

# Segregation of roosting habitat in migratory shorebirds on the Pacific coast of Colombia

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During fall migration in 1990, we conducted visual counts of shorebirds along the sandy shoreline of Punta Soldado (Valle, Colombia). Although this location is not regularly used as a feeding site by shorebirds, about 5,000 shorebirds of different species congregate on a limited portion of the beach. We mapped the location of these birds in relation to the tide line. We found that the most numerous species, *Actitis macularia*, used the innermost portions, which were covered with various grasses. *Charadrius wilsonia* and *C. semipalmatus* preferred a different section, which was covered with organic and inorganic detritus, and *Calidris mauri* showed a marked preference for the wet outer beach. We discuss the importance of resting sites as a limited resource for migrant shorebirds.

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Durante la migración de otoño de 1990, realizamos censos visuales de aves playeras en el litoral arenoso de Punta Soldado (Valle, Colombia). Aunque esta localidad no es usada regularmente como sitio de alimentación por estas aves, durante la noche se congregan en un sector limitado de la playa cerca de 5 000 individuos de diferentes especies. Durante los censos, mapeamos la ubicación de las aves contadas determinando su distancia con respecto a la línea de rompeolas. Encontramos que *Actitis macularia*, dominante numéricamente en la comunidad, utilizó la parte más interna, cubierta por vegetación rastrera y gramíneas, mientras que *Charadrius wilsonia* y *C. semipalmatus* prefirieron el segmento inmediatamente siguiente cubierto por detritus orgánicos e inorgánicos y por último, *Calidris mauri* mostró una marcada preferencia por la playa externa húmeda. Discutimos la importancia de los sitios de descanso como recursos limitantes para aves playeras migratorias.

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Les auteurs ont effectué des dénombrements visuels d'oiseaux de rivage durant la migration automnale à partir du rivage sablonneux de Punta Soldado, à Valle, en Colombie. Même s'il ne s'agit pas d'une aire d'alimentation utilisée régulièrement, quelque 5 000 oiseaux de rivage de diverses espèces s'y rassemblent. Nous avons cartographié l'emplacement de ces oiseaux par rapport à la laisse de marée. Nous avons découvert que l'espèce la plus abondante, *Actitis macularia*, se nourrissait des diverses graminées de l'arrière-plage. *Charadrius wilsonia* et *C. semipalmatus* préféraient une autre section de la plage, couverte de détritrus organiques et inorganiques, et *Calidris mauri* avait une nette préférence pour l'avant-plage humide. On traite de l'importance des aires de repos comme ressource limitée pour les oiseaux de rivage migrants.

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## Introduction

The Buenaventura Bay on the Pacific coast of Colombia (03°48'N, 77°10'W) has been shown to be important both as a stop-over area and as wintering grounds for populations of several species of Nearctic shorebirds (Franke 1986; Naranjo *et al.* 1987). Banding of several hundred shorebirds in the area during the last seven years has indicated strong site fidelity for all species, with several sites around the bay supporting different populations of sandpipers and plovers.

One of these sites is the Punta Soldado Island. Since 1985, we have found this site to be used as a

feeding area only by a few shorebirds at a time; at the same time, however, large numbers of roosting shorebirds congregate there. As there is no other locality around the bay where this phenomenon occurs, and as the roosting sites are restricted points of the beach of Punta Soldado, we sought to determine whether spatial segregation among species might be occurring. If such segregation can be demonstrated and if special features of the habitat are related to the pattern of occupation of discrete sectors of the coastline, the availability of suitable roosting sites may be a limiting resource for wintering shorebirds.

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## Study area and methods

Punta Soldado is located at the north-western end of the Buenaventura Bay. The island is separated from the mainland by a network of channels and mudflats partially covered by mangroves, but its outer shore is mostly a continuous sand beach. Tidal fluctuations are wide (up to 4 m), and during the high waters only a narrow tongue of this external beach is exposed.

We conducted visual counts of shorebirds and evaluated the roosting site at the peak of the 1990 fall migration. Birds were counted four times on 27 October using a 40× spotting scope, and their locations were mapped relative to a grid (10 m × 10 m squares) of wooden markers planted on the ground, from the surf line to the inner boundary of the beach, naturally marked by grasses and shrubs.

On 28 October, we measured the total area of the roosting site and determined the boundaries between microhabitats according to substrate texture and humidity, accumulation of debris and the slope of the beach measured with a clinometer located on a 10-m-long string tied to poles and parallel to the substrate.

Habitat selection and spatial segregation were examined by a chi-squared test for randomness of the location of each particular species.

## Results

The roosting site can be divided into four zones parallel to the shoreline. The outermost zone (number 1 in Table 1) corresponded to the shoreline proper and could be recognized by both texture (fine-grained sand) and humidity. Its width (perpendicular to the shoreline) was 20 m, and its slope was 2°. The second zone (number 2 in Table 1) was not directly affected by the surf, and the relatively dry sand in that zone contained a few pieces of debris. This segment, 100 m wide with a slope of 1.8°, was densely occupied by crabs (*Ocypode gaudichaudii*) and their burrows. The third zone (number 3) was the most distinct of all because of the loose coarse sand and the heavy deposition of debris. It was completely flat (slope = 0°), and its width averaged 20 m. Immediately after this zone, the beach ends in a fourth zone (number 4), 5 m wide with a slope of -0.14°, formed by fine-grained sand and locally humid because of the drainage of fresh water from inland. The inner edge of the beach was abrupt and coincided with a bank of mixed (sand-clay) texture. Bordering this bank, an additional zone of variable width was recognizable because of its dense cover of grasses and shrubs.

A total of seven species of shorebirds was recorded on the roost. We counted a few Whimbrels *Numenius phaeopus*, Willets *Catoptrophorus semipalmatus* and Sanderlings *Calidris alba* along the shoreline, but the roost proper (zones 1–4) was occupied only by Western and Spotted sandpipers (*Calidris mauri* and *Actitis macularia*) and Semipalmated and Wilson's plovers (*Charadrius semipalmatus* and *C. wilsonia*).

Adding up the numbers of shorebirds in discrete flocks arriving at the roosting site, we estimated that approximately 5,000 individuals spent the night on the beaches of Punta Soldado. This figure is realistic: during our first banding night at the roost, 99 birds were captured, and, although several banded birds were observed the following day, none of the 75 birds captured the second night was banded.

The results of four diurnal censuses carried out in 1990 are presented in Table 1. The Spotted Sandpiper is not included in our analyses, because these birds occupied the roost only at night and began to disperse before we had enough light to conduct our censuses. As the counts progressed, some movement between zones and from other sites along the beach to and from the roost was apparent for all species. Western Sandpipers moved towards the outermost zone following the retiring surf line while feeding; Semipalmated Plovers were leaving the roost at the same time, and Wilson's Plovers tended to concentrate around freshwater ponds at the innermost zone of the beach.

The regularity of the microhabitat choice was also evident. Testing the null hypothesis of random occupancy of the different sectors, by means of a chi-squared test, yielded significant rejection in all cases (for censuses 1–4, respectively,  $\chi^2 = 356.81, 290.75, 471.02$  and  $315.1, p < 0.001$ ).

## Discussion

Although we do not have information on inter-specific territoriality for the roost, this pattern of occupation strongly suggested selection for particular features of the microhabitat. Whereas the Western Sandpiper favoured the outer beach exposed to wave action, as well as the second band of humid sand, and the Wilson's Plover definitely preferred the innermost part of the beach, the Semipalmated Plover occupied all four zones. This pattern could be interpreted in terms of differential activity among species. Whereas the Western Sandpiper alternated roosting and comfort behaviour with variable bouts of feeding along the humid shoreline and the Wilson's Plover did the same around freshwater ponds, Semipalmated Plovers remained lying on their bellies,

**Table 1.** Roosting shorebird abundances across the beach of Punta Soldado in October 1990. For a description of zones, see text.

Species	Beach zone	Counts at different times of the day			
		07:00	07:30	08:00	08:30
Western Sandpiper	1–2	50	57	182	80
	3	54	58	31	0
	4	0	0	0	0
Semipalmated Plover	1–2	255	150	0	0
	3	107	37	0	0
	4	135	135	58	0
Wilson's Plover	1–2	0	0	0	0
	3	34	68	0	0
	4	211	211	200	235

camouflaged amid pieces of wood, dry leaves and inorganic litter. In addition, the presence of large numbers of Spotted Sandpipers roosting at night at the innermost zone of the beach also suggested habitat selection for roosting.

Because our censuses were made at a time of day when the birds had begun to fly towards the mudflats inside the bay, the numbers used for the analyses represent only a sample of the total populations. Nevertheless, we assume that our figures reflect the pattern of occupation of the roost, judging from observations of birds settling down on the beach during the evening.

The importance of the site as a restricted roost is further inferred from the fact that, although the beach continues towards the south-west, we have not detected a single flock spending the night at a different spot. Taking this into account, it is also important to note that there are no other sites with similar characteristics of width at high tide, slope and deposition of litter around the mouth of Buenaventura Bay. A similar trend was noted by Morrison & Ross (1989) for the Colombian Pacific coastline around Guapi, where sandy points of the beach were heavily occupied by small shorebirds at high tide. However, these authors failed to detect important numbers of peeps in the sector, which included our study area, although their survey was also made during high tide. Whereas the aerial surveys of Morrison & Ross (1989) yielded a total of only 181 shorebirds in our study area at the peak of migration, our lowest diurnal count (when most birds had left the roost) amounts to 315 birds!

Taking into account these facts, it thus seems likely that not only the area around Buenaventura Bay but also the rest of the sandy Pacific coastline of

Colombia support a population of shorebirds much larger than has been reported in the literature. Conservation efforts concerning the fate of migrant shorebirds in the Neotropics must take into account the existence of such restricted roosts as limiting resources. Beach sectors of a few hundred square metres may be particularly vulnerable to destruction owing to natural processes like erosion and plant succession and to human disturbance. An adequate evaluation of populations at these sites must be given top priority in the next few years if we want to preserve the ever-fascinating miracle of shorebird migration in the continent.

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