	*Sporophila telasco* (Lesson, 1828)		1		
Icteridae					
Great-tailed Grackle	*Quiscalus mexicanus* (Gmelin, 1788)		1		4

M = Mangrove; D = Dry scrub; B = Beach; S = Shrimp ponds

Table 2. Incidence based estimators of species richness for the island of Jambelí, and the percentage of species obtained in this study

Estimator	Mean	SD	%
ICE	54.34	-	82.8
Chao 2	55.83	7.83	80.6
Jackknife 1	56.67	4.01	79.4
Jackknife 2	62.8	-	71.7
Bootstrap	50.4	-	89.3

ponds, mangrove, dry scrub, canals, beaches and urban area, with shrimp ponds and mangrove covering the largest area (Figure 4).

Discussion

We inventoried 45 bird species in different ecosystems in Jambelí, with a conservation status of Least Concern (IUCN 2015). The most abundant were the boobies; however, they were inventoried in one of the years of study. Chapman (1926) in the last century collected specimens of Blue-footed Booby in Jambelí and also recorded the presence of Nazca Booby (*Sula granti*) (MECN-INB-GADPEO 2015).

The main populations of Blue-footed Boobies in continental Ecuador are on the island of La Plata with about 1000-3000 individuals and Santa Clara island with about 6.000-14.000 (Ortiz-Crespo and Agnew 1992, Albuja and Muñoz 1997, Ridgely and Greenfield 2001, Alava and Haase 2011).

We have registered only one individual Roseate Spoonbill, although in the Gulf of Guayaquil, Alava (2005) estimated absolute and relative abundances of

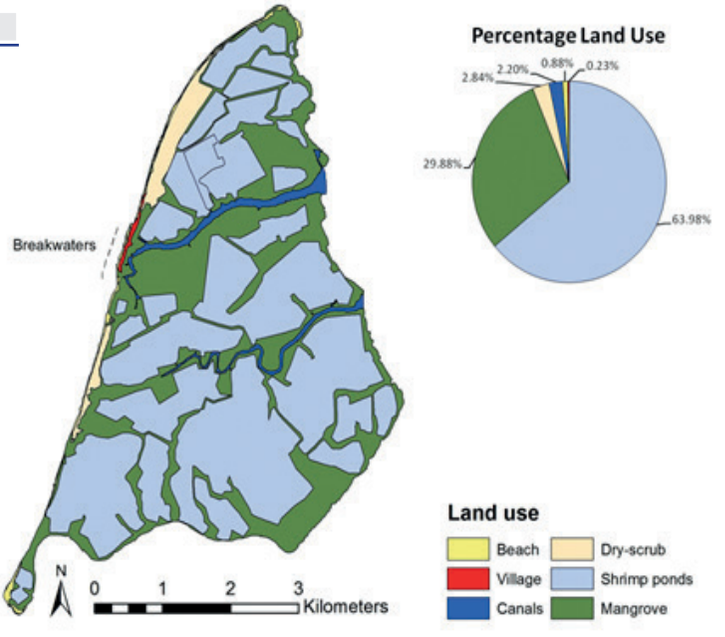

Figure 4. Land use on Jambelí Island.

0.7 birds/km and 0.014 birds/ha, respectively. Moreover, we have recorded the presence of the Magnificent Frigatebird, but other authors have reported the presence of the Great Frigatebird (*Fregata minor*) in Jambelí Island (MECN-INB-GADPEO 2015).

Orihuela-Torres *et al.* (2016) recorded 50 common species of birds for the whole archipelago, whereas in the present study we have detected 45 species in the Jambelí island only, indicating the importance of this island. In addition, there are 10 new species that we have recorded that are not listed in the book (White-cheeked Pintail, Peruvian Booby, Mangrove Black Hawk, Sanderling, Gull-billed Tern, Royal Tern, Amazilia Hummingbird, Grey-breasted Martin, House Wren, Chestnut-throated Seedeater), emphasizing even more the diversity of birds of these islands. However, the limitations of this study, caused by the limited sampling period, must be highlighted; nevertheless, the knowledge base is valuable for the future studies of these threatened habitats.

Regarding land use, Jambelí mangroves have suffered a serious decline because the shrimp industry has destroyed mangrove areas to build pools for shrimp breeding, 64% of the island is now shrimp ponds surface. This process is not unique to Jambelí but has happened widely in different areas with mangroves in Ecuador; it is estimated that between 1969 to 2006 27% of the mangrove area of the Ecuadorian coast was destroyed because of the shrimp industry, agriculture, logging and urban increase (Carvajal and Alava 2007, CLIRSEN 2007), although these data can amount to 40%-60% (Veuthey and Gerber 2012).

Another problem detected was the abundance of trash along the beaches, especially plastic debris. It is estimated that each year are discharged to the sea in Ecuador more than two thousand tons of persistent residues (Coello and Macias 2006), which implies a complex problem worldwide (Derraik 2002), but there is not only visible waste; in the Gulf of Guayaquil they have found pollutants originating from mining (Montaño and Robadue 1995, SES 1998). These environmental problems have negative consequences for biodiversity conservation.

Conclusions

This work shows the common birds in their different ecosystems of the island of Jambelí, which is included in one of the areas of importance for the conservation of birds by BirdLife International. However, in spite of this diversity, it is necessary to emphasize that among the uses of the land at the present time, the one that has greater surface is the shrimp pools, what constitutes therefore a great impact on the area of mangrove. Another major impact on biodiversity is the presence of urban solid waste.

It is necessary to implement policies that promote coastal conservation and sustainable use of these delicate ecosystems and not allow that mangroves be destroyed for the construction of shrimp ponds; while raising awareness on the implications of using rivers to dispose of waste. Then development and conservation can be reconciled so these natural ecosystems that persist today can reach to the next generation.

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