Wintering Western Sandpipers *Calidris mauri* at Estero de Punta Banda, Baja California, México

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From October to March of 1994-1995, we studied the age and sex distribution of Western Sandpipers *Calidris mauri* at Estero Punta Banda, B.C., México, a site with up to 4,000 wintering Western Sandpipers. Most birds converge to feed at the head of the estuary at high tide and in the main channel at low tide. We captured 390 birds and individually colour-banded 317 of them at three sites within the estuary. Males outnumbered females throughout the season, whilst the proportion of adults and juveniles sampled varied through the season. At roost sites, Western Sandpipers were distributed non-randomly with respect to age.

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INTRODUCTION

Western Sandpipers *Calidris mauri*, like many other shorebird species, often show complex patterns involving sex and age differences in timing of movements or in geographic distribution during the nonbreeding season (Myers 1981, Ruiz *et al.* 1989, Creswell *et al.* 1994, Warnock 1995). They segregate by age and sex during spring and fall migrations (Page *et al.* 1972, Senner *et al.* 1981, Butler *et al.* 1987), and males winter closer to the breeding grounds than females (Page *et al.* 1972, Harrington & Haas 1995).

The Western Sandpiper is one of the most common shorebirds of the Western Hemisphere (Wilson 1994) and the most abundant wintering shorebird along the west coast of Baja California (Page & Palacios 1993). Despite their abundance, relatively little is known about the bird's winter ecology in Baja California or in the rest of México. In this paper we: 1) document seasonal variation in Western Sandpiper numbers during the 1994-1995 winter; 2) determine age and sex ratios; and, 3) describe spatial and temporal distributions of Western Sandpipers roosting and foraging at Estero Punta Banda.

STUDY AREA AND METHODS

Estero Punta Banda, one of five major Pacific coastal lagoons in Baja California (Palacios *et al.* 1991), is located 13 km south of Ensenada, Baja California, México (31 40-31 48N, 11634-116 40 W), and encompasses an area of approximately 20 km^2. Monthly population size of Western Sandpipers at Punta Banda was estimated from monthly censuses of the entire estuary on low falling tides (October to March) and from counts of the major concentrations of feeding Western Sandpipers on the mudflats at low tides (November to March). Counts were carried out at the mouth, head, ponds and main tidal channels (Figure 1) by sweeping a spotting scope (15-45x) over flocks present and recording bird numbers on a mechanical counter. Numbers registered at the different sites were tallied and the total count was considered to be the total population in the estuary. We caught Western Sandpipers and individually colour-banded them with a U.S. Fish and Wildlife Service band and a combination of 3-5 colour-bands, under banding permit No. A00.-700.-(2)-00726 from the Secretaria de Desarrollo Social (SEDESOL, México). Catching took place at three sites at Punta Banda (Figure 1): the north-east side of the estuary (mouth), characterised by mudflats and *Spartina* sp., the south-east end of the estuary (head), characterised by mudflats and *Spartina-Salicornia* clumps, and at the estuary's south-west corner (ponds) in an artificial salt pond and a saltwater holding pond. Censusing was done at these sites and in the estuary's main channel, which is characterised by extensive mudflats during low tides (Figure 1). We mist-netted during daylight hours on the highest-rising tides of the month at the mouth and the head (Figure 1), birds caught per site can be seen in Table 1. Additional trapping at the ponds was done on tides higher than 1.50 m, as the birds moved in to roost or feed. We determined the sex of birds based on length of the exposed culmen and aged them based on colouration of wing coverts and scapulars (Page & Fearis 1971). Birds captured in March were not aged. To determine habitat use and local movements we searched for colour-banded birds on 15 days between November and March.

We used X^2 goodness-of-fit test on total numbers caught to detect monthly differences in age and sex ratios, assuming null

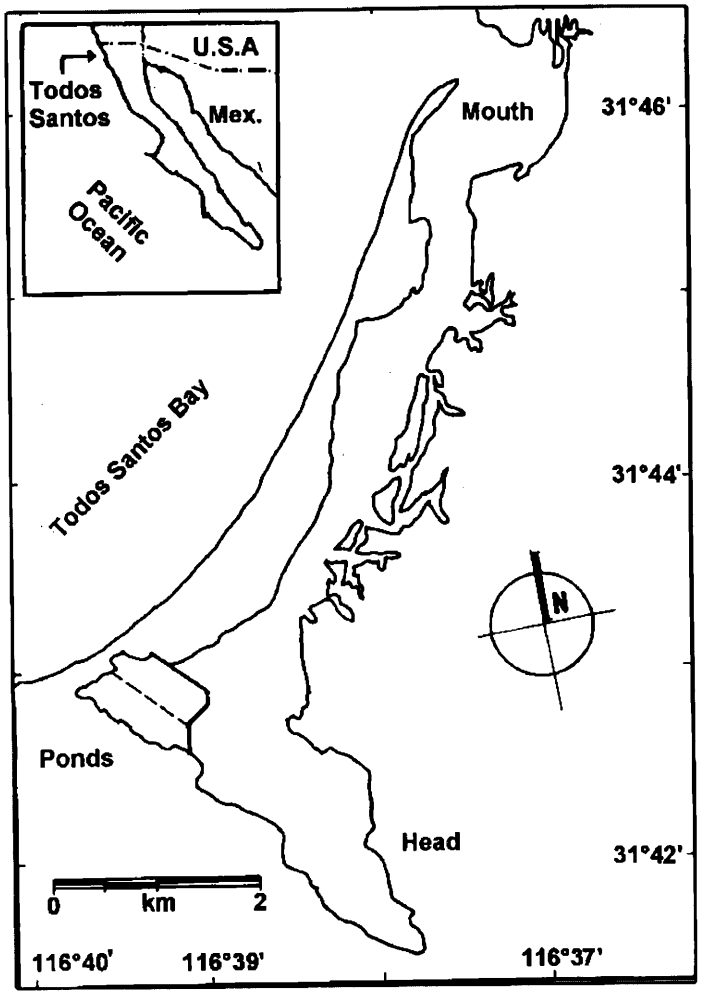

Figure 1. Map of Estero de Punta Banda. From Escofet *et al.* (1988).

hypotheses of 1:1 ratios, and X^2 contingency tables on total numbers to evaluate age, spatial distribution, and movements, assuming age and spatial homogeneity. Both tests were corrected for continuity when degrees of freedom was one (Zar 1984).

RESULTS

Abundance and age and sex ratios

Total number of Western Sandpipers declined from 4,000 birds in October to 1,300 birds in March (Figure 2). We failed to detect a significant difference in number of males versus females captured in October. However, after October, the percentage of male Western Sandpipers captured never dropped below 82%. We caught 390 birds and individually colour-marked 317, details are shown in Table 1. We were unable to determine the sex of 16 Western Sandpipers. Numbers of males captured per month from November to March were significantly higher than expected by chance, if we assume a 1:1 male to female ratio: Nov $^2_1$ = 73.57, p 0.01 n = 145; Dec $^2_1$ = 33.28, p 0.01 n = 53; Jan $^2_1$ = 76.12, p 0.01 , n = 134; Feb $^2_1$ = 7.68, p= 0.005, n = 22; Mar $^2_1$ = 5.81, p = 0.015, n = 11). The proportion of juvenile Western Sandpipers captured per month ranged from 43% (Jan) to 68% (Feb, Table 1). We failed to detect significant differences between numbers of adults and juveniles captured Dec-Feb, but we did capture significantly more juvenile than adult westerns in November $^2_1$ = 4.47, p = 0.03, n = 149).

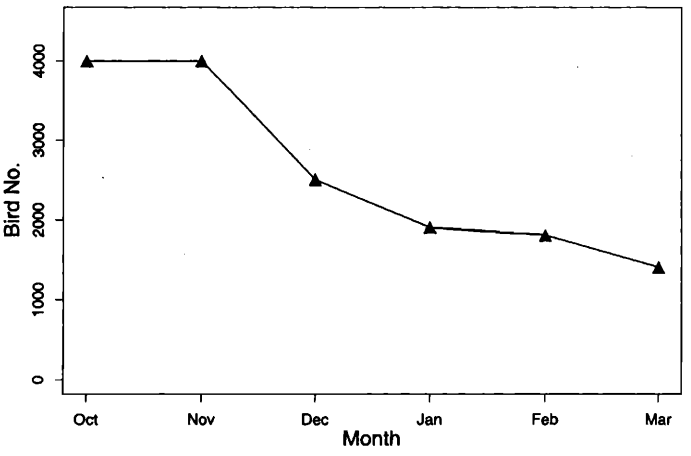

Figure 2. Monthly point count number of Western Sandpipers in Punta Banda during the 1994-1995 winter season.

Spatial distribution and local movements

The mouth and the head of the estuary were used by Western Sandpipers for feeding and roosting during high tides whilst the pond and dyke were used almost exclusively for roosting only during the highest tides (1.5 m). The main channel was only used for feeding during low tides (0.5 m). The ratio of first-year to adult Western Sandpipers varied significantly among our banding sites ($^2_1$ = 27.7, p 0.001). At the mouth of the lagoon, 35% of the birds we banded were first-year birds, compared to 46% at the head of the lagoon and 72% at the Ponds (Table 1). First year birds made up 86% of the resightings at the pond (n=22), compared to 69% at the Head (n =36), 47% at the Mouth (n = 17), and 41% in the Channel (n= 80).

DISCUSSION

Western Sandpipers arrive in Punta Banda in large numbers in October. We detected significantly more juveniles than adults in November, but the age ratio evened out as the season progressed. This and the fact that overall number of birds declined suggest that as late as November and December more juvenile birds than adults were moving out of Punta Banda whilst the adults stayed on. This may simply reflect the later migration timing of juveniles who move about a month after the adults (Butler *et al.* 1987, Wilson 1994). Adult Western Sandpipers depart from the breeding grounds and arrive at their wintering quarters earlier than juveniles (Wilson 1994). Birds may be moving to other sites in Baja California, the Gulf of California, or perhaps farther south. Naranjo *et al.* (1994) detected an influx of Western Sandpipers in December to a coastal site in Colombia, although most of their birds appear to be adults.

The high percentage (80%) of male Western Sandpipers at Punta Banda is similar to the percentage detected at Bolinas Lagoon, California, (86% , Page *et al.* 1972) and Bolivar Flats, Texas, (79% , Gordon 1985). Female Western Sandpipers at Punta Banda never accounted for more than 20% of our winter population. This ratio fits into the general observation that male Western Sandpipers winter farther north than females (Harrington & Haas 1995); in Colombia, 69% of Western Sandpipers captured were females (calculated from Naranjo *et al.* 1994).

Table 1. Western Sandpipers *Calidris mauri* banded at Estero de Punta Banda in 1994-1995 by month, age, and banding location.

		MONTH					
		Oct	Nov	Dec	Jan	Feb	Mar
AREA	AGE						
Mouth	Adult	0	34	8	3	0	0
	First-year	0	9	7	8	0	0
	Unknown	0	0	0	0	0	12
Head	Adult	0	17	0	79	7	0
	First-year	0	21	0	53	15	0
	Unknown	00	0	0	0	0	
Ponds	Adult	0	10	20	0	0	0
	First-year	10	58	19	0	0	0
	Unknown	0	0	0	0	0	0
TOTAL		**10**	**149**	**54**	**143**	**22**	**12**

Our results show a heterogeneous age distribution of birds in the estuary. Even if mist-netting biases existed towards a group (most likely first-year birds), our trapping efforts in different places in the estuary resulted in a heterogeneous site and tide-dependant catch. This heterogeneity allows us to conclude differential use of the estuary by different aged bird groups for this winter. (Tables 2 and 3).

Proximity of roost sites to suitable foraging areas might also influence where birds roost. The ponds had low invertebrate densities compared to mudflats by roost sites at the mouth and head of Punta Banda (Buenrostro unpub. data). Birds roosting in the ponds have to move farther to begin feeding when the tides fall than do birds roosting at the head and mouth of the estuary.

		HIGH TIDE										LOW TIDE					
		Natural habitats				Artificial habitats						Natural habitats					
		Mouth		Head		Pond		Dyke				Mouth		Head		Channel	
Month	n	A	SA	A	SA	A	SA	A	SA	Month	n	A	SA	A	SA	A	SA
Nov	5	0	0	0	0	0	0	0	5	Dec	16	1	2	4	5	4	0
Dec	16	2	0	0	0	2	8	0	4	Jan	12	1	3	0	4	1	3
Jan	30	3	3	9	15	0	0	0	0	Feb	72	0	0	0	0	42	30
Feb	4	0	0	0	1	1	2	0	0	Mar	2	2	0	0	0	0	0
Total	55	5	3	9	16	3	10	0	9	Total	102	4	5	4	9	47	33

Table 2. Western Sandpipers *Calidris mauri* resighted by area and age during low and high tides at Estero de Punta Banda during the 1994-1995 winter. A=adult; SA=sub-adult

The observed differential roost and foraging patterns of first-year vs. adult Western Sandpipers at Punta Banda has been detected for other shorebirds at other sites. Ruiz *et al.* (1989) found age and sex segregation of Dunlin (*C. alpina*) within roost sites, but had no explanation for its occurrence. Intraspecific competition, especially over food, may lead to spatial segregation in shorebirds (Recher and Recher 1969, Groves1978, Goss-Custard *et al.* 1982). Western Sandpipers are aggressive and will defend temporary feeding territories (pers. obs.), but we do not have data on whether first-year birds experience more aggression than adults.

Raptor predation influences spatial distributions of shorebirds (Warnock 1990, 1994, Cresswell & Whitfield 1994). A Prairie Falcon *Falco mexicanus* and Coopers Hawks *Accipiter cooperii* were observed to attack and capture Western Sandpipers roosting in the ponds. Adult birds may learn where areas of high predation risk are and avoid them, whereas first-year birds may still not have learned where these areas are (Warnock 1990).

Spatial age distribution of Western Sandpipers at Punta Banda has to be studied further to help explain site preference both within and between years, including an explanation of the populations reduction throughout the winter. Comparison of Western Sandpiper sex and age proportions at other overwintering sites both north and south of Punta Banda will help create a better picuture of migration dynamics and winter habitat preferences of these birds.

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	HIGH TIDE Capture site					LOW TIDE Capture site				
Resighting	**Mouth**	**Head**	**Pond**	**Dyke**	**TOTAL**	**Mouth**	**Head**	**Pond**	**Dyke**	**TOTAL**
Mouth	6	1	0	1	8	29	39	12	7	87
Head	9	4	6	6	25	4	1	3	1	9
Pond	2	3	4	4	13	1	4	5	3	13
Dyke	0	0	1	8	9	27	44	20	11	102
TOTAL	**17**	**8**	**11**	**19**	**55**	**61**	**88**	**40**	**22**	**211**

Table 3. Comparison of capture and resighting areas for Western Sandpipers *Calidris mauri* during low and high tides at Estero de Punta Banda during the 1994-1995 winter.

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Autumn feeding strategy of *Wader Experts* at the Special WSG Meeting, Langebaan, Western Cape, South Africa, 12-15 August, 1998. Note the mixed age structure in this flock - juveniles, adult males and very adult males!