Spring staging of Nearctic Knot in Iceland

Gudmundur A. Gudmundsson & Thomas Alerstam

Gudmundsson, G.A. & Alerstam, T. 1992. Spring staging of Nearctic Knot in Iceland. *Wader Study Group Bull.* 64, *Suppl.*: 110-113.

This is a progress report on Knot studies carried out in west Iceland in the springs of 1986 - 1988. Most Knots arrive in the first week of May and leave in the last. Their median spring staging time is 21 days. The available evidence suggests that Knots are site-faithful in spring, and that there is little turnover. Ringing recoveries show that spring staging Knots have wintered in western Europe and breed in northwest Greenland and northeast Canada. Visual and radar observations indicate that they reach the breeding areas by a high-altitude flight in the rhumbline sector 290-310° over the Greenland icecap. During their Icelandic stopover, Knots gain mass with an average of 3.1 g/day. Their diet consists of small mussels *Mytilus edulis* and periwinkles *Littorina* spp.. Foraging activity appears similar during day and night.

G.A. Gudmundsson & T. Alerstam, Department of Ecology, Animal Ecology, University of Lund, Ecology Building, S-223 62 Lund, Sweden.

INTRODUCTION

A prominent feature in arctic bird migration are long flights (2,000 - 4,000 km) directly to breeding grounds from distant spring staging sites. Major staging sites serve as entrance gates for migratory birds to the high arctic breeding region, and may be of crucial importance for the evolution of circumpolar migration systems.

Iceland constitutes such a major staging site for several populations of high arctic waders and geese. We have carried out studies in west Iceland since 1986 with special emphasis on the Nearctic subspecies of Knot *Calidris canutus islandica*. Our primary aims are:

1) to fill in gaps in our knowledge of migration patterns of different populations and species;
2) to throw light on selective factors governing the evolution of arctic migration systems: flight distances, orientation, time, energy and competition.

STUDY SITES

Our study has been carried out on the west coast of Iceland (Figure 1), where most of the Knots are staging (Gudmundsson & Gardarsson 1992). The reason for the uneven distribution of Knots can be sought in the division of favourable habitat between parts of the country. Out of an estimated 400 km² of coastal habitats suitable for Knots (mudflats, rocky shores with extensive seaweed areas), more than 85% is on the west coast (Ingolfsson 1975). This is due to topographical reasons and also to much a greater tidal amplitude (4 m) than at other parts of the coast.

Arrival of migrating birds was studied in late April and early May 1987 and 1988 on the south coast, mainly at Stokkseyri (63°50'N, 21°04'W).

Departure observations in late May have been carried out on various places on the west coast, from Gardskagi (64°05'N, 22°42'W) 1989, Malarrif (64°44'N, 23°48'W) 1986, Latrabjarg (65°30'N, 24°32'W) 1986 and 1988, and Vatnsfjördur (65°35'N, 23°10'W) 1986, 1987 and 1988.

Staging ecology of Knots has been studied both in southwest Iceland, near Reykjavik, and in northwest Iceland at Vatnsfjördur.

TIMING OF ARRIVAL AND DEPARTURE

Observations of arriving migrants were only made in late April and early May 1987 and 1988, thus the main arrivals of Knots were missed in 1986. The earliest arriving flock was seen on 22 April 1987. A

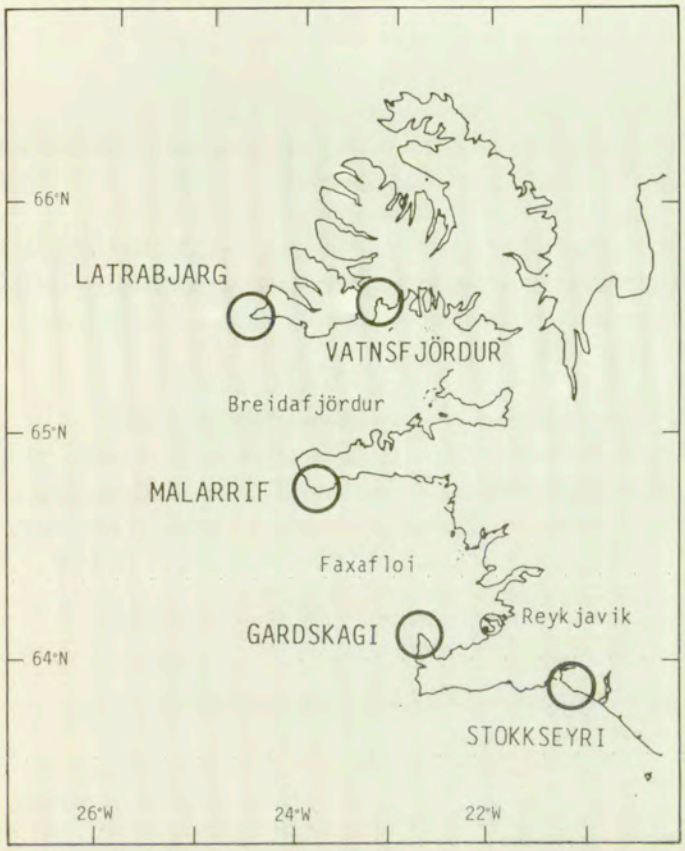

Figure 1. Location of study sites on the west coast of Iceland.

total of 35 Knot flocks (1,124 ind.) were seen arriving, whereof five flocks were mixed with other species (Turnstone, Dunlin). Knots have been counted regularly for several years on a mudflat in Kopavogur in southwest Iceland, where up to 3,100 birds are found during peaks. Earliest arrivals are 14-16 April, and a peak usually occurs between 4 and 12 May. Another smaller peak has been observed later in May, usually a fortnight after the first one (Gardarsson & Nielsen 1989).

During three spring seasons, 1986 - 1988, 303 flocks (31,200 individuals) of migrating Knots and Turnstones *Arenaria interpres*, and 77 flocks (3,200 individuals) of Brent Geese *Branta bernicla hrota* have been observed departing from west Iceland towards Nearctic breeding grounds (Alerstam *et al.* 1990).

All three species mainly departed between 25 May and 1 June in all three years. The peak of Knot departure was between 27 and 29 May. Figure 2 shows the seasonal timing of wader departures from Iceland in late May 1986 - 1988. All flocks of Knots, Turnstones and unidentified waders (Knots 90% of identified) are pooled within a year. In 1986 there were two peaks of departure, 27 and 30 May, due to poor weather with rain and strong winds on the intervening days. Both in 1987 and 1988 there was a single peak of departure, 28 and 29 May respectively, as weather was stable and favourable throughout the period.

Waders generally departed in the afternoon and evening, during rising tide. Significant differences in daily timing between seasons were associated with between-year differences in the tidal cycle (Alerstam *et al.* 1990).

DURATION OF STAY AND TURNOVER

A fairly good picture demonstrating the average staging time can be compiled from available data (Figure 3). The figure is based on data from two surveys on the west coast in May 1987 (cf. below), regular counts in Vatnsfjördur 1988 and observed departure during three seasons. Median spring staging time for Knots in Iceland is 21 days (between the points where 50% of the maximum have arrived and departed).

Turnover has not been measured directly. Controls of ringed birds indicate high site faithfulness. A

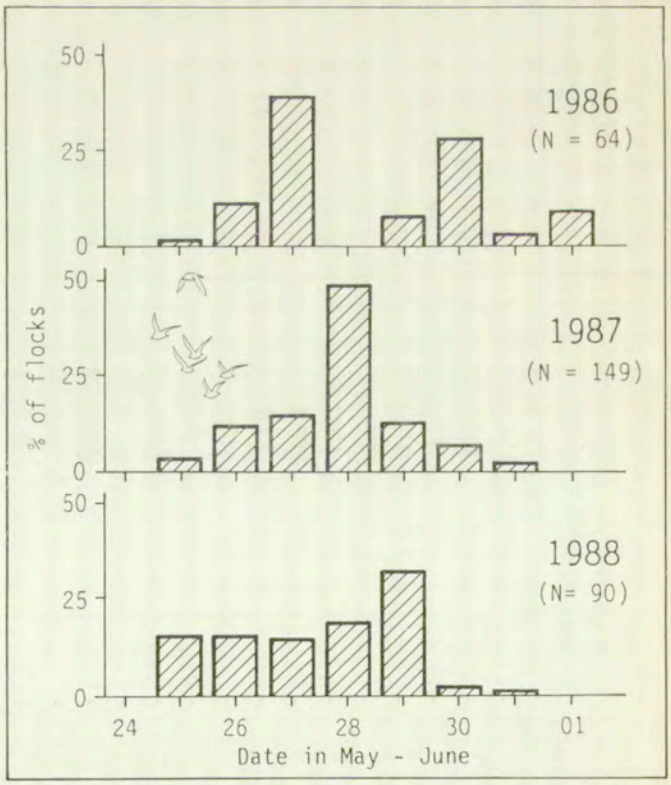

Figure 2. Timing of departure of waders from west Iceland in late May in three different years. The percentage of the seasonal total of flocks (N) is shown for each day. Knots represented 90% of identified individuals.

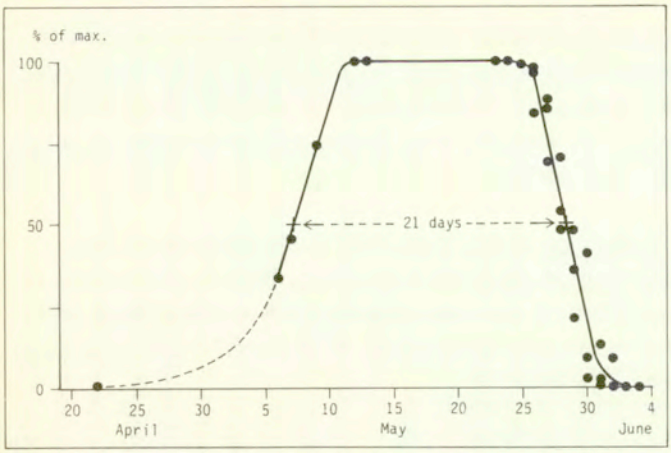

Figure 3. Duration of spring staging of Knots in west Iceland 1987 and 1988, from first arrival to last departure observed. Data is shown as percentage of maximum number in certain areas.

repeated survey of 76 sites on the west coast, in early and late May 1987, demonstrated no tendency for the Knots to arrive earlier at southern as compared to northern parts of the Icelandic west coast. These circumstantial evidence suggests site fidelity with respect to staging locality.

ORIGINS AND DESTINATION

The winter range of Knots staging in Iceland is clear from ringing results. There are *c.* 150 recoveries abroad of Knots ringed in Iceland, and *c.* 220 foreign ringed Knots have been recovered in Iceland. This population winters on the west coast of Europe, between Denmark and Portugal, mainly in Britain. Breeding origins are indicated by 10 summer recoveries from northwest Greenland and northern Canada.

Departing flocks were tracked by telescope equipped with azimuth and elevation scales, and departure directions were determined. Orientation data for more than 100 Knot flocks, 20 Turnstone flocks and 33 Brent Goose flocks were collected. Mean orientation was close to 300° (geographical direction) in all three species, with angular deviation 21-26°. It is concluded that the overwhelming majority of the individuals of all three species are bound for breeding sites in northern Canada and northwest Greenland (Alerstam *et al.* 1990).

A surveillance radar (S-band, 60 NM range) located at Keflavik airport, southwest Iceland, has been used to record bird migration in May 1988, 1989 and 1990, and July 1987, 1988 and 1990. An automatic camera mounted on the radar screen (PPI) was used to obtain continuous time-lapse registration 24 hrs a day. Preliminary analysis of films from late May 1988 shows a good correspondence to field observations, with respect to directions as well as timing.

The main flight route, as can be deduced on basis of visual, radar and ringing data, falls in the 290 - 310° rhumbline sector from Iceland across the Greenland icecap.

By using an optical range-finder we have also measured flight speed, height and rate of climb. Departing waders climbed steeply, often by circling and soaring flight, with an average climbing rate of 1.0 m/s, up to altitudes 600 - 2000 m above sea level (Alerstam *et al.* 1990).

BODY MASS AND FAT ACCUMULATION

Trapping data show that Knots gain in mass due to fat deposition throughout their stay in Iceland. Knots arrive in Iceland with almost no fat as can be seen from a catch of 156 Knots 2 May 1972 (Morrison 1975) where the mean body mass was 136 g. At departure, 26-31 May, mean body mass has risen to approximately 205 g, or 53% of lean body mass (Morrison 1975; Gudmundsson *et al.* 1991). The average fat deposition rate is 3.1 g/day.

FOOD SUPPLY AND FORAGING BEHAVIOUR

Knots forage both on mudflats and in *Ascophyllum* and *Fucus* seaweeds on rocky shores. *Macoma balthica* which is their base food during winter and at many other staging areas is absent from Icelandic mudflats. Field observations in Vatnsfjördur and analysis of remains in faeces have shown that small *Mytilus edulis* is the main food item on mudflats, and on rocky shores *Littorina* spp. are selected.

In an analysis of stomach content of 15 Knots collected on two mudflats in southwest Iceland *Mytilus edulis* was the main food item in 10 individuals, *Mya arenaria* in three, *Littorina* spp. in one, and Chironomidae larvae in one (Gardarsson & Nielsen 1989).

Marked shifts in selection of feeding habitats were observed in Vatnsfjördur, influenced by the tide. During spring tides, Knots began foraging on rocky shores as they left their roosts. Later they moved

over to mudflats as these became exposed, and foraged there during low tide. During rising tide they gradually returned to foraging on the rocky shores, until they began roosting again. During neap tides the mudflats were not used at all.

Foraging at night has been observed on a mudflat in Kopavogur. Birds were seen in middle of the night in reflections of city lights. Activity seemed to be at a similar level as in broad daylight.

ACKNOWLEDGEMENTS

Many thanks to our co-workers, P.E. Jönsson, J. Karlsson, Å. Lindström and I. Rudebeck, and to all others that have supported this study.

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.

Gardarsson, A. & Nielsen, O. 1989. (Seasonal variation in numbers of birds on two tidal mudflats in SW Iceland. Part I. Shorebirds.) *Natturufraedingurinn* 59: 59-84. (In Icelandic with English summary.)

Gudmundsson, G.A., Lindström, Å. & Alerstam, T. 1991. Optimal fat loads and long-distance flights by migrating Knots *Calidris canutus*, Sanderlings *C. alba* and Turnstones *Arenaria interpres*. *Ibis* 133: 140-152.

Gudmundsson, G.A. & Gardarsson, A. 1992. The numbers and distribution of Knots in Iceland in May 1990: preliminary results of an aerial survey. *Wader Study Group Bull.* 64, *Suppl.*: 118-120.

Ingolfsson, A. 1975. (Life on seashores). In: Gardarsson, A. (ed.), Votlendi. *Rit Landverndar* 4: 61-99. (In Icelandic with English summary.)

Morrison, R.I.G. 1975. Migration and morphometrics of European Knot and Turnstone on Ellesmere Island, Canada. *Bird-Banding* 46: 290-301.