
Northward migration of waders wintering in Senegal in January

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Hötter, H., Bruns, H.A., & Dietrich, S. 1990. Northward migration of waders wintering in Senegal in January. *Wader Study Group Bull.* 59: 20-24.

A departure on migration of many Little Stints, Curlew Sandpipers, Dunlins, Ruffs and Black-tailed Godwits was observed in the Guembeul reserve in the delta of the River Senegal in late January 1990. Most birds departed in small flocks in the late afternoon. The Calidris species especially the Dunlin often departed in mixed flocks; Ruffs and Black-tailed Godwits usually remained in single species flocks. Departing birds usually headed in north-western direction, which would not lead them to their presumed staging sites at the Atlantic coast in Mauretania, Morocco or Iberia. The reason for the departures were the vanishing of fresh resources due to the drying out of many wetlands in the course of the dry season.

INTRODUCTION

In the course of a study of the ecology of wintering Avocets *Recurvirostra avosetta* in Senegal (Dietrich *et al.* 1990, Bruns, Dietrich & Hötter in prep.) we tried to observe the departure of individuals of this species between 7 January and 31 January 1990. This effort was completely in vain, but instead of departing Avocets we noticed many Little Stints *Calidris minuta*, Curlew Sandpipers *Calidris ferruginea*, Dunlins *Calidris alpina*, Ruffs *Philomachus pugnax*, and Black-tailed Godwits *Limosa limosa* which were obviously starting their northward migration in the end of January. Such an early start of home migration has as far as we know never before been reported for these species (see Cramp & Simmons 1983) with the exception of the Black-tailed Godwit (Beintema & Drost 1986). This paper gives some details about these early departures.

STUDY SITE

We made our observations in the Réserve Spécial de Faune de Guembeul (15°55'N, 16°28'W), about 15 kms south of St. Louis, Sénégal. In the centre of this reserve there is a c.300 ha large temporary lagoon, which is filled with surface water and the floods of the river Senegal during the rainy season (June - September) and loses its water in the course of the dry season. A new sluice stopped the outflow of water in 1990 so that in January most of the area was still covered with water.

Due to evaporation the water level sank at a rate of about 0.8 cm per day and the salinity rose from 7‰ on 7 Jan, to 14‰ on 31 Jan. By the end of January nearly all other lagoons in the lower part of the Senegal delta were already dry or even more salty than Guembeul, and the majority of waders present in the whole region concentrated in Guembeul (Table 1). In the last January days the Chironomid larvae, the main food supply for the waders in Guembeul, began to die probably due to the high concentration of salt in the water.

METHODS

On nearly every day between 7 January and 31 January we spent at least some hours at the study lagoon. After having noticed the first departures on 27 January (we are sure that few, if any birds left on

25 January; no observations took place on 26 January) we looked systematically for departing birds during the periods given in Table 2. A bird or a flock was considered to depart for migration when the following conditions were fulfilled:

- i. bird(s) departing in a more or less straight direction
- ii. bird(s) steadily gaining altitude (angle of gradient 5 - 15 degrees)
- iii. bird(s) calling (with the exception of Ruff)

When going to the nearby mangroves the birds flew low and silently over the savanna. These flights to the bathing and drinking sites could clearly be distinguished from migration departures and are not considered here. In some occasions flocks of Ruffs passed us flying quickly and lowly between the bushes, as they usually do when going to their roosts. Although we could not exclude the possibility that these birds were migrating, they also were not taken into account in the analysis here.

Departing birds were followed through binoculars to a distance of 1-2 km. The position of the observer was very close to the place where the birds actually started to fly. The departure directions were estimated with a compass. We did not see any passing birds that had started from elsewhere than the Guembeul lagoon.

RESULTS

The numbers of departing waders are given in Table 2. Besides the birds listed in Table 2 we noticed one Ringed Plover *Charadrius hiaticula* and two Marsh Sandpipers *Tringa stagnatilis* departing on 28 January. Table 1 shows that some of the species, notably Little Stint and Curlew Sandpiper concentrated in Guembeul before they



left. For both species only a small percentage of the leaving birds were actually observed departing. The same holds true for the Black-tailed Godwit. Individuals of these species either departed during those periods when no observation occurred or, more likely, at night. It is possible that there were not many departures on 29 January, when we were not in Guembeul, because it was raining nearly all day. For those species whose departure we could not

Table 1. Counts of waders in Guembeul during the time of their departure.

Date	21 Jan 1990	28 Jan 1990	31 Jan 1990
Avocet <i>Recurvirostra avosetta</i>	3,300	1,215	912
Black-winged Stilt <i>Himantopus himantopus</i>	114	55	43
Ringed Plover <i>Charadrius hiaticula</i>	121	+	18
Kentish Plover <i>Charadrius alexandrinus</i>	51	+	6
Little Stint <i>Calidris minuta</i>	2,700	7,000	2,790
Curlew Sandpiper <i>Calidris ferruginea</i>	1,080	1,500	720
Dunlin <i>Calidris alpina</i>	70	+	180
Ruff <i>Philomachus pugnax</i>	98	+	31
Black-tailed Godwit <i>Limosa limosa</i>	1,300	1,100	333

+ indicates that the species was present, but no accurate counts were made

Table 2. Observation periods and numbers of departing waders in January 1990

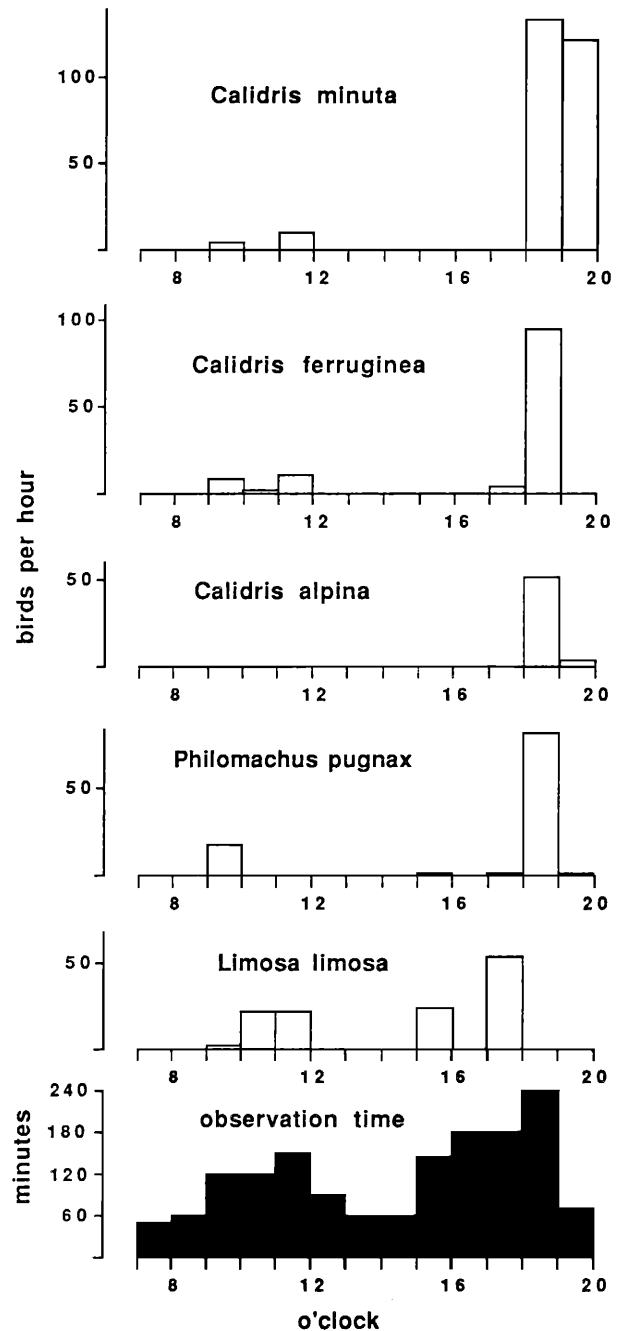
Date	observation periods (hours local time)	Little Stint	Curlew Sandpiper	Dunlin	Ruff	Black-tailed Godwit
27 Jan.	11.00-12.30	182	36	-	23	110
	15.20-19.15					
28 Jan.	7.10-19.20	-	17	-	52	-
29 Jan.	no observations (raining all day)					
30 Jan.	18.00-19.15	238	201	110	156	-
31 Jan.	9.00-11.30	292	180	98	138	214
	15.15-19.20					
Totals		712	434	208	369	324

observe, mainly Avocet and Ringed Plover, departures may also have been at night. We saw more departing Dunlins and Ruffs than we counted at one time in Guembeul in January 1990. This means that some individuals coming from different sites had just a short stop at Guembeul and continued their migration quickly.

The timing of departures is shown in Figure 1. The data, which are expressed as birds per hour to correct for variations in observation time, clearly show that most birds started their migration in the late afternoon. With the exception of Dunlin all species also showed a small peak in the late morning. Departures of Black-tailed Godwits were more evenly distributed over the daytime than those of other species.

The analysis of departure directions (Figure 2) shows that all birds, except some Black-tailed Godwits, left for northern and western directions. The mean directions (also given in Figure 2) do not lead

Figure 1. Timing of departures and daytime distribution of observation time. The heights of the columns show the numbers of waders departing in the hour given on the x-axis, divided by the time spent by us in the study site during different days.

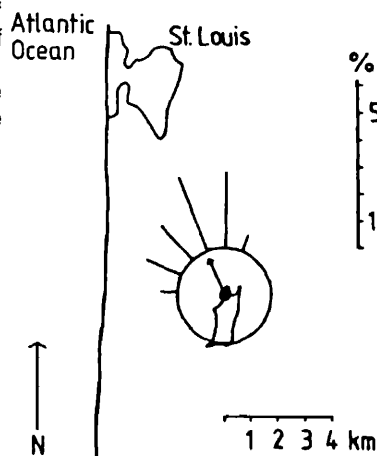


to the next possible resting sites: the Banc d'Arguin and the wetlands along the Moroccan Atlantic coast. If the birds actually followed their departure directions, most of them would end up in the Atlantic or go directly to Greenland or Canada, which they clearly do not do. Owing to the generally quite low visibility we could not follow the birds over a long distance. It is possible that the birds first fly to the shoreline and then follow it northwards. This would bring them more or less directly to the Banc d'Arguin or Morocco. Birds never circled to gain height. Most of the waders departed facing the wind.

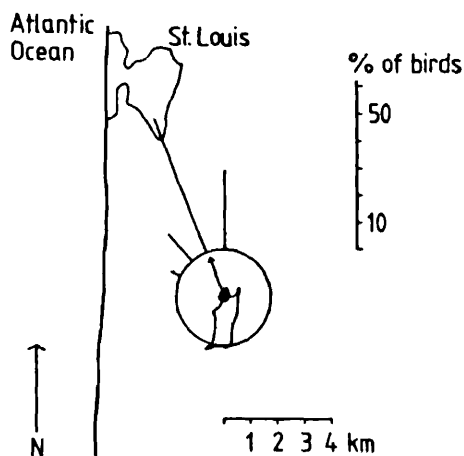


Figure 2. Departure directions of waders leaving the Guembeul reserve. The lengths of the lines on the circle show which percentage of birds left for a given direction. The direction of the small arrow in the circle shows the mean departure direction. Its length represents the concentration index r (Batschelet 1965). The radius of the circle equals to an r of 1.

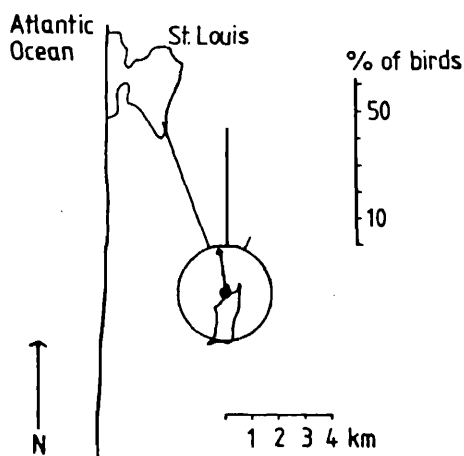
Calidris minuta



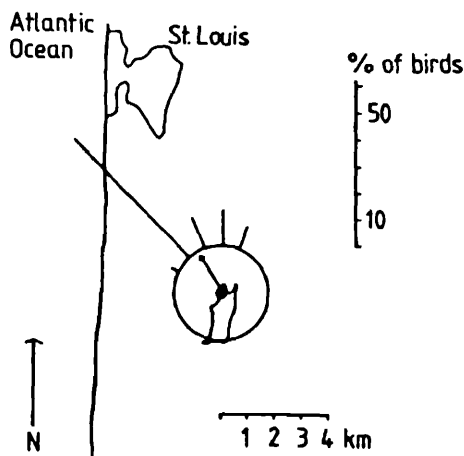
Calidris ferruginea



Calidris alpina



Philomachus pugnax



Limosa limosa

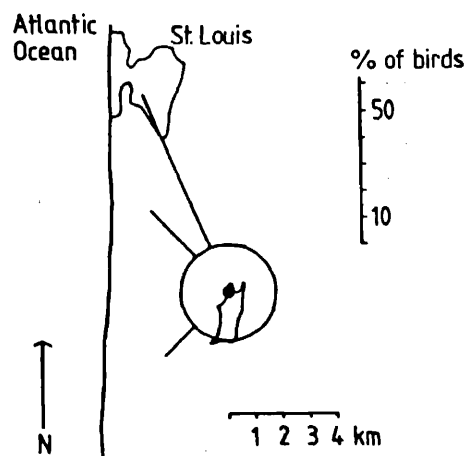


Table 3. Association of different species in departing flocks of waders.

The figures in each column show the number of birds of that species departing in mixed flocks together with the number of bird species indicated on the left. Bold figures in single-species flocks. In the lowest row the percentages of birds in mixed flocks is given.

	<i>Charadrius hiaticula</i>	<i>Calidris minuta</i>	<i>Calidris ferruginea</i>	<i>Calidris alpina</i>	<i>Philomachus pugnax</i>	<i>Limosa limosa</i>
<i>Charadrius hiaticula</i>	-	-	1	-	-	-
<i>Calidris minuta</i>	-	404	314	147	36	-
<i>Calidris ferruginea</i>	-	188	89	72	105	6
<i>Calidris alpina</i>	-	173	176	10	1	-
<i>Philomachus pugnax</i>	-	26	40	40	258	25
<i>Limosa limosa</i>	-	1	-	-	4	293
% of birds in mixed flocks	-	43%	79%	95%	30%	10%

note: that the totals of each species do not always add up to this percentage, since some birds departed in flocks of three species. These birds are therefore counted twice in the table.

Most birds departed in small flocks (Figure 3 and Table 3). There was much intra-specific and probably also inter-specific variation in flock size. Table 3 gives the ordinary mean flock sizes as well as the mean flock sizes seen from the view of the departing birds. The underlying question for this second mean is: how many birds departed in a given flock size?

The (*Calidris*) usually departed in mixed flocks of two or three species (see Table 4). Then species usually mixed with each other. Black-tailed Godwits, however, only occasionally mixed up with other species.

DISCUSSION

Published information on departures of waders on migration is quite scarce (see review of Piersma *et al.* 1990). This is especially true for



Figure 3. Flock sizes of departing waders. The black columns represent single birds. Conspecific groups in mixed flocks were counted as separate single species flocks.

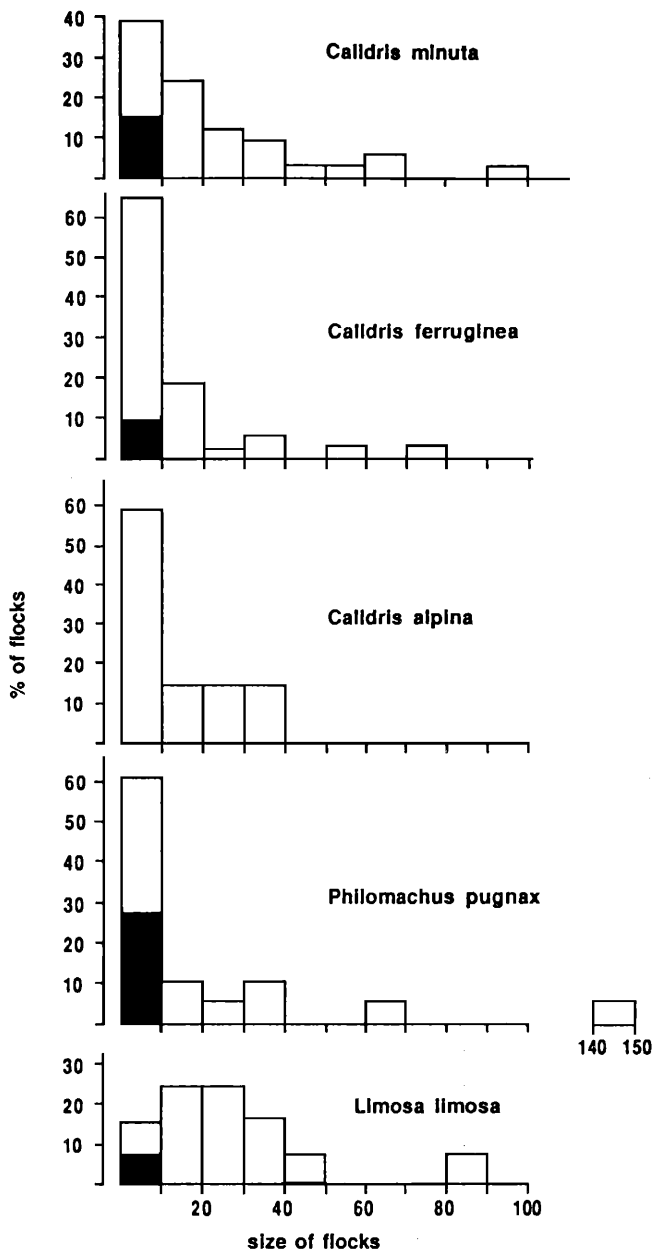


Table 4. The composition of five flocks containing three wader species.

flock no.	1	2	3	4	5
<i>Calidris minuta</i>	7	15	12	2	1
<i>Calidris ferruginea</i>	40	75	40	9	30
<i>Calidris alpina</i>	5	10	25	21	-
<i>Philomachus pugnax</i>	-	-	-	-	35
Flock size	52	100	77	32	66

the species described here. Some of the findings presented here are similar to most studies of departing waders (e.g. Meltofte 1988, Piersma *et al.* 1990): the birds were calling during departure and most of the birds left in the late afternoon. As mentioned before, however, we cannot exclude the possibility that birds also left Guembeul during the night. The reason for their generally choosing the late afternoon for departure is not clear. A simple sun orientation can be excluded, since the birds could not see the evening sun on any of their departure days. It was either cloudy or the sunset was obscured by dust storms. Like the waders departing from the nearby Banc d'Arguin in spring, the Senegalese waders started with a too westernly direction. Piersma *et al.* (1990) found that this may be compensated by south-western winds at heights more than 2 km. We could not follow the birds long enough to contribute anything new to this idea. For further discussion of the problem see Piersma *et al.* (1990).

In contrast to the findings of Piersma *et al.*, we found many mixed species flocks. The occurrence of mixed flocks might have been enhanced by the fact that three of the five species are about the same size (*Calidris*). The Dunlin, which nearly always joined flocks of other species was scarce on the site and so might have had difficulties in finding enough flock mates. Its size between the Little Stint and the Curlew Sandpiper allowed it to fly with both species. The Ruffs and the Black-tailed Godwits, which differ in size from each other and from the *Calidris* species, preferred to fly in single species flocks.

Such an early departure of waders from this region has, as far as we know, not yet been described, although it was suspected for the Black-tailed Godwit (Beintema & Drost 1986). The reason for the departure obviously was the vanishing food resources. All the lagoons in the lower part of the Senegal delta became dry by the end of January so that the waders had to concentrate in Guembeul. In Guembeul the food availability in late January was quite high because the water level sank and vast areas of mud or shallow waters became available. The increasing salinity, however, already began to reduce the viability of the Chironomid larvae so that a complete disappearance of the food must have occurred in the beginning of February.

After having left Guembeul we had a look on some of the wetlands in the southern part of the Senegal. We found suitable resting sites for waders only on the Cap Verde Peninsula. These sites were very limited in size, however (a few hundred hectares). All the "tannes" (temporary river lagoons) in the Saloum Delta which are known to be important sites for *Calidris* waders and Ruffs (we saw thousands of them in these sites in November 1988) were more or less abandoned by the waders because they were dry or too salty. The same holds true for most of the sites in the part of the Senegal Delta. The early departures of waders for this reason therefore does not seem to be a Guembeul-specific phenomenon. Probably most of the 10,000 - 20,000 Little Stints, 5,000 - 10,000 Curlew Sandpipers, 500 - 1,000 Dunlins as well as a fair proportion of the Ruffs and Black-tailed Godwits wintering in Senegal had to leave the country in late January (population estimates from Meininger 1989 and own data).

The lagoons and inundation zones in the Senegal Delta as well as the tannes in the Saloum Delta dry out each winter. The early departures of waders must therefore be a regular event. The actual timing of the drying out may vary considerably from year to year, depending on the amount of rain in the rainy season and on the river discharges. In extremely dry years (e.g. 1984, 1985) there was



hardly any water in the system. In 1990 the period in which the water remained in Guembeul was artificially prolonged by a sluice which stopped the outflow of the water. A year before the lagoon dried out about two weeks earlier (Thioune, *pers. comm.*). The waders wintering in the described habitats are an example for a migration which is introduced by exogenous factors. Any endogenous factors would fail to give the right timing. It is very probable that the proximate and the ultimate cause of the migration are the same: the shortage of food.

With the exception of the Black-tailed Godwit all species mentioned here are arctic or even high arctic breeders. The timing of spring migration, at least of that part of the migration which leads them to their breeding grounds, must involve proximate releasers (daylength) which work partly independently from the ultimate factors (food, resources and climate in the breeding grounds). The waders we observed in Senegal obviously used two different systems to release their home migration. The first part of the journey is released by vanishing resources. The second part of the trip starts at some spring resting sites. The underlying releasing process probably is endogenous and involves a Zeitgeber, as it is supposed for many long distance migrators (Berthold 1975).

The waders wintering in the temporary wetlands in Senegal are living in much less stable habitats than those wintering on the shores of West Africa, especially those wintering on the intertidal areas of the Banc d'Arguin and of Guinea Bissau. The Senegalese waders are forced to move during midwinter. They cannot be sure about the timing of their departures and there even is uncertainty that their wintering quarters will have any suitable habitats available in some years. This depends on the amount of rain in the rainy season. It is not known to where the birds go after leaving the Senegal. There is certainly little benefit in going to the generally wetter southern part of the country because the food availability there is as bad as in the North. Unfortunately we do not have counts from Mauretania, Morocco or Iberia which might show an influx of Senegalese waders in January or February. The only information available shows an increase in the numbers of Avocets in Merja Zerga in Morocco in February, but not of any other of the species concerned here (Thevenot *et al.* 1982).

ACKNOWLEDGEMENTS

We thank the Service des Parcs Nationaux du Sénégal, especially its Director S. I. Sylla, and the Conservateur of the Guembeul reserve, D. Thioune as well as the staff of the Guembeul reserve, for the permission to work in the reserve and their technical help during the project.

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