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Distribution and habitat use of the birds of Cima Islet (Rombo Islets, Cabo Verde) in winter

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RESUMO

O ilhéu de Cima é considerado um importante *hotspot* de biodiversidade em Cabo Verde para espécies de aves marinhas. Contudo, a riqueza, distribuição e utilização do habitat de aves terrestres, costeiras, limícolas e de rapina têm sido largamente negligenciadas até agora. Realizámos o primeiro levantamento detalhado da avifauna não marinha do ilhéu de Cima para orientar a conservação e gestão desta Reserva Integral. Efectuámos 24 transectos em Janeiro e Fevereiro de 2021. No total, detectámos 22 espécies, 12 das quais eram novos registos para o ilhéu. As espécies mais comuns foram pardais-de-Cabo-Verde, maçaricos brancos, rolas-do-mar, borrelhos-grandes-de-coleira e corvos. As espécies apresentavam-se largamente distribuídas de acordo com a disponibilidade dos principais recursos alimentares dos mesmos. As limícolas e costeiras concentraram-se principalmente em locais costeiros ou interiores durante a maré alta e espalharam-se para forragear em zonas intermareais durante a maré baixa, particularmente na costa norte. O relativamente elevado número de corvos (até 18) e o casal reprodutor de corujas-de-Cabo-Verde estão provavelmente a predar várias aves marinhas reprodutoras, o que pode ser preocupante para a conservação. Os nossos resultados enfatizam que o ilhéu de Cima é um santuário não só para aves marinhas, mas também para outras espécies migradoras e residentes.

Palavras-chave: abundância; forrageamento intermareal; levantamento por transectos; predação a aves marinhas

ABSTRACT

Cima Islet is considered a key biodiversity hotspot in Cabo Verde for seabird species. However, the richness, distribution and habitat use of terrestrial birds, shorebirds, wading birds and birds of prey have been largely neglected so far. We performed the first detailed survey of the non-marine avifauna of Cima Islet to guide the conservation and management of this Integral Reserve. We carried out 24 transects in January and February 2021. Overall, we detected 22 species, 12 of which were new records for the islet. The most common species were Iago sparrows, sanderlings, ruddy turnstones, ringed plovers and brown-necked ravens. Species were largely distributed according to the availability of their main food resources. Wading and shorebirds mostly concentrated on coastal or inland sites during high tide and spread for foraging on intertidal areas during the low tide, particularly on the northern coast. The relatively high numbers of brown-necked ravens (up to 18) and the breeding pair of Cabo Verde barn owls are probably preying upon several breeding seabirds, what may be of conservation concern. Our results emphasize that Cima Islet is a sanctuary not only for seabirds, but also for other migrating and resident bird species.

Keywords: abundance; intertidal foraging; seabird predation; transect surveys

INTRODUCTION

Assessing the distribution and abundance of birds is crucial for their, effective conservation planning (Abie *et al.* 2019). However, this basic information is often lacking for many regions such as Cabo Verde. These islands in the middle of a major Atlantic flyway between the northern and the southern hemispheres are regularly visited by more than one hundred migratory bird species (Hazevoet, 2003).

Cima is one of the Cabo Verde islets commonly visited by migratory birds. It is uninhabited and target of several studies regarding its marine and terrestrial diversity, chiefly seabirds (Cruz-Flores *et al.* 2018, Semedo *et al.* 2020, Torres *et al.* 2021). Cima is considered a key reproduction site for five seabird species: the Cabo Verde storm petrel *Hydrobates jabejabe*, the white-faced storm petrel *Pelagodroma marina*, the Bulwer's petrel *Bulweria bulwerii*, the Boyd's shearwater *Puffinus boydi* and the red-billed tropicbird *Phaethon aethereus* (Semedo *et al.* 2020). However, information on terrestrial birds, shorebirds, wading birds and birds of prey is much scarcer. Among them, the peregrine falcon *Falco peregrinus madens*,

with 15–20 breeding pairs in the 1960s, stood out (Hazevoet 1995). A few whimbrels *Numenius phaeopus*, greenshanks *Tringa nebularia* and turnstones *Arenaria interpres* were also recorded, but no study was performed in the winter so far (Hazevoet 1992). Recently, a review by Garcia-del-Rey (2016) indicated the occurrence of 18 terrestrial bird species.

Cima was included within the Important Bird Areas network by BirdLife International (Hazevoet *et al.* 1995) and later declared an Integral Reserve by the Cabo Verde government (Anonymous 2003). Since then, the islet is inaccessible for tourists, which may explain the information gap on its terrestrial avifauna. However, it has been suffering anthropogenic impacts, such as illegal visits, predation from introduced mammals (i.e. mice and ants) and habitat destruction (i.e. stepping on nests) Rocha & Neves (2007). No management plans have yet been developed for bird species and surveillance of the reserve is poor (Vasconcelos *et al.* 2012).

To understand the importance of Cima as a wintering site for migratory and resident terrestrial birds we conducted transect. This

allowed us to: (1) provide a preliminary checklist of their occurrence; (2) infer their abundance; (3) assess their spatial distribution and habitat use in winter; and (4) understand

the changes in distribution, and feeding/resting behaviour of wading and shorebirds with tides.

MATERIAL AND METHODS

Cima Islet, located 8 km Northeast of Brava, where this study was performed, belongs to Rombo Islets group (Fig. 1A), composed by Grande (2.5 km²), Luis Carneiro, Rei and Sapado islets which are smaller (<0.25 km²). Cima is a rocky flat islet with 1.5 km² and a

small hill (~77 m high). Data were collected in January–February 2021 by walking along the islet, most times following the coastline, but sometimes inland to include terrestrial habitats (Fig. 1B).

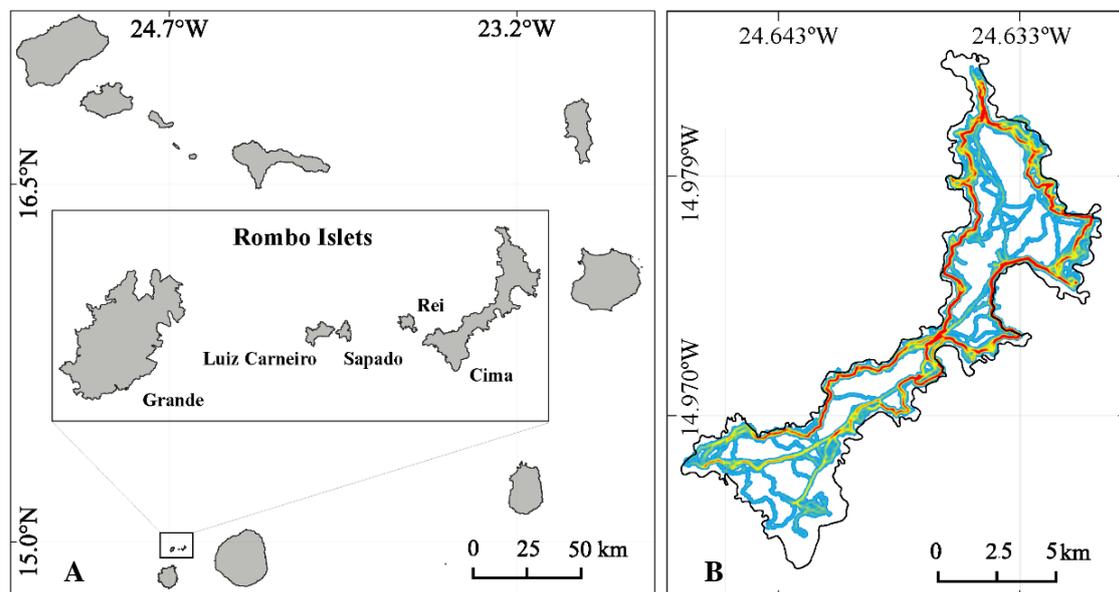


Fig. 1. Study area. **A)** Geographic location of Cima Islet (Rombo Islets, Cabo Verde) and **B)** of the 22 transects performed in January and February 2021. The colours depict the transect effort in three levels: high (red), average (yellow) and low (blue).

We classified the habitats in seven categories and clumped them into four main habitats – beach (white sand), inland, intertidal (flat coastal rocks), rocks (hilly coastal rocks) – and other (habitats not included in the behavioural analyses: black sand, hill top and slopes). We used Opticron 10x42 binoculars and a Canon 2000D camera with 70–300 mm lens to confirm species identifications based on literature (Clarke 2006; Svensson *et al.* 2009). A total of 24 transects were performed within a minimum 3h-interval, during the high tide (N=10), low tide (N=11), and in medium

tide (N=3), with an average duration and standard deviation of $2.06 \text{ h} \pm 0.68$ (range= 0.23–3.17 h) and average length of $6.17 \text{ km} \pm 1.90$ (range= 1.10–8.79 km).

To record the sampling effort per area (classified as high, average or low) as well as the GPS position of each sighting, we used Wikiloc version 3.20.9 (www.wikiloc.com). For each sighting we recorded the species, type of plumage (winter or prenuptial), sex (only possible for Iago sparrows *Passer iagoensis* due to technical limitation), age (only possible for turnstones, sanderling

Calidris alba and ringed plover *Charadrius hiaticula* because of technical limitation to distinguish the plumage on other species), the behaviour of the birds (flying, foraging, or resting), and habitat type (beach, inland, intertidal or coastal rocky areas). Regarding the Iago sparrow juveniles were identified by

the movement of the wings when asking for food. We also took pictures of each sighting, whenever possible. Distribution and abundance maps were produced with QGIS version 3.10.5. Individual maps and graphs were produced only for the species with more than 15 sightings.

RESULTS

Sampling effort was mainly concentrated on the coast and was higher in the northern than in the southern part of the islet (Fig. 1B). Overall, we identified 22 non-marine bird species, 12 of those new for Cima Islet (Table 1, Fig. 2). The greatest bird concentrations were along the northern coast, mainly

composed of wader species, such as ruddy turnstone, sanderling, ringed plover or whimbrel (Fig. 2). The most abundant species was the Iago sparrow with a maximum of 139 individuals sighted in one day (Table 1, Fig. 2A). Most species were seen in low numbers, usually 1 to 2 individuals (Table 1, Fig 2B).

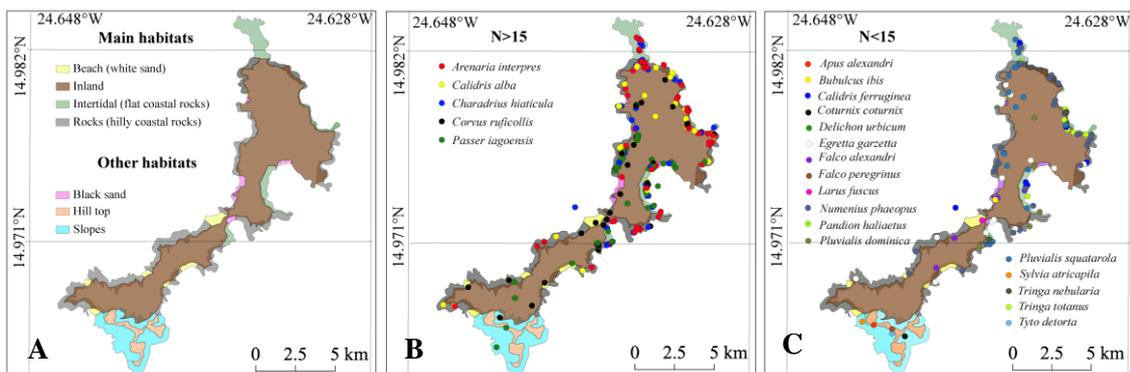


Fig. 2. Distribution of the habitats and non-marine bird sightings on Cima Islet (Rombo Islets, Cabo Verde). A) Distribution of main and other habitats. B) Distribution of species with more than 15 individuals (N>15) and C) of species with less than 15 individuals (N<15).

The ruddy turnstone used almost all habitats. In low tide, turnstones were mostly foraging, regardless of the habitat. In low tide, birds dispersed over the flat intertidal central and northern areas. During high tide, most individuals were resting concentrated in specific resting points mainly inland and in flat intertidal areas (Fig. 3A and 3B). However, when they were in coastal rocky areas in high tide, approximately half of the sighted birds were foraging and the other half was resting. Only a small percentage of individuals were flying.

Sanderlings mostly foraged during the low tide, both in the flat intertidal or coastal rocky

areas. During low tide, they dispersed more than during high tide, but still concentrated on flat intertidal areas. During high tide they used coastal rocky areas to rest, while they used flat intertidal areas for foraging or resting and were found mostly in the north (Fig. 3C and 3D).

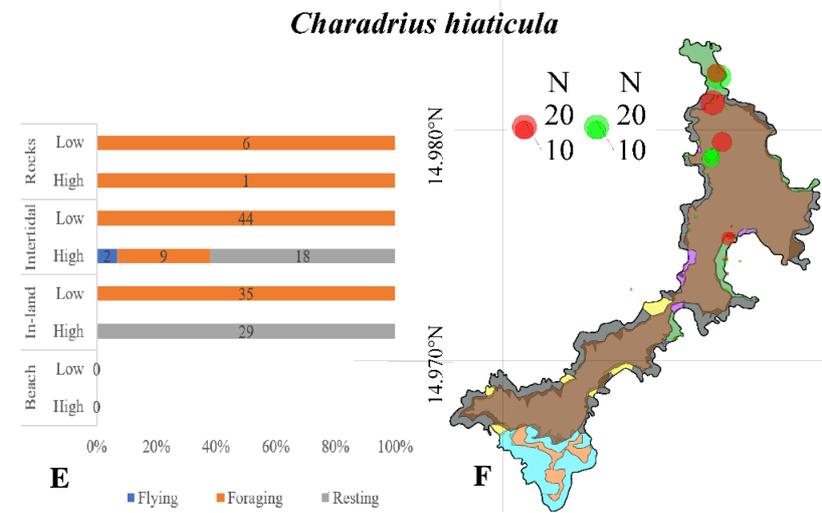
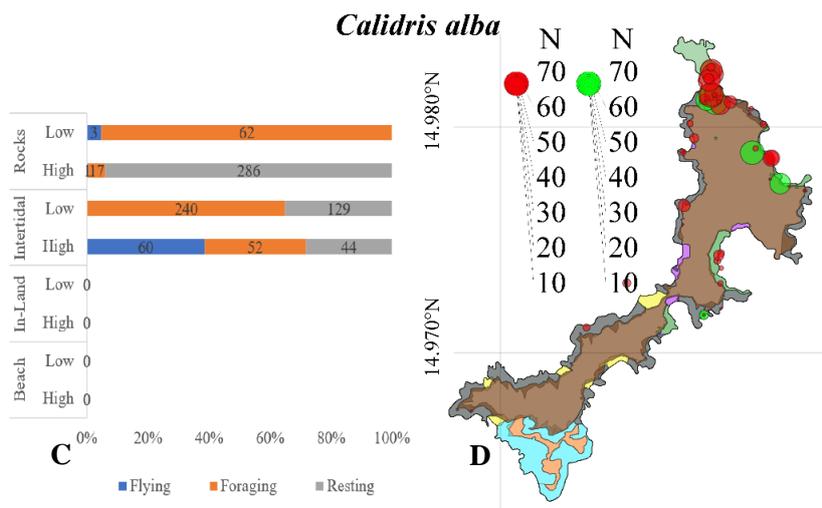
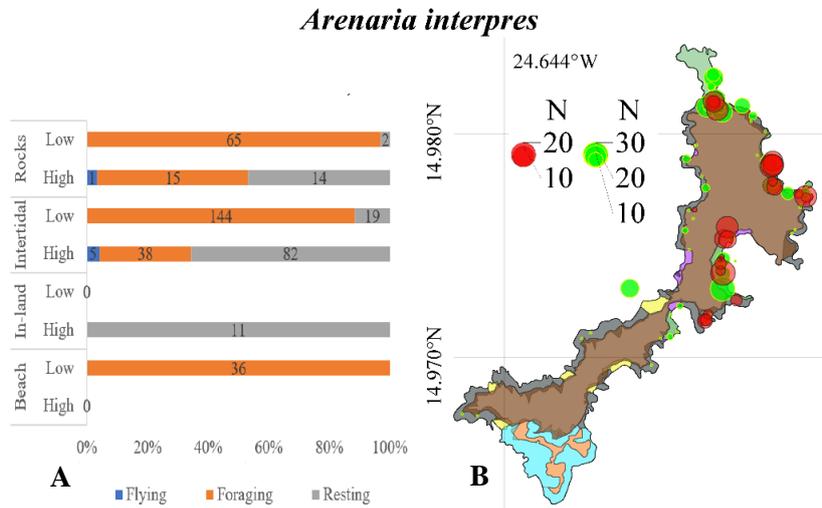
Ringed plovers used a wide range of habitats, but only in the north. In coastal rocky areas birds were always foraging regardless the tide. During low tide birds widely dispersed in flat intertidal areas for foraging, but also to inland areas, and in high tide they mostly rested in flat intertidal areas reducing their distribution (Fig. 3E and 3F).

Table 1. Details on the species recorded on Cima Islet (Rombos, Cabo Verde) in January and February 2021. The taxonomy, life history (resident, migrant, wintering, or vagrant), global distribution (endemic, pantropical, Nearctic, Neotropical, Afrotropic, or Palearctic), maximum number of records per species per day (N), and cumulative age composition (A, adult; J, juvenile) of each species is shown. Their conservation status, considering the global IUCN status (Global) and national (Local) Red Lists (LC, Least Concern; NT, Near Threat; EN, Endangered; NE, Not Evaluated), and their population trends following the IUCN (Pop: +, increasing; -, decreasing; 0, stable, ?, unknown) are also given. New records for Cima Islet are marked with an asterisk (*).

Taxonomy			Life history	Distribution	N	Age composition	Conservation status		
Family	Common name	Scientific name					Global	Local	Pop
Apodidae	Cabo Verde swift	<i>Apus alexandri</i>	Resident	Endemic	1		LC	NE	+
Ardenidae	cattle egret	<i>Bubulcus ibis</i> *	Migrant	Pantropical	1		LC	NE	+
	little egret	<i>Egretta garzetta</i>	Wintering	Pantropical	1		LC	NE	+
Charadriidae	ringed plover	<i>Charadrius hiaticula</i> *	Wintering	Pantropical	19	35A+31J	LC	NE	-
	American golden plover	<i>Pluvialis dominica</i> *	Vagrant	Nearctic/Neotropic	1		LC	NE	-
	grey plover	<i>Pluvialis squatarola</i> *	Wintering	Pantropical	2		LC	NE	-
Corvidae	brown-necked raven	<i>Corvus ruficollis</i> *	Resident	Afrotropic	18		LC	NE	+
Falconidae	common kestrel	<i>Falco alexandri</i>	Resident	Endemic	1		LC	NE	-
	peregrine falcon	<i>Falco peregrinus</i>	Migrant	Pantropical	1		LC	NE	0
Hirundinidae	house martin	<i>Delichon urbicum</i>	Migrant	Pantropical	1		LC	NE	-
Laridae	lesser black-backed gull	<i>Larus fuscus</i> *	Migrant	Pantropical	1		LC	NE	+
Pandionidae	osprey	<i>Pandion haliaetus</i> *	Resident	Pantropical	1		LC	EN	+
Passeriniidae	Iago sparrow	<i>Passer iagoensis</i>	Resident	Endemic	139		LC	NE	0
Phasianidae	common quail	<i>Coturnix coturnix</i> *	Resident	Palearctic/Afrotropic	1		LC	NE	-
Scolopacidae	ruddy turn-stones	<i>Arenaria interpres</i>	Wintering	Pantropical	70	415A+165J	LC	NE	-
	sanderling	<i>Calidris alba</i>	Wintering	Pantropical	107	309A+131J	LC	NE	?
	curlew sandpiper	<i>Calidris ferruginea</i> *	Wintering	Pantropical	1		NT	NE	-
	whimbrel	<i>Numenius phaeopus</i>	Wintering	Pantropical	2		LC	NE	-
	green shank	<i>Tringa nebularia</i> *	Wintering	Pantropical	1		LC	NE	0
	red shank	<i>Tringa totanus</i> *	Wintering	Pantropical	1		LC	NE	?
	Sylviidae	blackcap	<i>Sylvia atricapilla</i> *	Vagrant	Palearctic/Afrotropic			LC	NE
Tytonidae	Cabo Verde barn owl	<i>Tyto alba detorta</i>	Resident	Endemic	2		NE	NE	?

Whimbrels were distributed widely during low tide where they were found mostly foraging on the flat intertidal areas foraging. During high tide, birds were mostly resting,

even though some were flying. In high tide they congregated at specific points in the East, but were also observed sporadically inland (Fig. 3G and 3H).



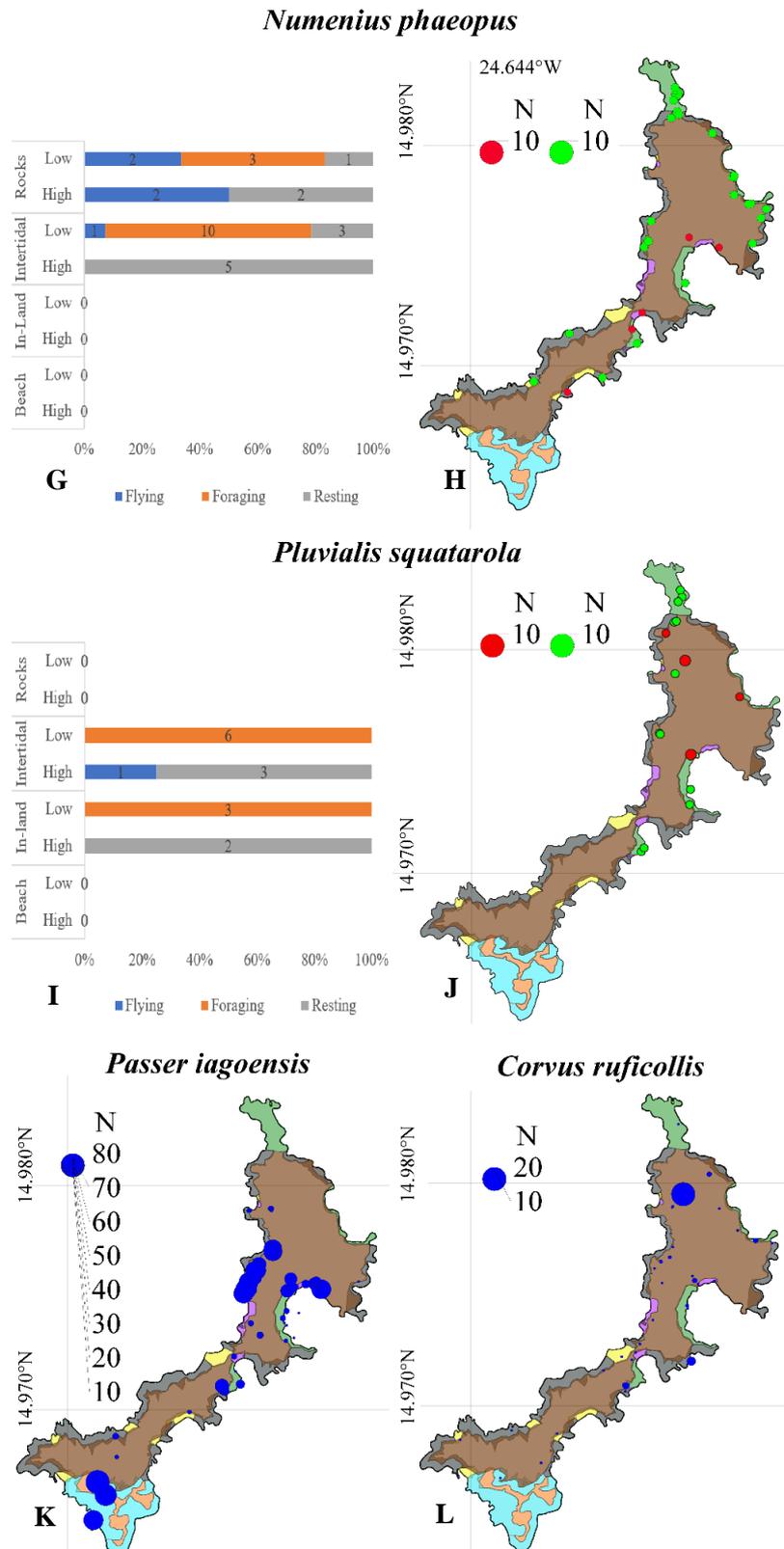


Fig. 3. Habitat use, distribution and behaviour in relation to the tide (low or high) of non-marine bird species with more than 15 sightings on Cima (Rombos, Cabo Verde) in January and February 2021. Data for **A**) & **B**) the ruddy turnstone *Arenaria interpres*, **C**) & **D**) the sanderling *Calidris alba*, **E**) & **F**) the ringed plover *Charadrius hiaticula*, **G**) & **H**) the whimbrel *Numenius phaeopus*, **I**) & **J**) the grey plover *Pluvialis squatarola*, **K**) the Iago sparrow *Passer iagoensis*, and **L**) the brown-necked raven *Corvus ruficollis*. The number of birds (N) seen at high tide (red) and low tide (green) is proportional to the size of the dots. Foraging in orange, flying in blue and resting in grey (all measured in percentage, %). Habitat characterization polygons as in Fig. 2.

Grey plovers *Pluvialis squatarola* were only seen in the north and showed a well-defined behaviour regarding tides. During low tide they were mostly foraging widely dispersed across flat intertidal rocky areas. During high tide, there was a clear reduction in sightings, with individuals seen further inland mostly resting (Fig. 3I and 3J).

The distribution of Iago sparrows was almost uniform, but with three concentration foci in the midwest, mideast and southern tip

(Fig. 3K). Similarly, brown-necked ravens *Corvus ruficollis* showed a uniform distribution across the islet with a slight preference for the north (Fig.3L).

Regarding age classes, ruddy turnstones and sanderlings were mostly composed by adults (>60% of the sightings), whereas ringed plovers were more balanced, with 53% adults and 47% juveniles. Iago sparrow females were more frequent than males (3:1 in 916 sightings).

DISCUSSION

This is the first detailed non-marine bird survey for Cima Islet in winter, including details on their distribution and abundance during high and low tide, habitat use and behaviour. It is also the first detailed characterization of the islet habitats. Cima offers a diverse habitat combination for wintering, passing and resident birds, highlighting its value and the need for its effective protection as a sanctuary not only for seabirds, but also for other migrating and resident bird species.

Most records were of wintering waders. Due to the location of the flat intertidal areas, where waders were more abundant, the observation effort was greater in the north than in the south of the islet and in coastal areas. Nevertheless, given all areas were visited a minimum of five times, our results still provide a representative assessment of birds across the islet.

Previously, 18 non-marine bird species were described for Cima, including two not currently occurring in Cabo Verde, black kites *Milvus milvus* and red kites *Milvus migrans* (Garcia-del-Rey 2016). In this study, restricted to the wintering period, we recorded 22 species (seven residents, 15 European breeders and one American breeder), 12 of which were new records for the islet. Some corresponded to rare sightings in Cabo Verde, such as the American golden plover *Pluvialis dominica* (Garcia-del-Rey 2016). Regarding their IUCN conservation status, most are

classified as Least Concern, although more than half show decreasing population sizes or present unknown trends. Additionally, the curlew sandpiper *Calidris ferruginea* is classified as Near Threatened, and the osprey *Pandion haliaetus* is considered locally Endangered (Hazevoet 1996), highlighting the interest to closely monitor these species. Moreover, three taxa are Cabo Verde endemics, thus highlighting the value and the need for an increase of an effective protection of this islet as a sanctuary not only for seabirds, but also for other migrating and resident bird species.

Regarding habitat use and behaviour, shorebirds typically dispersed and foraged during low tides in flat intertidal areas and concentrated for resting in a several coastal or inland locations. These changes in distribution and behaviour with tides are commonly found in waders, given they mainly feed on intertidal invertebrates, which are unavailable during high tide (Burger *et al.* 1977, Fonseca *et al.* 2017).

In winter, species distribution is mainly influenced by prey availability (Gauthreaux 1982), and the same was observed in some non-marine birds on Cima Islet. Iago sparrow is an example of this. Although widely distributed, two of the three foci, in the central east and southernmost of the islet, are in the fishermen and visitors camp sites where sparrows profit from food remains. Other factor explaining those foci is the presence of

natural and artificial seabird nests that sparrows use for nesting. Similarly, the brown-necked ravens were widely dispersed in the islet, but showed a preference for the north coast, probably because it holds a huge breeding colony of white-faced storm-petrel (Grant *et al.* 2000). In December, these petrels visit their burrows and start laying in March (Campos 1999). They breed in sandy burrows that often collapse or are easily breached by brown-necked ravens to prey upon them (both on adults and juveniles, pers. obser.). The number of brown-necked ravens detected in the area and the apparent level of predation may be of conservation concern for storm-petrels, Bulwer's petrel and even for red-billed tropicbirds and warrants further scrutiny. Cabo Verde barn owls *Tyto detorta* are only present in the southern tip of the islet,

where they strongly predate on Cabo Verde and white-faced storm petrels, as both were found in great numbers in their regurgitations and nests (70% of prey's remains on the nest; pers. obser.). We argue that the level of predation on breeding bird species and their impacts should be closely monitored.

The present survey was restricted to January and February, and therefore it would be very convenient to extend it along the year to fully understand the role of the islet as a stopover and feeding site, specifically during migration peaks between Europe and Africa (particularly during September–October and April). Likewise, it is advisable to increase sampling effort in the inland to confirm the presence of desertic birds, which have been only occasionally detected (pers. obser.), but not confirmed in this study.

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