

# The migration of Red Knots through Porsangerfjord in spring 2008: a progress report on the Norwegian Knot Project

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We report on the results of the Norwegian Knot Project for 2008. The stopover population in Porsangerfjord, N Norway, was estimated at 40,000. Knots arrived earlier than in 2005–2007, from 11 May or earlier to 16 May. Within the study area, the distribution continued to shift towards the north-east. Resighted flagged knots showed a high return rate of 24.1%. Sightings of 55 Porsanger-flagged knots from outside Norway were within the winter range of *C. c. islandica*. Two sightings of marked knots from Germany showed that departure from there can be as late as 18–19 May: this is consistent with some arrival dates in Porsanger. The mean mass on 18 May was 151.6 g. This was higher than in 2006 or 2007 which can be attributed to the earlier arrival. Mass on 26 May, near departure time was 179.9 g, similar to 2007. On 28 and 30 May 2,473 knots were seen departing towards the west and north-west. Nine Porsanger-flagged knots were recorded in the Tromsø-Balsfjord area approximately 180 km to the south-west of Porsanger, three of which were within-year resightings. There were six sightings approximately 200 km to the east in the Varanger area, five of which were within-year. In 2008, marked birds were seen from Canada (1), France (1), the Netherlands (14) and Germany (2).

## INTRODUCTION AND STUDY SITE

In this paper we present the results of the fourth year of spring migration studies of Red Knots at Porsangerfjord, North Norway. The aims of the project and the study site are described in Wilson & Strann (2005).

## METHODS

Fieldwork took place from 12 to 31 May and comprised 117 man-days. For methods see Wilson *et al.* 2007. On total count days, counts were made at all knot sites in Porsangerfjord and Lille Porsangerfjord. If a site was not counted then the number from the previous count at that site was added to the total count for the day to give an estimated population. Knots were caught on 18 and 19 May during the arrival period, on 23 May during the main fattening period and on 26 May just before or during the departure period. No DNA samples were taken in 2008. A boat survey of the inner fjord was made on 23 May.

## RESULTS

### Passage period and population size

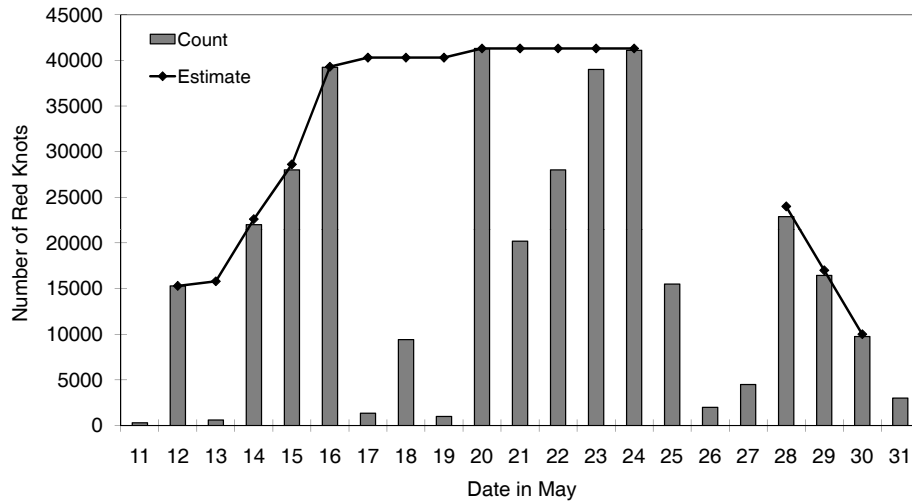
The first total count was made on 12 May when 15,000 knots were recorded (Fig. 1). Numbers steadily built up to the peak of about 40,000 on 16 May. The population then remained stable until at least 24 May. No total counts were made between 25 and 27 May due to cannon netting, but by 28 May numbers had dropped to 23,000 and at the end of May only 3,000 remained.

### The distribution and dispersion of knots within Porsangerfjord

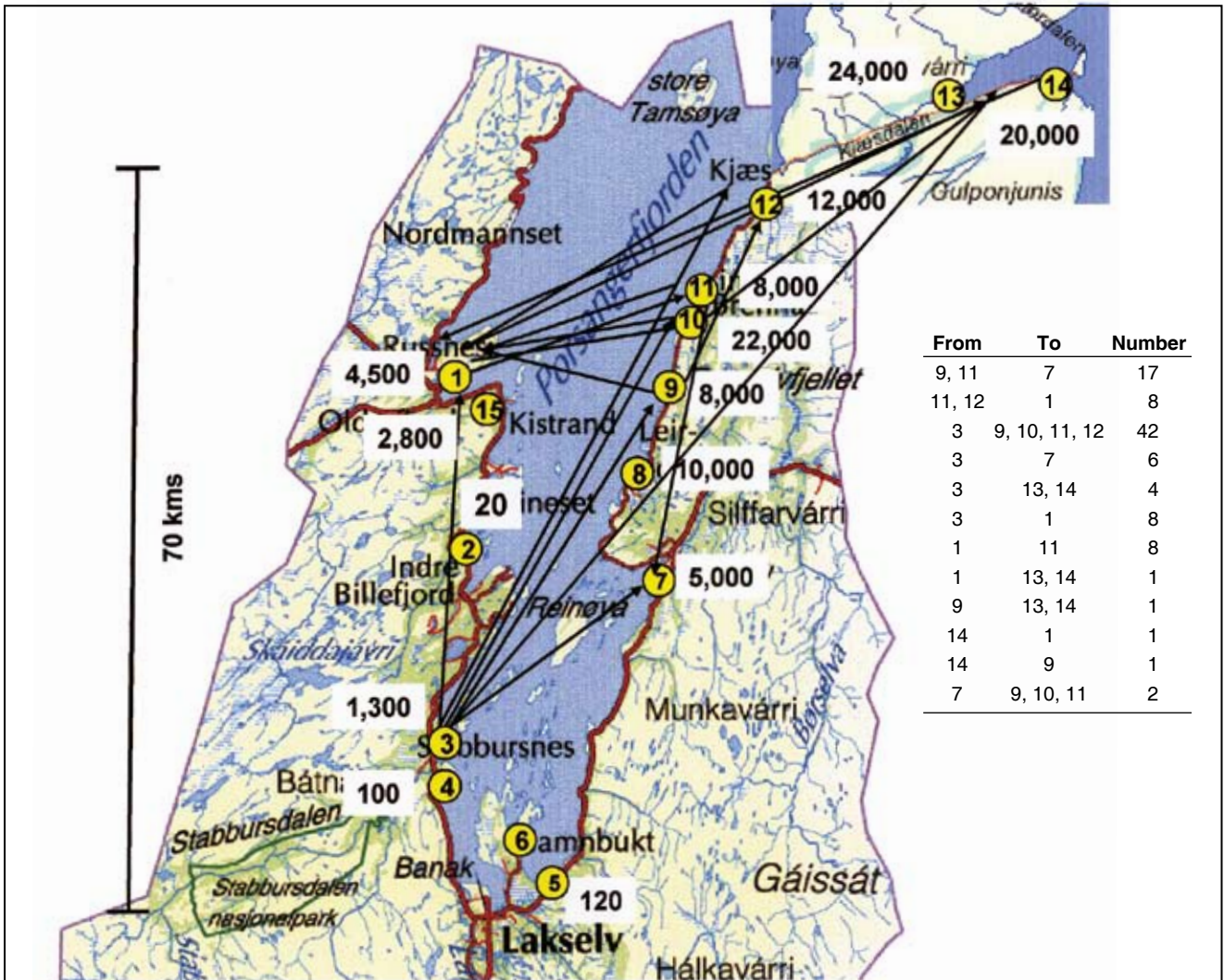
At the first total count on 12 May there were 15,000 knots on the east side of the fjord at Kjæs (12 in Fig. 2) and in Lille Porsanger (13), compared with 106 on the west side of the fjord. By the 16 May there were 38,000 from Brenna (11) to Kjæs (12) and in Lille Porsanger (13) in the east and only 350 in the west. The flock at Igaldas (3) built up from 115 on 11 May to 300 on the 16 May, 1,000 on 17 May and 1,300 on 18 May. There was probably a high turnover at this site because, although 41 individually marked birds were seen there by Tomas Aarvak during 11–17 May, there were only two in a catch of 291 made there on 19 May. After that catch, the marked knots rapidly dispersed from Igaldas and 61 were resighted later elsewhere in Porsangerfjord (Fig. 2). There were only two knots at Olderfjord (1) on 17 May. The flock had increased to 1,500 on 25 May and 4,500 on 27 May, possibly partly due to knots moving from the east side of the fjord as departure time approached as evidenced by seven flag resightings. Numbers at Viekker (7) increased from 200 on 21 May to 4,000 by 26 May as some knots from Brenna (11) and Kjæs (12) moved south into the fjord. Billefjord (2), which was a traditional site up to 2005, seems to have been abandoned. Also Austerbotn (5) which was used by up to 7,000 knots in 2005–2007 was hardly used in 2008 (Wilson *et al.* 2006, 2007).

### Departures

A total of 2,473 knots were seen leaving on migration on



**Fig. 1.** Counts of Red Knots in Porsangerfjord in 2008. The estimated figure includes birds thought to be present in places which were not visited on a daily basis (see text).



**Fig. 2.** The distribution and movements of Red Knots in Porsangerfjord in 2008. The maximum count at each site is shown in black. Arrows indicate movements of marked knots. The table shows within year movements between sites or groups of sites. Site names: 1 Olderfjord, 2 Billefjord, 3 Igaldas, 4 Valdak, 5 Austerbotn, 6 Luonkenjárklubbu, 7 Vækkir, 8 Mårnes, 9 Lystrevika, 10 Hjellneset, 11 Brenna, 12 Kjæs, 13 Lille Porsangerfjorden, 14 Veineset, 15 Kistrand.

**Table 1.** Migratory departures of Red Knots observed from Porsangerfjord in May 2008.

Date	Time	Number	Direction	Cloud cover	Precipitation	Wind	Flocks	Low tide
28 May	17.36	26	W-NW	8/8	No rain	No wind	1	16.08
28 May	18.10	14	W-NW	8/8	No rain	No wind	1	16.08
28 May	18.15	35	W-NW	8/8	No rain	No wind	1	16.08
30 May	16.05	200	310	8/8	No rain	No wind	1	16.08
30 May	16.40	1,300	320	8/8	No rain	SE 1–2	3–4	18.07
30 May	19.21	120	310	8/8	No rain	SE 1–2	1	18.07
30 May	19.40	260	310	8/8	No rain	SE 1–2	1	18.07
30 May	20.15	500	305	8/8	No rain	SE 1–2	3	18.07
30 May	20.55	18	305	8/8	No rain	SE 1–2	1	18.07

28 and 30 May from the east side of Porsangerfjord (Table 1). All departures were towards the west to north-west, and all were seen departing from feeding flocks on the rising tide. Flocks were followed with a telescope and binoculars for five to six minutes as they crossed over the fjord, steadily climbing, flying directly away from us. Knots, viewed at a range of 50 m, were feeding immediately prior to departure. At 12.00 h on 30 May, 9,000 knots were counted at the roost at Hjellneset (10) one hour after high tide. At 16.40 h, a Peregrine attacked the knots which had then spread out and were feeding along the nearby shores. The birds took off *en masse* and in many flocks, some flying along the shore and others flying high as is often the case after a Peregrine attack. About 1,300 knots in four flocks broke away and were then seen to depart to the west on migration. On 29 May, winds were from the south-west, force 6, and it was noteworthy that on that occasion the knot flocks exhibited no departure behaviour, calling or song.

### Mass

The mean mass of the catch at Brenna on 18 May was 151.6 g which is significantly greater than that of the catch made the following day at Igaldas of 146.5 g ( $t = 1.28$ ,  $df = 408$ ,  $p < 0.001$ ) and also significantly greater than that of catches made on the same dates in 2006 (mean = 143.4 g  $\pm$ SD 12.2,  $t = 5.36$ ,  $df = 303$ ,  $p < 0.001$ ) and 2007 (mean = 143.5 g  $\pm$ SD 11.9,  $t = 730$ ,  $df = 516$ ,  $p < 0.001$ ; Fig. 3). The mean mass of catches made on 23 and 26 May was 175.3 and 179.9 g

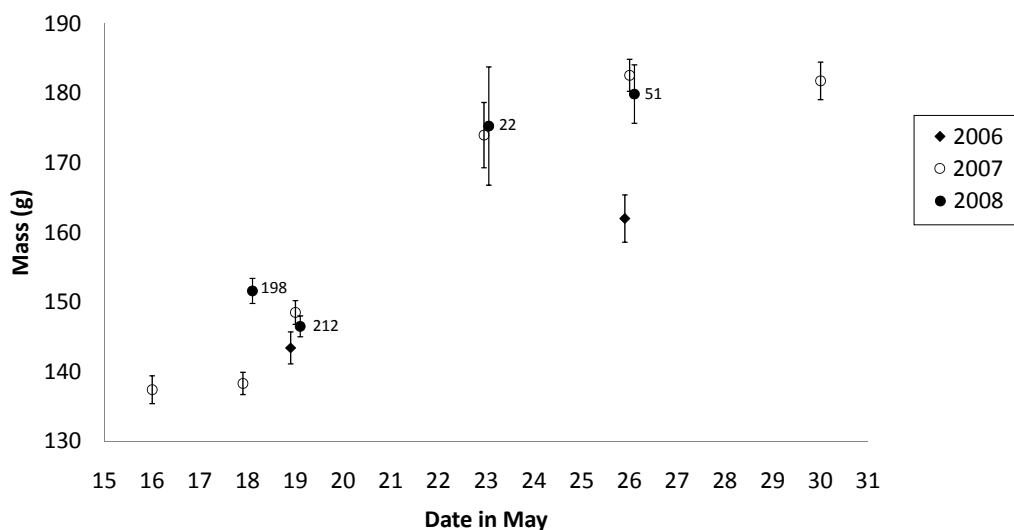
respectively, similar to that of catches made on comparable dates in 2007.

### The resighting rate of flagged birds in Porsangerfjord

During 2006–2008 1,302 knots have been individually flagged (Table 2). In 2008, 282 of these were resighted in Porsangerfjord, 14 from 2006, 141 from 2007 and 127 from 2008. The resighting rate for birds marked in 2006 was 10.4% and for birds marked in 2007 was 20.6%.

### Resightings of birds marked in Porsangerfjord elsewhere in Norway

There have been seven resightings of Porsanger-marked knots in a later year and nine same year sightings in N Norway (Fig. 4). Four resighted near Tromsø on 13 May (2) and 18 May (2) were possibly still on passage to Porsanger, as was CLX which had been marked on 18 May 2007, was seen at Storfjord on 20 May 2008, and resighted at Porsangerfjord on 23 May 2008. There were three same-year resightings of knots which had moved south-west from Porsangerfjord to Balsfjord and six that had moved east to the Varangerfjord area and beyond. KLH was photographed three days after marking in Porsangerfjord at Kirkenes near the Russian border. KEX was originally marked at Igaldas on 19 May 2008, resighted at Brenna on 30 May 2008 and then resighted at the mouth of Varangerfjord on 4 June.



**Fig. 3.** Mass of Red Knots staging at Porsangerfjord, N Norway, in May 2006–2008 plotted against date (mean  $\pm$  95% CIs, sample sizes are given for 2008).

**Table 2.** Return rates of individually marked Red Knots to Porsangerfjord.

Date flagged	Sighted in 2008	Total flagged	Sighting rate
19 May 2006	9	73	12.3
26 May 2006	5	62	8.1
2006 Total	14	135	10.4
16 May 2007	15	70	21.4
18 May 2007	31	156	19.9
19 May 2007	38	161	23.6
23 May 2007	9	51	17.6
26 May 2007	42	230	18.3
30 May 2007	6	28	21.4
2007 Total	141	696	20.6
18 May 2008	57		
19 May 2008	54		
23 May 2008	2		
26 May 2008	14		
2008 Total	127	471	27.0
Grand total	282	1,302	

### Sightings of Porsangerfjord flagged birds outside Norway 2006–2008

As of 15 October 2008, there have been 55 resightings of yellow-flagged Porsanger knots outside Norway (Table 3). The complete combination of three letters was recorded for 35 of these birds, allowing them to be individually identified. During autumn migration, in July and August, records extend from W Iceland and W Ireland east to the island of Gotland in the Swedish Baltic. Late autumn and winter records are from the Netherlands, Germany, France, England and Scotland. There was a marked shift in sightings from the Netherlands and Germany in autumn to England and Scotland in winter. On spring migration in May, two were recorded in the German Wadden Sea on 6 May, one in SW Iceland on 20 May and one in NW Iceland on 26 May.

### Sightings of foreign-marked knots and controls of foreign-banded knots in 2008

Eighteen individually colour-marked knots from outside Norway were recorded at Porsangerfjord in 2008, 14 from the Netherlands, one from Alert (Canada), one from France and two from Germany. Both German birds were banded on 18 May 2007, one as a second year bird with mass of 154 g, and one as an adult with a mass of 205 g. Banded knots were caught from the Netherlands (2) and England (4). A total of 102 foreign individually-marked knots have been resighted since 2004; and 25 foreign-banded knots have been caught since 2006.

## DISCUSSION

The main arrivals of knots in 2008 were three to four days earlier than in 2005, 2006 or 2007. Also the population increased from about 30,000 to 40,000. The early arrival was also reflected by the high mean mass of the catch on 18 May at Brenna which was greater than that of catches on similar dates in 2006 and 2007 (Fig. 3). The mass at Igaldas on 19 May was similar to masses in 2006 and 2007. However the Igaldas count data showed that the birds had just arrived, and later sightings of flagged birds showed that birds quickly dispersed away from the site. As a result of this early arrival and

early start to fattening of a large part of the population we had expected departure masses to be higher than in previous years, but they were similar to 2007 with a mean of about 180 g. It is possible that this is the optimal departure mass for Porsanger knots, even if in some years they have more time to put down larger reserves. However May 2008 was exceptionally cold. The mean temperature at Banak, at the head of the fjord, during 15–31 May was 4.3°C, compared with 5.5°C, 6.2°C and 7.1°C in 2005–2007 respectively and in the main fattening period from 18–26 May was 3.6°C, compared with 6.6°C, 7.6°C and 7.6°C in 2005–2007 respectively ([www.tutiempo.net/clima](http://www.tutiempo.net/clima)). With these low temperatures birds might have had to use a greater part of their food intake to thermoregulate, and the rate of mass increase may have been lower than the high rates achieved in 2007 (Wilson *et al.* 2007).

The arrival in Porsanger is late compared with knots in Iceland: in most years the main population does not arrive until 17–19 May. As few knots are recorded in S Norway on spring migration, we assume that they are still in the Wadden Sea, possibly as late as 18 May. This is contrary to what was previously thought: for example Prokosch (1988) stated that *C. c. islandica* leaves the German Wadden Sea by 10 May. In 2006, some knots were probably forced by a weather front to land in S Norway on 18 May (Wilson *et al.* 2006). Colour-marked knots seen in Porsanger might be in the Wadden Sea as late as 19 May. The one bird mentioned above with a mass of 205 g in Germany on 18 May was certainly at departure mass ready for a flight to N Norway. Also a bird marked in the Netherlands on 26 July 2001 and resighted in Germany on 19 May 2003 was seen in Porsanger on 25 May 2004.

Additional evidence for this late migration comes from catches in the German Wadden Sea on 16 and 18 May 2007 in which the majority was probably *C. c. islandica*. Out of 69 individuals, 30 were >185 g (and 17 were >195 g) (J. Leyrer *et al.* unpubl. data). These masses are too high to relate to *C. c. canutus* that have recently arrived from W Africa and it seems more likely that they were *islandica* about to depart for N Norway.

The probable reason why this late departure has not been previously detected is that as many tens of thousands of *C. c. islandica* depart to Iceland before 10 May and tens of thousands of *C. c. canutus* arrive from Africa after 10 May, the departure of the relatively small number of Norwegian-bound knots after 10 May might be difficult to detect in the Wadden Sea count data.

*Islandica* knots return from their breeding grounds on a broad front (Wilson & Morrison 1992). Sightings on autumn migration in W Iceland and W Ireland fit into this pattern. It is, however, surprising that an adult knot from Porsanger could turn up so far east as Gotland, suggesting it might be a Siberian bird. On the other hand, five adult and two juvenile knots ringed on autumn migration at Ottenby (Sweden and near Gotland), and five adult and four juvenile knots ringed in the Gulf of Gdansk, Poland, have been recovered in W Europe in winter (Gromadzka 1992, Helseth *et al.* 2005) and it is probable that these birds were *islandica*. Most sightings of Porsanger knots in the German and Dutch Wadden Sea were in autumn and spring, and most in Britain were in winter, and all were within the winter range of *islandica*. This fits with a pattern of many *islandica* knots moulting in the autumn in the Wadden Sea, moving to Britain in the winter, and then using the Wadden Sea again in the early spring (Davidson & Wilson 1992).

One of the aims of the Porsanger study is to determine whether Porsanger knots belong to the same breeding pop-



**Fig. 4.** Sightings of marked Red Knots from Porsangerfjord elsewhere in Norway: green circle – sightings in a later year than marking; yellow circle – sightings in the same year; arrows – direction of same-year movements.

ulation as those that stopover in Iceland, and how much interchange there is between birds using the two stopovers. If they are separate populations there are important conservation implications, particularly in view of the fact that the Norwegian population is relatively small. Two flag sightings show that knots from Porsanger have switched to the Icelandic migration route in a later year. However the stable population and later timing of the Porsanger stopover suggests that there is little route switching. Additional evidence for this comes from the flag sightings which show that 20.6% of birds flagged in 2007 were seen in 2008. If it is assumed that annual mortality is 16% (Brochard *et al.* 2002) the real resighting rate was 24.1%. However it is uncertain how many individuals were inspected. Few of the 20,000 knots using Lille Porsanger were scanned for flags as they were difficult to approach. Knots at other sites were scanned several times on different days and as knots move between sites it is not known how many were scanned at least once. Of the 40,000 knots that used Porsanger in 2008, it is certain that we scanned less than half, and quite possibly not more than 10,000. This indicates that the return rate to Porsanger is very high, and hence few are likely to change to the Icelandic route.

The distribution of knots continues to change within the Porsanger study area (see also Wilson *et al.* 2007) with more birds in the east and numbers increasing in Lille Porsanger (13,14) from 18,000 in 2007 to 24,000 in 2008. Austerbotn

(5, 6) seems to have been abandoned in 2008. It may be significant that a new Peregrine eyrie has been established between Austerbotn (5) and the roosting site (6). However, in 2008 a Peregrine was hunting daily between Lystrevika (9) and Brenna (10) and this still remains one of the main areas for knots. We do not yet know to what extent the distribution of knots has been affected by changes in the availability of food resources. However, there were huge resources of *mytilus* on the rocky shores between Lystrevika (9) and Kjæs (12) in 2008. Although some knots arrived at the southern end of the fjord at Igaldas and rapidly dispersed, the majority must have flown direct into the north-east and Lille Porsanger (13), where they mostly remained. Towards the end of May some moved south along the east coast to Viekker (12) and to the west to Olderfjord (7). A westward movement close to departure time was noted in 2004, 2005 and 2006. In 2004 and 2005, it involved at least 22,000 knots, or most of the population.

Data are accumulating on movements within N Norway. Three knots have now returned to Balsfjord in the same spring season (see Wilson *et al.* 2007). The sightings around Tromsø in mid-May were possibly of knots still on passage to Porsanger. More knots have been reported from the Varanger area with five within-year sightings showing that some birds there have moved through Porsanger. The extent of this movement is surprising as knots are moving 180–200 km

**Table 3.** Porsanger-flagged Red Knots resighted outside Norway up to 15 October 2008

Country	July	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	April	May	June	Total 1	Total 2	Total 3
Netherlands	3	9	2	4						1			19	18	1
Germany		6	3				1		2	3	2		17	1	16
France								1					1	1	
England			1				2	4	1	3			11	9	2
Scotland						2							2	2	
Ireland		1											1	1	
Sweden	1												1	1	
Iceland	1										2		3	2	1
Total	5	16	6	4	0	2	3	5	3	7	4	0	55	35	20

Total 1: Grand total of all flagged knots

Total 2: Number where complete letter combination was reported (3 letters)

Total 3: Number of flag sightings without a complete reading

further east, away from the breeding areas. Also, in the past, that area is not known for supporting large numbers of knots. We do not know if this is a real expansion to the east due to milder spring climates, and/or a possible increase in the population, or is merely because bird watchers are now aware of the Porsanger project and are looking for knots. We also do not know whether it is significant that four of the birds in the Varanger area have been seen very late in the season (three on 29 May and one on 4 June), after the main departures of knots from Porsanger.

## FUTURE WORK

We have not yet answered one of the original questions set by the project: Are the Norwegian birds from the same breeding population as the Icelandic birds and to what extent do they switch migration routes? With 1,200 birds flagged there is now an excellent opportunity to search for flags in Iceland – however the Porsanger team cannot do this, at least not after 13 May, and to date there seems to have been little interest among Icelandic bird watchers. Therefore we are looking for volunteers to run an Iceland knot expedition. The number of movements further east in Norway are surprising and we need counts from Varangerfjord to the Russian border. In 2009, we are planning that part of the Porsanger team will spend two to three days travelling east looking for and counting knots towards Varanger. We are building up a picture of how knots use Porsangerfjord, but we need studies on the food resources to help explain their distribution. It would only be possible to run this as a secondary project, probably using students, as the Porsanger team is too small to do everything. It is intended to run the project in much the same form in 2009.

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