

---

*Islandica* Knots in spring and summer





# Observations on the departure of Knots from the Dutch Wadden Sea in spring

C. Swennen

Swennen, C. 1992. Observations on the departure of Knots from the Dutch Wadden Sea in spring. *Wader Study Group Bull.* 64, *Suppl.*: 87-90.

During the four spring seasons of 1964 - 1967, the northward departure of Knots *Calidris canutus islandica* was monitored on the island of Vlieland in the Dutch Wadden Sea. In the course of some days in the first half of May, large numbers of Knots assembled on the mudflats south of the island. Out of these aggregations smaller flocks (10's or 100's of birds) regularly emerged in the period of two hours before sunset. Birds in such flocks called loudly. The departing flocks kept gaining height while overflying the island in a NNW direction, presumably starting on a direct flight to the staging areas on Iceland. No correlation was apparent between weather conditions and departure. Since the Knots stopped feeding a few hours before they left, they apparently flew with empty alimentary tracts.

C. Swennen, Netherlands Institute for Sea Research (NIOZ), P.O. Box 59, 1790 AB Den Burg, Texel, The Netherlands.

## INTRODUCTION

In 1964 a number of observations were made on the departure of the Knot *Calidris canutus* leaving the Wadden Sea at the island of Vlieland. It was soon realized that these observations were of interest because all birds left within a few hours at the end of the daylight period and, also, because the departures were within a narrow range of directions. The observations were therefore continued for four seasons. This contribution is a revision of an old manuscript which had disappeared in large piles of paperwork in the 1960s. Since the original observations do not seem to have lost their interest in suggesting a direct link between spring staging sites of Knots, and in adding to the available descriptive framework on wader migration ecology (see Lank 1989; Alerstam *et al.* 1990; Piersma *et al.* 1990), the old paper was revised to be included in these proceedings.

## STUDY AREA AND METHODS

The observations were made from a high dune ridge in the middle of the island of Vlieland in the Dutch Wadden Sea (53°16'N, 04°58'E), from where a fine view may be obtained over the saltings and the neighbouring mudflats along the southern shore of

the island. Observations were made with a Hensoldt telescope (dialyt 40 x 60), which allowed us to follow flocks of Knots departing from the mudflats for between 6-20 min, corresponding to flight distances of approximately 5-25 km. The direction of disappearance of the birds could be determined precisely with the help of the telescope-backsight and a compass. Each day, we made observations from a point on the dune ridge as close as possible to the concentrations of Knots on the mudflats. This procedure ensured that the departing flocks disappeared almost overhead, so that no correction for parallax effects was needed.

## RESULTS

### Timing of departure

The feeding rhythm of the Knots near Vlieland was, as usual, largely determined by the tides. During low water the birds spread out over the extensive mudflat feeding areas south of the island. During high water they stayed some 4-5 hours at certain well defined roosts, where thousands congregated on very small areas. Here they were often roosted together with Bar-tailed Godwits *Limosa lapponica* and Dunlins *Calidris alpina*. Since the time of high water shifted with about 40 minutes per day, the birds fed and rested at a later hour each day. On



Table 1. Summary of the timing of departures of Knot flocks from Vlieland. Note that: 1) sunset was between 20.05 and 20.20 h, and 2) the migratory departures are always directed towards the NNW. Wind force is Beaufort scale.

Year	Day	Time of dept.	Time of high water	Wind dir.	Wind force
1964	5 May	18.00-19.30	14.08	WSW	4
1964	6 May	18.08-19.45	15.21	SSW	4
1964	7 May	18.05-19.20	16.54	SSW	4
1965	6 May	18.26-19.50	11.49	W	4
1965	10 May	18.13-20.14	16.40	NW	7, later 5
1966	2 May	18.07-18.33	19.30	S	2
1966	6 May	17.05-19.47	22.25	SW	6
1966	7 May	18.12-19.38	23.08	NNW	5, later 4
1966	8 May	17.48-19.30 20.43 21.43	23.38	S	4
1967	6 May	19.17-20.15	19.27	SE	1
1967	8 May	18.11-19.59	20.39	SW	3
1967	9 May	18.50-20.15	21.12	E	1
1967	10 May	18.44-19.42	21.44	ENE	4

the days of departure, however, this rhythm of rest and feeding was abandoned in the course of the afternoon. A large group of Knots then remained stationary on the high tide roost, although others might leave the dense flock to recommence feeding. If the tide was already low in the afternoon, the birds would assemble on the high tidal flats that were the first to dry out. In such cases the Knot-flocks were not associated with flocks of other wader species. Birds in such flocks did not feed. Every now and again, the volume of the calls produced by the flock increased strongly.

After a few hours, groups of 10's or 100's of Knots separated themselves from the total group, flew off and climbed within a short time to heights of 100 m and more. Such departures were accompanied by increased calling by the departing birds, and probably also by those remaining behind on the flats. The departure flights differed in a striking way from the normal flights to feeding grounds, which generally occurred at a lower altitude and with few, if any, calls. Departures of Knots were only observed in the first ten days of May (Table 1).

In all cases the time of departure was from about two hours before sunset to sunset itself. On 8 and 9

May 1967, the times of departure and the sizes of all departing flocks were noted (Table 2), while Table 1 summarizes the remaining information on the diurnal timing of migration. Departures were never seen at other times of the day, although we paid special attention to this possibility. We are unable to say whether birds also left after nightfall, although it seems improbable because we never heard the calls of departing flocks at night from our nearby lodging-house.

#### Flight behaviour of the departing birds

Departures took place as 'eruptions'. Birds ascended rather steeply for at least 100 m. Early on during the departure period on a particular day quite a few of the birds that flew up first returned to the ground, but gradually the proportion doing so decreased. During and after climbing they gradually found their definitive direction of migration. At the same time they started flying besides each other so that a broad front was obtained (an 'echelon'; see Piersma *et al.* 1990: Figure 5 for terminology). Even during the formation of these echelons, individual birds might return to the ground.

The birds at both ends of the departing echelon-type flocks, especially initially, showed strong tendencies to fly away from the general direction of the group. In this way the echelon grew more extended, and now and then birds were seen at the left and right ends that loosened themselves from the rest. The inclination to remain together appeared much stronger, however, than the inclination to fly individual courses. Often, the heading of the whole flock

Table 2. Times of departure and number of Knots per flock observed on two successive departure days in 1967. Sunset was at 20.16 h.

8 May 1967		9 May 1967	
Time	Flock size	Time	Flock size
18.10	50	18.50	40
18.30	70	18.57	400
18.45	40	19.09	200
19.12	200	19.27	30
19.35	120	19.28	150
19.46	200	19.30	40
19.50	80	20.15	15
19.55	200		
19.56	100		
19.57	30		
19.58	250		
19.59	200		



was changed somewhat, whereas the birds at the ends might concede to the others, so that the front remained closed. Since at the beginning of the flight this happened regularly, the course of departing flocks would zigzag to some degree. After some time such course changes were less striking.

#### Direction of migration and weather conditions

The measured departure directions of the flocks are presented in Table 3. All directions fall between 320° and 357°, with 338° as the average. This would mean that the general direction of departure is NNW. Since there was no apparent relationship between wind direction and departure (track) direction, I suggest that the birds compensated for wind drift.

Wind force and direction varied a lot between departure days, and so did the degree of cloud cover. On 2 May 1966 the sky was clear, on 6 and 10 May 1965 it was completely covered, and on the remaining days the sky was partially cloud covered. On two days we witnessed attempts to depart when the weather seemed quite unfavourable. On 10 May 1965 Knots tried to leave when they faced a headwind of 50-60 km/h. They hardly made progress when they reached higher levels. Many birds returned to the mudflats, but repeatedly the birds formed echelons that tried to stand the opposing wind. It remains uncertain whether all departing birds eventually returned on that evening, since low clouds rapidly obscured the birds. After sunset the wind calmed down.

On 7 May 1966 the headwind faced by departing birds was initially 30-40 km/h, and later on was 20-30 km/h. The flocks advanced only slowly and now and then disappeared in the clouds. Between 18.00 and 19.15 hour many flocks returned to the ground. When the wind force decreased, departing birds no longer returned.

It was observed that individual birds lagging behind a flying flock could speed up to overcome the others in a very short time. This suggests that Knots in an echelon fly more slowly than the speeds of which they are capable.

#### Plumage of the departing Knots

All Knots which took part in departures were in full summer plumage. Only once, on 8 May 1967, did we see one bird (in a flock of about 200), which was in the light-coloured winter plumage. We had the impression that among the birds in foraging

Table 3. Bearings of the points of disappearance of Knots departing from Vlieland. Each value represents the bearing of one flock, taken 8-20 minutes after it had passed the observer.

Date	Wind	Direction of disappearance dir.
2 May 1966	S	338°, 341°, 340°
6 May 1966	SW	332°, 334°, 344°, 349°, 357°
7 May 1966	NNW	320°, 331°, 335°
8 May 1967	SW	336°, 339°
9 May 1967	E	326°, 347°

flocks on the mudflats, two-thirds were in summer dress. The relative contribution of summer-plumaged birds changed quickly in the course of early May: as the number of Knots near Vlieland decreased towards the middle of May, the percentage of birds in winter plumage increased.

#### DISCUSSION

If the Knots departing from Vlieland continued to fly on their average departure direction of 338°, they would first reach Iceland, and then the east coast of Greenland after flights of 2,000 - 2,500 km. An arrival on arctic breeding grounds as early as 8-12 May (i.e. a month before egg-laying) is highly unlikely in the light of the recent accumulated information (see Davidson & Wilson 1992; Davidson & Morrison 1992). Since the seasonal timing of departure from Vlieland nicely fits in with the timing of Knot-arrivals on Iceland (Gudmundsson & Alerstam 1992), the Knots from Vlieland are most likely to have departed for the Icelandic staging areas, and are therefore probably of the *islandica* subspecies. My observations complement those of Piersma *et al.* (1991), who observed Knots to leave for the northwest (Iceland) from the Wadden Sea in Schleswig-Holstein, Germany, on 8 and 9 May 1990.

Finally I can comment on three aspects of the departure behaviour of these Knots. Experiments and field observations on the defaecation by waders feeding on Dutch intertidal flats, show that the digestion of food is finished 1-2 hours after the birds stop feeding. Since the Knots stop feeding some 1-5 hours before departure, it seems that they begin their flight with an empty alimentary canal, thus saving on the costs of initially carrying the considerable weight of water and shell material of their mollusc prey. Knots departed in all phases of the tidal cycle (Table



1). The fact that they did not feed before departure and then timings of their departures contrast with the observations of Lank (1989), who found that waders in the Bay of Fundy departed during rising tide and probably kept on feeding until the moment of take off.

The behaviour of individuals in departing flocks when they are in the process of forming an echelon, is also interesting. The zigzagging during the first part of their course may result from a compromise between the track directions of different birds. Since the Knots fly in a long line beside each other, all individual differences are discounted in this compromise. One may assume that each individual makes a small error in determining its course. Following an average course may provide one of the great advantages of migrating in flocks. Hamilton (1967) came to the same conclusion.

The observations on weather conditions in relation to departures indicate that the direction and force of the wind are apparently of little influence on the willingness of the Knots to leave Vlieland for Iceland. As humans we are always impressed by the weather conditions in our immediate neighbourhood. These birds have to travel very long distances, however, and it is certain that the weather at one end of the journey may differ much from that at the other end. Moreover, they have to arrive on the breeding grounds at a very definite time in spring, when life bursts from ice and snow at once. The breeding season available to them is very short. One can imagine that under such conditions it is better not to allow delay through 'bad' local weather.

## ACKNOWLEDGEMENTS

I have to thank my respective collaborators in the different years, E. Meelis, B. Schrieken and A.L. Spaans, for much help during the investigations. I thank Theunis Piersma for pursuing me to find the old, and for editing it into a new, manuscript.

## REFERENCES

- Alerstam, T., Gudmundsson, G.A., Jönsson, P.E., Karlsson, J. & Lindström, Å. 1990. Orientation, migration routes and flight behaviour of Knots, Turnstones and Brant Geese departing from Iceland in spring. *Arctic* 43: 201-214.
- Davidson, N.C. & Wilson, J.R. 1992. The migration system of European-wintering Knots *Calidris canutus islandica*. *Wader Study Group Bull.* 64, *Suppl.*: 39-51.
- Davidson, N.C. & Morrison, R.I.G. 1992. Time-budgets of pre-breeding Knots on Ellesmere Island, Canada. *Wader Study Group Bull.* 64, *Suppl.*: 137-143.
- Gudmundsson, G.A. & Alerstam, T. 1992. Spring staging of Nearctic Knot in Iceland. *Wader Study Group Bull.* 64, *Suppl.*: 110-113.
- Hamilton, W.D. 1967. Social aspects of bird orientation mechanisms. Pp. 57-71 in: Storm, R.M. (ed.), *Animal orientation and navigation*. Oregon State University, Corvallis.
- Lank, D.B. 1989. Why fly by night? Inferences from tidally-induced migratory departures of sandpipers. *J. Field Ornithol.* 60: 154-161.
- Piersma, T., Zwarts, L. & Bruggemann, J.H. 1990. Behavioural aspects of the departure of waders before long-distance flights: flocking, vocalizations, flight paths and diurnal timing. *Ardea* 78: 157-184.
- Piersma, T., Tulp, I., Verkuil, Y., Wiersma, P., Gudmundsson, G.A. & Lindström, Å. 1991. Arctic sounds on temperate shores: the occurrence of song and ground display in Knots *Calidris canutus* at spring staging sites. *Ornis Scand.* 22: 404-407.