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**Autumn and winter in Europe and Africa**



# Occurrence of the Knot *Calidris canutus* in Denmark, with special reference to the Danish Wadden Sea

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This paper describes the seasonal changes in abundance and distribution of Knots in Denmark. In the Danish Wadden Sea, Knots occur in largest numbers (up to 48,000) in spring, when they roost on the few isolated sandy islets in the area. Outside the Wadden Sea, Knots occur at scattered sites all over northern and eastern Denmark, but in much smaller numbers (up to 2,000 birds at a site). In eastern Denmark largest numbers occur during passage in late May and early June. It is argued that both the *islandica* subspecies (in autumn, early winter and early spring) and the *canutus* subspecies (in early autumn and late spring) use Danish wetlands as staging grounds.

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## INTRODUCTION

During their migratory and wintering periods Knots *Calidris canutus* occur in scattered and in relatively small numbers in Denmark, except in the Wadden Sea, where they occur yearly and in large numbers (Meltofte 1980, 1981, in prep.; Laursen & Frikke in prep.).

Further north in Europe, only a few sites in northern Norway and Iceland are known to hold large numbers of Knots for a short time during the spring migration (Håland & Kålås 1980; Davidson *et al.* 1986; Strann 1990) and the autumn migration (Iceland only, see e.g. Davidson & Wilson 1992).

Especially in spring, Knots are found in large concentrations in the German/Danish Wadden Sea, where they moult and improve their physical condition before initiating the flight to the high arctic breeding grounds (Dick *et al.* 1987; Prokosch 1988). Recent studies have shown that sites in the southern parts of the Danish Wadden Sea are by far the most important for staging Knots in Denmark (Meltofte 1980; Laursen & Frikke in prep.).

The aim of this paper is to describe the occurrence and migration pattern of Knots in Denmark, largely based on data collected alongside a study of water-

fowl ecology in the Danish Wadden Sea, but also on existing data on its occurrence in Denmark outside the Wadden Sea.

## MATERIAL AND METHODS

Data were collected in the Danish Wadden Sea in the years 1980 - 1990. Information from other studies are used to describe the migration patterns of the Knot and its occurrence in both western and eastern Denmark.

### The Danish Wadden Sea

The Danish Wadden Sea covers approximately 850 km<sup>2</sup>. The extent of different habitats is described by Laursen & Frikke (1984).

The first organized wader counts were performed in the early 1970s. In 1978 monthly counts from both land and aircraft were conducted (Meltofte 1980). Data on the occurrence of the Knot in the Danish Wadden Sea presented in this paper were mainly obtained during monthly counts from airplane at high tide in the period 1980 - 1990. The methods will be given by Laursen & Frikke (in prep.). Data on Knot occurrence and migration from monitoring programmes carried out at Højer and Langli are also included (Gram 1985; Jakobsen & Hansen 1987).

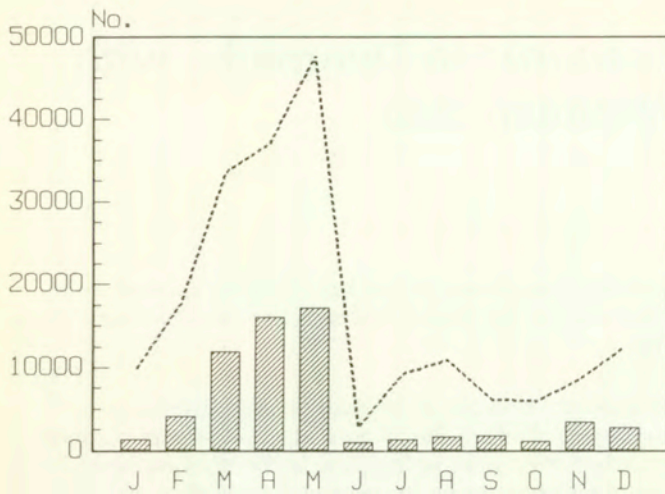


Figure 1. Phenology of Knots in the Danish Wadden Sea 1980-90. Mean numbers per month (hatched bars) and maximum number per month (dotted line) are based on 126 aerial surveys.

#### Localities outside the Danish Wadden Sea

Salomonsen (1972) and Dybbro (1978) gave general information on the occurrence of the Knot in Denmark, and Meltofte (1981) contributed detailed information obtained through a national wader census from 1974 - 1978. Additional data on occurrence and migration were available from the following localities: northern Jylland (Møller 1978); Bornholm (Génsbøl 1973); Sjælland (yearly reports from 1980 to 1987) (e.g. Dissing 1984); and Tipperne (based on counts from 1928 - 1982, Meltofte 1987).

At Blåvandshuk, the westernmost point of Denmark, monitoring of spring and autumn migrating waders was carried out in the period 1963 - 1977 (Meltofte & Lyngs 1981; Meltofte *et al.* 1972).

## RESULTS

#### The Danish Wadden Sea

The Knot occurs all year round, with peak numbers in spring. The monthly maximum varies from about 3,000 birds (June) to 48,000 birds (May) (Figure 1).

After a short period during summer with low numbers present, the number of Knots increases during autumn and culminates in November. In December the numbers level off and a winter minimum is reached in January, after which an increase throughout February - March leads to a spring culmination in May (Figure 1).

A more detailed description of the spring migration (Figure 2) shows that the numbers increase during

March, leading to a peak in the first 10-day period of April. Numbers decrease throughout April and peak again within the first two 10-day periods of May.

During spring the Knots concentrate at high-sands (low lying, pretty barren, sandy islands), with highest numbers at the islets of Jordsand (SE of Rømø), Koresand (SW of Mandø) and Langjord (SW of Fanø) (Figure 3). The most regular occurrence is found at Jordsand, holding up to 45,000 roosting birds at high tide. Aerial surveys in the nearby parts of the German Wadden Sea indicate that exchanges between roosting sites in the border area take place.

During autumn few birds occur in the Danish Wadden Sea, and they primarily roost on the sandy beaches of Fanø, Mandø and Rømø.

In the first ten days of June, the maximum number of Knots counted in the aerial surveys was 3,000 (3 June 1986). However, ground observations of large concentrations of Knots in mid June indicate that in some years, a late spring migration occurs through the southern parts of the Danish Wadden Sea. Gram (1985) reported up to 5,000 roosting Knots at Højer in late June and, during the evening of 16 June 1984, approximately 10,000 Knots left the area towards east (own unpubl. data). In the saltwater lagoon at Højer, large concentrations of Knots were observed on several occasions, e.g. in 1988 when 2,500 - 15,000 birds were recorded in the period 26 May - 24 June (Bladt 1989).

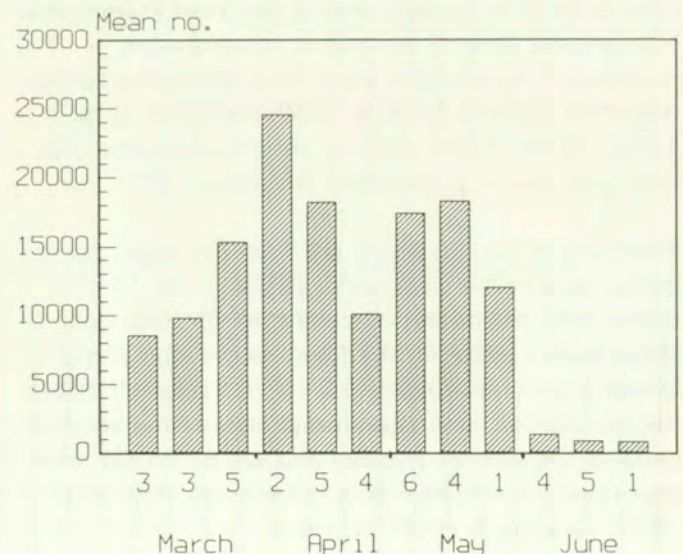


Figure 2. Spring numbers of Knots in the Danish Wadden Sea in 1980-90. Mean number for all years given per 10-day period from 1 March to 1 July (number of aerial surveys per 10-day period is indicated, total  $n = 43$ ).

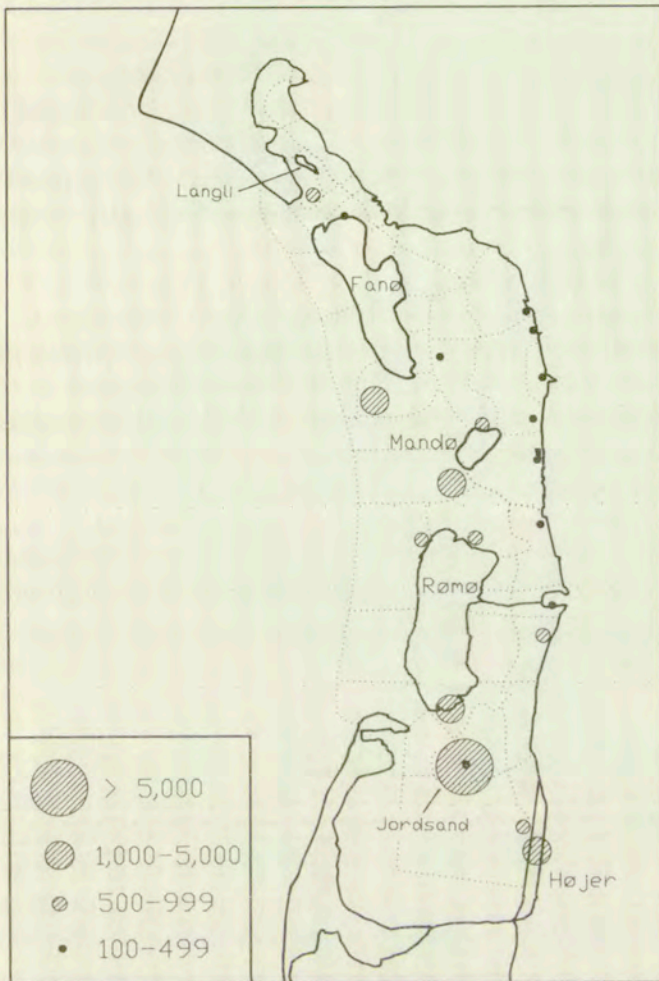


Figure 3. Spring numbers and distribution of Knots in the Danish Wadden Sea in 1980-89. Mean numbers per spring survey per sub-area are shown.

On Langli, in the northernmost part of the Danish Wadden Sea, the occurrence of the Knot differed from the general phenology indicated in Figure 1. Here the autumn numbers were higher than in spring, with peaks in mid September (up to 2,500 birds) and early May (up to 300 birds) (Jakobsen 1987; Jakobsen & Rasmussen 1989).

#### Localities outside the Danish Wadden Sea

During migration the Knot occurs in localities outside the Wadden Sea in small numbers (Figure 4). In early autumn the most important staging areas, with up to 1,600 Knots, occur in Horsens Fjord, Mariager Fjord, the western Limfjord and Nissum Fjord (Figure 5) (Meltofte 1981). At these sites Knots may be found in all months, although very few are observed from December to May (Figure 6). In nationwide spring counts up to 500 staging Knots have been counted per locality (Meltofte 1981 and in prep.).

The phenology in western and eastern Denmark (Figure 5) differs, indicating that the Knot migrates through western Denmark earlier in spring and later in autumn than in eastern Denmark (Figure 6).

In northwestern Denmark the spring migration peaks in the middle of May (Møller 1978). Autumn migration culminates in August and is dominated by adult birds at the beginning of the month, and by juvenile birds from the end of August onwards. Staging Knots occur until October and November (Møller 1978).

At Tipperne in western Denmark, the numbers of staging Knots are low in spring (max. 200) compared to autumn (max. 7,300). In autumn numbers peak in late July and late August, representing passage of adult and juvenile birds, respectively (Meltofte in prep.).

Visual observations of migrating Knots are made at few localities. At Tipperne flocks of Knots migrating southwestwards are observed occasionally in August. A maximum number of 1,000 was recorded on 22 August 1978 (Meltofte 1987). Migrating Knots are regularly observed at Blåvandshuk in the western and in Sjælland in the eastern part of Denmark.

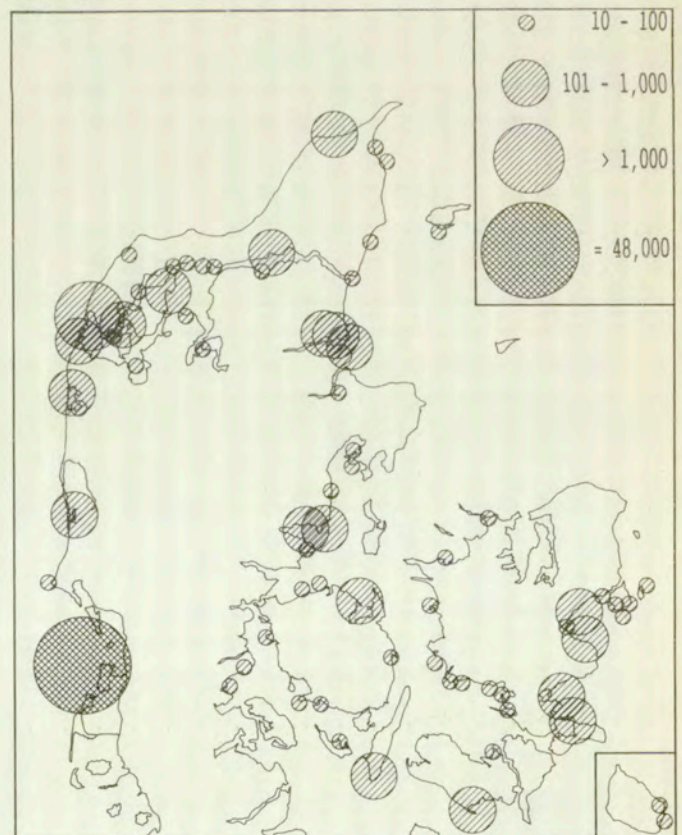


Figure 4. Maximum numbers of roosting Knots at Danish wader sites censused in the years 1974-78 (based on Meltofte 1981).

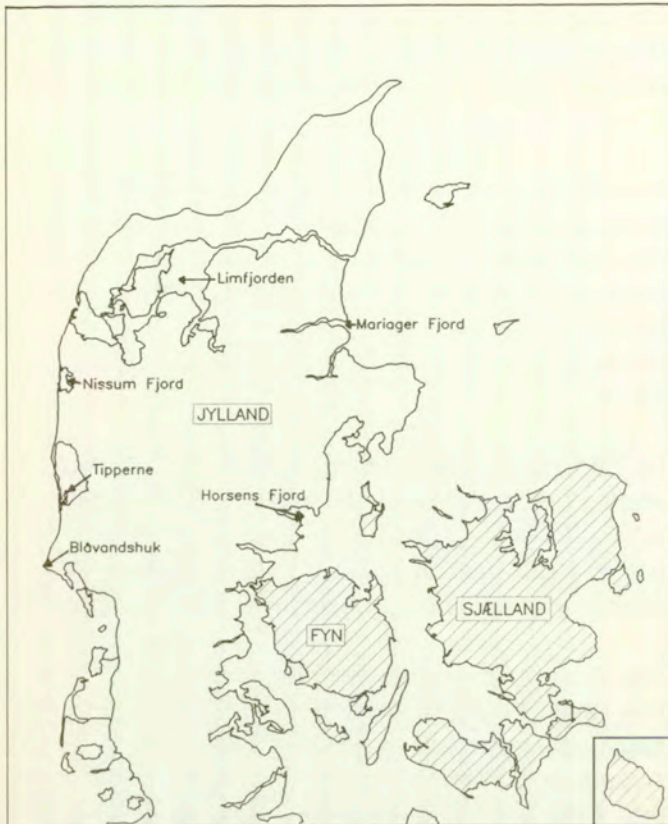


Figure 5. The division of Denmark into a western and an eastern part (hatched area), and the most important localities outside the Wadden Sea.

At Blåvandshuk, Knots are observed in small numbers during spring, with most birds (2.7 birds per hour) passing in the middle of May (Meltofte & Lyngs 1981). The autumn migration is much larger and more regular. It lasts from the middle of July to September, with mean peak numbers of almost 50 birds per hour around 1 August (Meltofte *et al.* 1972). In contrast to this general pattern, a total of 26,080 Knots were observed heading north west over the North Sea between 8 and 14 May 1973. The birds passed late in the afternoon in large flocks at high altitudes (Meltofte & Lyngs 1981).

In Sjælland, visibly migrating Knots are only observed on a few occasions in spring. In total, 13 flocks with more than 100 migrating Knots were observed between 25 May and 13 June in the years 1976 - 1987. Up to 3,000 birds were recorded migrating towards the east and the north east (11 June 1983) (Dissing 1984).

**DISCUSSION**

The occurrence and migration patterns of the Knot in Denmark as described above indicate two main

passages, which reflects that two subspecies migrate through Denmark in both spring and autumn: the population breeding in Siberia and wintering in western and southern Africa, *Calidris c. canutus*, and the Nearctic population breeding in Canada and Greenland and wintering in western Europe, *C. c. islandica*. Several earlier studies suggest and support this conclusion (e.g. Meltofte & Rabøl 1977).

In eastern Denmark the Knot mainly occurs and migrates in late spring, peaking in June when thousands of Knots fly eastwards. The spring pattern matches the main passage of Knots in southern Sweden (Blomqvist & Lindström 1992). Autumn passage peaks early in the season (July/August) and is completed before the end of September (Figure 6). The early autumn passage in eastern Denmark, where numbers of both adult and juvenile birds peak before the end of September, indicates a passage of Knots originating from the Afro-Siberian population (Piersma *et al.* 1992).

Migration and numbers of staging birds in western Denmark (excl. the Wadden Sea) coincide with the passage of Nearctic Knots through western Europe (Cramp & Simmons 1983). In spring, numbers peak in May, the month in which the departures end. This coincides with increasing numbers of staging Knots being observed in northern Norway (Strann 1990) and Iceland (Morrison & Wilson 1992). In autumn, numbers peak almost one month later than in eastern Denmark, and passage of both adult and juvenile birds lasts about four months (July - November),

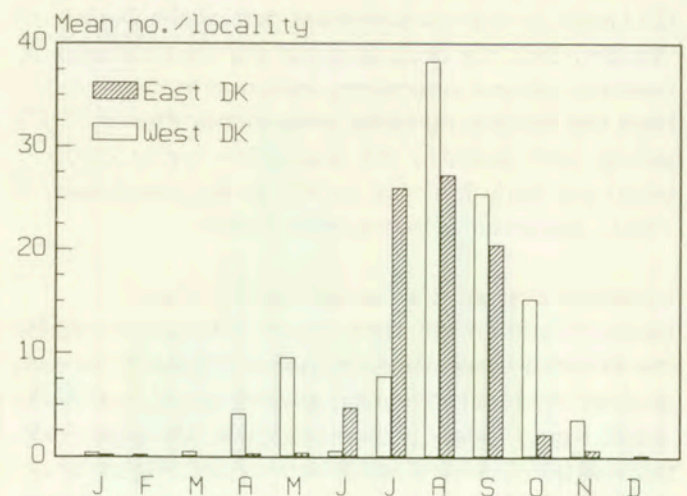


Figure 6. Phenology of Knot in western Denmark (excluding the Wadden Sea) (open bars) and in eastern Denmark (hatched bars) 1974-78 (compare Figure 5). Mean number per month per locality is indicated (east includes 44 localities; west includes 62 localities; based on Meltofte 1981).

with high numbers recorded as late as October. This indicates that these Knots may belong to the Nearctic population that winters in western Europe.

The fact that approximately 60% (mid August) of adult Knots moult while staging at Tipperne in western Denmark during early autumn (Meltofte 1987) also indicates that mainly Nearctic Knots pass through western Denmark during the autumn migration (cf. Davidson & Wilson 1992).

In contrast to this, *canutus* Knots pass western Europe quite early in autumn (arriving in West Africa in mid August, see Piersma *et al.* 1992), and start moulting after their arrival in winter quarters. However, several studies conclude that both subspecies migrate through western Denmark in autumn (e.g. Meltofte & Rabøl 1977; Meltofte in prep.), and it seems that there is no distinct separation between the two populations which may be influenced, for example, by actual weather conditions.

The total Knot population staging in Europe is estimated at about 850,000 individuals (Prokosch 1988); the Nearctic breeding population amounts to 450,000 birds and the Afro-siberian population to 400,000 birds. Both populations stage in large numbers in the Schleswig-Holstein Wadden Sea, especially in spring (Prokosch 1988). The Knots staging in the Danish Wadden Sea and western Denmark in general belong mainly to the Nearctic population, while it seems that the Afro-Siberian Knots mostly overfly Denmark to and from the staging areas in Schleswig-Holstein, only roosting occasionally and in small numbers in Denmark.

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