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The spring migration of two Bar-tailed Godwit *Limosa lapponica* populations in Sweden

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Abstract

The regional distribution and timing of spring passage of the Bar-tailed Godwit *Limosa lapponica* in Sweden is reported (160,300 observed birds in 1976–1995). Birds were observed in most provinces, with the highest concentrations in southernmost Sweden. Timing of passage was bimodal, with distinct peaks in the middle and end of May, suggesting that two separate populations are passing. The peak in mid-May probably refers to the European population wintering in north-western Europe and bound for breeding areas in Scandinavia, Finland and westernmost Russia. The later peak most likely represents the Afro-Siberian population, on passage from West Africa to northern Siberia. The European birds were recorded over most of Sweden, whereas the Afro-Siberian birds were concentrated to the southern part. More European than Afro-Siberian birds were seen, even though the European population is considerably smaller. Presumably, a higher proportion of European than of Afro-Siberian birds stops in southern Sweden. The time pattern of Bar-tailed Godwit migration is compared with the passage of other arctic migrants previously reported.

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Introduction

Several wader species migrating along the East Atlantic Flyway gather in the Wadden Sea area for a long, final spring staging, before departing for the breeding areas in northern Europe and Russia (Smit & Wolff 1983, Piersma et al. 1987, Smit & Piersma 1989, Meltofte et al. 1994). When leaving the Wadden Sea, their migration routes fan out in directions between north and east. By its size and geographic position on the Scandinavian Peninsula, extending from 55° N to 69° N, Sweden offers good opportunities for studies of latitudinally related migration patterns of this contingent of birds in Northwest Europe (Blomqvist & Lindström 1992, 1995). There are no major staging areas for spring migrating arctic waders within Sweden, but vast numbers can be expected to pass. A well developed system of organised bird reporting in Sweden, based on local and regional ornithological societies, in combination with a network of bird observatories where regular observations are recorded, further favours studies of the large-scale geographical patterns (Blomqvist & Lindström 1996).

So far, the spring occurrence in Sweden of four arctic breeding wader species has been presented: Red Knot *Calidris canutus* (Blomqvist & Lindström 1992), Sanderling *C. alba*, Little Stint *C. minuta* and Curlew Sandpiper *C. ferruginea* (Blomqvist & Lindström 1995). Here we describe the spring migration of another northern breeding wader, the Bar-tailed Godwit *Limosa lapponica*. Our study is based on an extensive set of records from the whole of Sweden, including a long-term series of observations from a single site (Ottenby), starting in the early 1950s. The geographical pattern and the timing of the spring passage over Sweden are described and compared with Bar-tailed Godwit records from other areas along the Flyway. We also compare the spring migration of the Bar-tailed Godwit with that of the

arctic wader species previously analysed (Blomqvist & Lindström 1992, 1995).

Distribution and migration of the species

At least two populations of the Bar-tailed Godwit migrate through West Europe (Prokosch 1988, Drent & Piersma 1990). Recently, the two populations have been given subspecies status, based on a combination of differences in breeding and wintering distribution, and morphological characters (Engelmoer & Roselaar 1998). The European population *L. l. lapponica* of about 125,000 birds, winters chiefly around the North Sea (Smit & Piersma 1989). Most of this population gathers in the Wadden Sea from March to mid-May for spring staging (e.g., Prokosch 1988, Meltofe et al. 1994, Salvig et al. 1994a, Scheiffarth 2001), prior to an assumed non-stop flight to breeding areas in northern Europe (Figure 1). A minor part of this population, still several thousand strong, uses staging areas in Denmark which are closer to Sweden (Meltofe 1993). The breeding range stretches from the northern part of Fennoscandia (Norway, Sweden and Finland), eastward to the White Sea area, in northwestern Russia (Figure 1). The highest abundance of breeding birds is probably found in the eastern parts of the range (Cramp & Simmons 1983).

The Afro-Siberian population *L. l. taymyrensis* comprised about 700,000 birds in the early 1980s (Smit & Piersma 1989), but today fewer seem to winter in West Africa, mainly on the Banc d'Arguin in Mauritania (Trotignon et al. 1980, Gowthorpe et al. 1996, Hagemeijer et al. 2000), and in the Arquipélago dos Bijagós in Guinea-Bissau (Zwarts 1988, Salvig et al. 1994b, Frikke et al. 2002). These birds leave their African wintering grounds in late April to early May. After a direct flight to the Wadden Sea, they spend about a month in this area, before departing in late May and early June (Drent & Piersma 1990, Piersma & Jukema 1990), on an assumed direct flight to the breeding areas in western and central arctic/subarctic Siberia (Figure 1). During the later phase of the spring staging, the birds gradually move towards the north-eastern Wadden Sea, and also to some sites outside the Wadden Sea, primarily in Denmark (Meltofte 1993, Green et al. 2002a, cf. also Piersma et al. 1994). The breeding distribution of the Afro-Siberian population is poorly known, and its true extension may differ somewhat from that shown in Figure 1. The main breeding area is situated between the peninsulas of Yamal and Taimyr, but whether it is continuous or disjunct (as shown in Figure 1) is not clear.

Both populations of Bar-tailed Godwit follow the east North Atlantic coast, turn northeastward at the Wadden Sea, pass Scandinavia and the Baltic Sea, and then head for the northern arctic/subarctic breeding areas (Glutz et al. 1977, Cramp & Simmons 1983). Some thousand pairs breed in northern Fennoscandia, with the majority (1 300 pairs) found in Norway (Mjelstad & Sætersdal 1986) and Finland

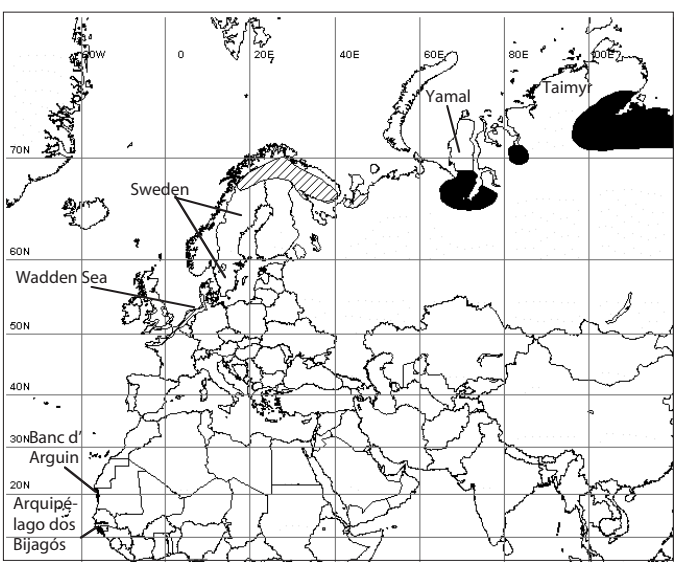

Figure 1. Breeding areas of the European Bar-tailed Godwit *Limosa l. lapponica* population (hatched) and the Afro-Siberian Bar-tailed Godwit *Limosa l. taymyrensis* population (black). Also shown are the wintering area of the European population in Western Europe (hatched), which is used as staging area by both groups, and the African wintering areas of the Afro-Siberian population (black) in Mauritania (Banc d'Arguin) and Guinea-Bissau (Arquipélago dos Bijagós) (sources: Dementev & Gladkov 1969, Glutz et al. 1977, Cramp & Simons 1983, Morozov 1998).
Häckningsområden för de europeiska (streckat) och de afro-sibiriska (svart) populationerna av myrspov. Övervintringsområde för europeiska myrspovar och rastningsområde för båda grupperna i Västeuropa (streckat) samt den afro-sibiriska populationens övervintringsområden (svart) i Mauritanien (Banc d'Arguin) och Guinea-Bissau (Arquipélago dos Bijagós) visas också.

(200–500 pairs; Väisänen et al. 1998), whereas Sweden normally holds only 5–25 pairs, in some years maybe up to 100 pairs (Svensson et al. 1999). The Bar-tailed Godwit is a regular spring migrant in Sweden, recorded annually in April to June (SOF 2002).

Material

Data collection

Our data cover the whole of Sweden, and originate from three main sources: (1) replies to inquires sent to the regional (provincial/county) report committees of the Swedish Ornithological Society, (2) direct communication with certain observers or observatories, and (3) literature searches, mainly in local bulletins. Observations from the time period 1 March to 20 June were included in the analysis. The bulk of the material is from the time period 1976–1995, but some records from the period before 1976 and from the year 1996 are also included. From the southernmost province of Sweden, Skåne, data up to 1999 are included.

Replies were received from all 30 regional report committees in Sweden (Figure 2). These committees compile records reported voluntarily by ornithologists. Spring observations of the Bar-tailed Godwit were reported to most of the regional committees, with a few exceptions (north Halland, Öland, Gotland). In the province of Bohuslän records were not collected during 1993–1995 and in Västerbotten not before 1990. Reports from the Ottenby Bird Observatory (Figure 2) on Öland, a major observation site for waders, were available for all years. From the West Coast (N. Halland), observations were available from two bird observatories (at Getterön and Nidingen), and from Gotland and Västerbotten large flocks and migration count data were also reported. Hence, for the main time period studied (1976–1995), we believe thatthe data set evaluated reflects fairly well the spring occurrence pattern of the Bar-tailed Godwit in Sweden. Futhermore, the observation series of 45 years (1951–1995) from one single site, the Ottenby Bird Observatory, offered an opportunity to analyse a long-term trend.

In order to avoid double counts of birds within a province/county, and particularly within a single locality, all records were carefully assessed. Hence, reported figures represent the minimum number of birds observed. Birds staying for longer periods at a stopover site were entered with the first date of observation. All figures mentioned refer to the total number of birds observed during an approximate 20-year period, unless otherwise stated.

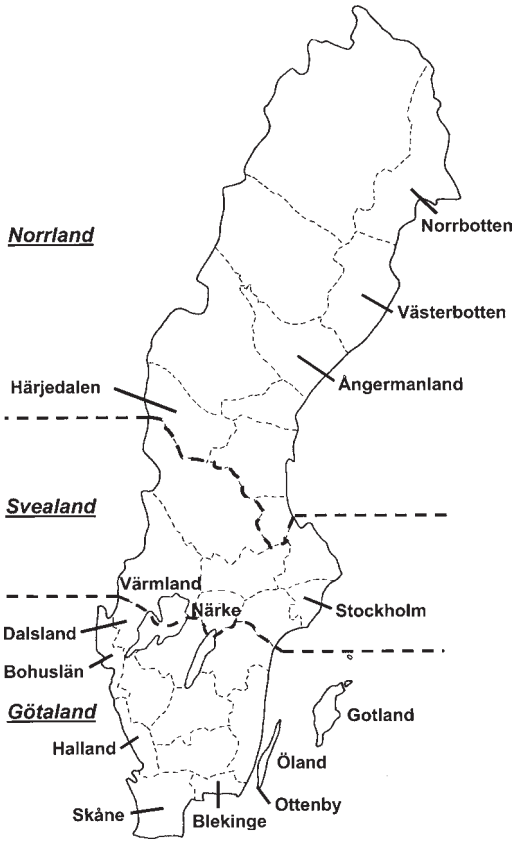

Figure 2. Map of Sweden and the different provinces/counties. Provinces/county mentioned in the text are named. The three large regions Götaland, Svealand and Norrland are separated by thick broken lines.
Karta över Sverige med de olika rapportområdena. Områden och regioner som omnämns i texten anges med namn.

Results

The present analysis is based on spring records of 160,300 Bar-tailed Godwits observed in Sweden (Figures 3 and 4). Two thirds (67%) of all reported birds were seen on the ground at stopover sites, while one third (33%) was observed during migratory flight.

Yearly totals varied greatly, from a few 1000 individuals up to more than 10,000 birds. Therefore, no effort was made to analyse year-to-year variation in the reported total number of birds in the whole

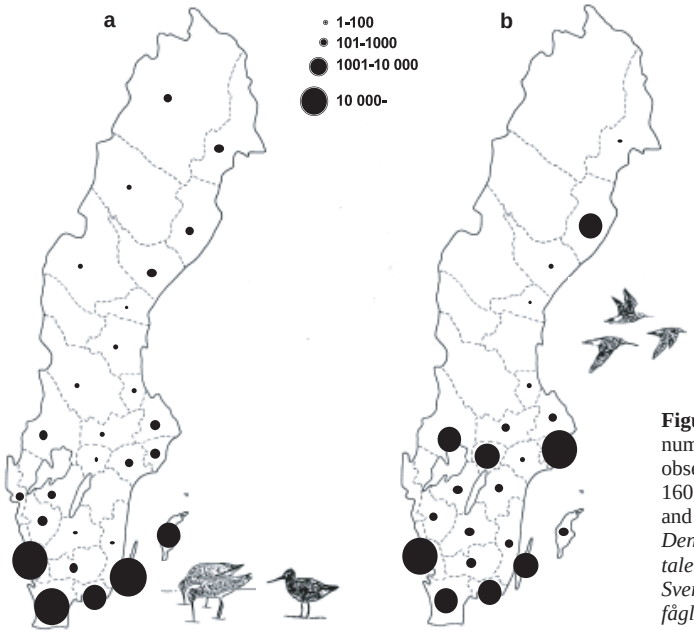

Figure 3. Geographic distribution of the total number of Bar-tailed Godwit *Limosa lapponica* observed 1 March–20 June in Sweden (n = 160,300), separated into birds at stopovers (*a*) and on migration (*b*).
Den geografiska fördelningen av det totala antalet rapporterade myrspovar under våren i Sverige, (n = 160.300), fördelat på rastande fåglar (a) och sträckande fåglar (b).

country. At Ottenby, the only site with a long-term series record, annual numbers varied between a handful up to 1800 birds. However, a correlation analysis of the time series of 1951–1995, revealed no significant temporal trend (Spearman's rank correlation, $r_s = 0.06$, n = 45, p = 0.70).

Regional differences in bird numbers

Spring observations of the Bar-tailed Godwit were reported from all regional committees, except Dalsland and Härjedalen, both situated inland in western Sweden (Figure 3). Most (81%) birds were observed in the southernmost part of the country, mainly along the coasts from Halland to Gotland. A major part of these observations were from the provinces of Skåne (30%), Öland (21%) and Halland (20%). Bar-tailed Godwits were reported from inland areas of south Sweden in most years, but the numbers were usually low, with maximum counts of up to a few hundred birds. About 3% of the grand national total, or up to 500 birds per year, were reported from the area of large lakes in south central Sweden (in Värmland and Närke). In the county of Stockholm, at the east coast, migration of Bar-tailed Godwits was observed yearly, usually with a few hundred birds, but in some years several thousands. In all, ten percent of the grand national total was recorded in the county of Stockholm. The coastal areas of northern Sweden (Ångermanland, Norrbotten and Västerbotten) contributed 3% of the total national sum.

Some differences were found between the geographical distributions of birds recorded at stopovers and birds seen on active migration (in flight) (Figure 3). Large numbers of birds (>1000) on the ground were recorded only in the five southernmost coastal provinces (Figure 5). Among these, Skåne was the only province regularly holding large spring staging numbers. A few hundred birds were present at any

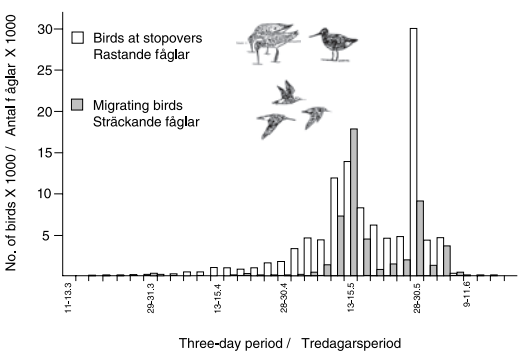

Figure 4. Number of Bar-tailed Godwit *Limosa lapponica* recorded in Sweden per three-day period, from 1 March–20 June. Median date for the grand total is 17 May (n = 160,300).
Tidsmönster för rapporterade myrspovar under våren i Sverige. Mediandatum för hela materialet är 17 maj (n = 160.300).

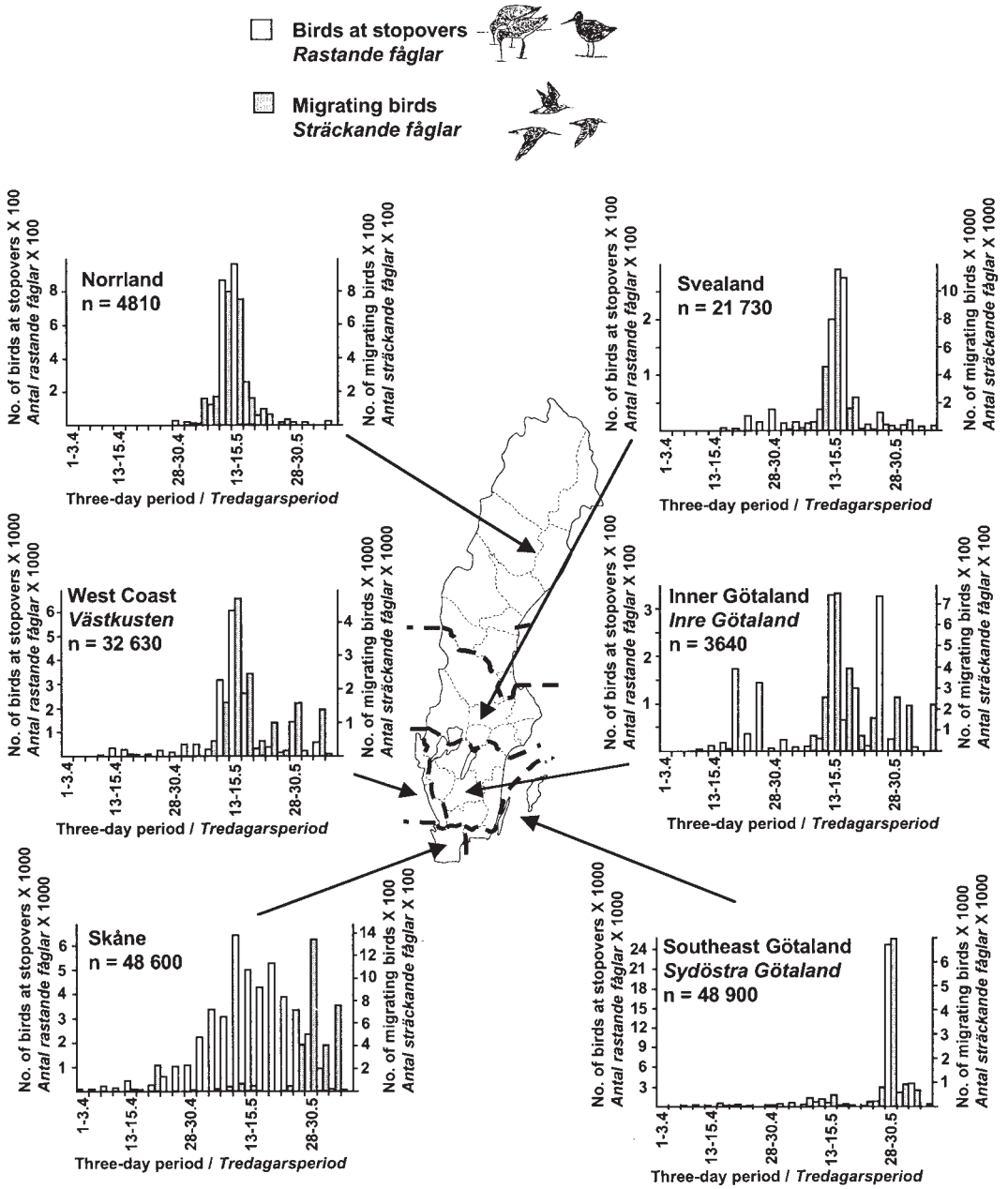

Figure 5. Time patterns in spring occurrence of Bar-tailed Godwit *Limosa lapponica* in six regions of Sweden (for regional median dates, see text).
Tidsmönster i våruppträdandet av myrspov i sex olika regioner i Sverige (för mediandatum för de olika regionerna, se texten).

one time each year in Skåne, with a maximum of 1200 birds, and up to a few thousand birds recorded per season. In the other four provinces, only small numbers made regular stopovers, whereas large numbers were seen resting temporarily in the south-eastern parts during periods of inclement weather conditions (headwinds of gale force in combination with rain). Such situations occurred in 1976, with about 10,500 birds at Öland 27–30 May (Breife 1976), and in 1987, with about 6500 birds at Öland 29–30 May, 4000 birds at Gotland 28–29 May, and 2000 birds in Blekinge 29–30 May (Waldenström 1987, Hedgren 1988).

Regular spring staging also took place in coastal areas of the northern provinces of Ångermanland, Västerbotten and Norrbotten (Figure 3a), where flocks of up to some 50 Bar-tailed Godwits were reported more or less annually from river deltas and coastal bays. Few birds were reported from inland areas of Norrland.

Migrating birds were predominantly seen in the southern coastal areas, and in the county of Stockholm and the province of Västerbotten (Figures 3b and 5). However, relatively large numbers were also recorded inland, in the area around the large lakes in the south-central parts of Sweden.

General time pattern

Starting in mid-March, small numbers of Bar-tailed Godwits turned up along the coasts of southernmost Sweden (Figure 5). In total, 830 birds (0.5% of the grand total) were observed in March (Figure 4), mostly in the provinces of Skåne and Öland. In these provinces, the numbers in March increased significantly over the years covered (Skåne: Spearman's rank correlation, $r_s = 0.55$, $n = 30$ years, $p < 0.002$, for the time period 1970–1999; Öland: $r_s = 0.79$, $n = 26$ years, $p < 0.0002$ for the time period 1970–1995), indicating that more birds arrived earlier in later years. In the 1970s, the Bar-tailed Godwit was a rare March visitor, in the 1980s single birds were recorded in some years, while in the 1990s up to 100 birds were observed annually in the province of Skåne, and 25 birds at the island of Öland.

In April, Bar-tailed Godwits were regularly observed in the whole southern third of Sweden (Figure 5). In total, about 9000 birds (6% of the grand total sum) were reported from this month (Figure 4). The numbers were low early in the month, and increased slowly towards the end. As in March, most Bar-tailed Godwits observed in April (91%) were reported from coastal areas of the southern provinces. However, small numbers of birds were also observed in other parts of Götaland (Figure 5). At Ottenby, the number of Bar-tailed Godwits observed in April increased significantly during the period 1970–1995 (Spearman's rank corelation, $r_s = 0.61$, $n = 26$, $p < 0.001$). The number of birds observed in the whole of Götaland increased significantly in the period 1975–1995 (Spearman's rank, $r_s = 0.52$, $n = 21$ years, $p < 0.015$).

May was the main migration month, with 136,000 Bar-tailed Godwits observed (85 % of the grand total sum). Two distinct peaks were recorded (Figure 4): one in the middle of May and one in the end of May. About 15,000 birds (9% of the grand total) were reported from the first week of June, but few thereafter. The birds observed in May fell into two groups; the first group included all birds recorded before 22 May, while the second group consisted of birds recorded from 22 May onwards. Fifty-nine percent of the Bar-tailed Godwits were categorized into the early group, and 41% into the late group; median date for the two groups were 13 May and 29 May, respectively.

Regional time pattern

In order to evaluate geographical differences in numbers and timing of the Bar-tailed Godwit in Sweden, the country was divided into six large regions (Figure 5). In Skåne, in the far south, a gradual build up of staging birds was observed from April, with a peak in mid-May (median date 14 May, n = 44,410). However, migrating birds in Skåne were recorded in relatively low numbers in April and the great part of May, followed by a distinct peak in late May–early June (median date 30 May, n = 4190). In Southeast Götaland, i.e., the provinces of Blekinge, Öland and Gotland, a relatively small peak was recorded in mid-May, followed by a large peak in the last days of May. Median date was 29 May for migrating birds (n = 11,421), and 28 May for birds at stopover (n = 37,479). A large fraction of these birds (40%) were observed during a few occasions when birds were grounded by inclement weather conditions. However, excluding the latter birds and re-running the analysis did not change the general pattern in this region. The resulting median date was 28 May, both for migrating birds (n = 7224) and birds on stopover (n = 22,287).

Along the West Coast (Halland, Bohuslän) two peaks were recorded (Figure 5). However, unlike the pattern in Southeast Götaland, the first peak in mid-May was largest, followed by a smaller peak in late

May–early June. Only a minor difference was recorded in the timing of migrating birds and birds at stopover (median dates 15 May, n = 14,550 and 13 May, n = 18,080, respectively).

In the inner and eastern parts of Götaland, few Bar-tailed Godwits were reported (Figure 5), but the bimodal time pattern in May resembled that found in other parts of southern Sweden. Median dates of migrating birds (17 May, n = 1922) and birds at stopover (16 May, n = 1718) were close. Also, an earlier small peak in late April was recorded in this area.

In contrast to Götaland, the time pattern observed in the northern two thirds of Sweden was unimodal (Figure 5). A single peak was recorded in mid-May, with an identical median date (13 May) for Svealand (n = 21,730) and Norrland (n = 4810), for migrating birds as well as for birds at stopover.

Discussion

Seasonal timing

The two distinct peaks in the time pattern of spring migrating Bar-tailed Godwits recorded in Sweden (Figure 4) seem to reflect the passage of two different populations. The first peak, in the middle of May, coincides in time with the departure of the European Godwits from the Wadden Sea (Prokosch 1988, Drent & Piersma 1990, Meltofte 1993, Salvig et al. 1994a), as well as records of first arrival date at the breeding grounds in the White Sea area (median date 17 May, range 8–22 May), and from the peninsula of Varanger (median 20 May, range 13–30 May) in northeastern Norway (Glutz et al. 1977). However, a single note from the Varanger area states a somewhat earlier (11 May) date (Frantzen et al. 1991), as do records (median 6 May, n=18) from the county of Troms, farther westward in north Norway (Barrett 2002).

The second peak, in the last days of May and the first days of June (Figure 4), coincides in time with the departure of Afro-Siberian Bar-tailed Godwits from the Wadden Sea (Prokosch 1988, Drent & Piersma 1990, Piersma & Jukema 1990, Meltofte 1993). Likewise, a recorded median passage date of 1 June (in 2000) for 21 radio-tracked Afro-Siberian birds over south Sweden coincides in time (Green et al. 2002a). The passage of the Afro-Siberian population through western Siberia is reported to take place in late May to early June (Glutz et al. 1977). Arrivals in Taimyr have been recorded from the end of May until the end of June, with a majority in June (Dementev & Gladkov 1969, Glutz et al. 1977).

Different migration strategies of the two populations

At least 75% of all Bar-tailed Godwits migrating through Europe are Afro-Siberian birds, whereas <25% are heading for the European breeding grounds (Smit & Piersma 1989, Drent & Piersma 1990). However, in Sweden, the highest numbers of Bar-tailed Godwit were recorded for the mid-May peak (Figure 4), which contains over 50% of the observed birds and most likely represents European breeders. The comparatively low proportion of Afro-Siberian birds in Sweden may be due to few of them actually passing Sweden during migration. However, this seems unlikely, since the Afro-Siberian birds are known to spring stage in the Wadden Sea (Prokosch 1988, Drent & Piersma 1990, Piersma & Jukema 1990), making them more or less bound to pass Sweden on their flight towards the Siberian breeding areas (Green et al. 2002a). In a radio-telemetry study of Afro-Siberian birds in 1999–2001, 38 out of 66 marked individuals (58%) were recorded to pass a narrow corridor (75 km wide) over southernmost Sweden (Green 2003). In addition, we have found no indication that Afro-Siberian Godwits migrate along the south and east coast of the Baltic (Tomiałojc 1976, Klafs & Stübs 1987, Leibak et al. 1994). We conclude that most of the Afro-Siberian birds are likely to pass Sweden on their way to the breeding grounds. This passage may be difficult to observe, because most birds fly at high altitude and during night.

In essence, most Afro-Siberian Bar-tailed Godwits passing Sweden in spring seem to conduct the final part of their migration in long, non-stop flights at high altitudes, while a higher proportion of the European breeders use a mixed strategy, with shorter flights coupled to brief stops at several sites along the routes. If so, more European birds are likely to be encountered during the short time stopovers, and when flying at low altitude, while Afro-Siberian birds usually pass over, beyond the limit of conventional observation methods. Also, this dichotomy in migration pattern is corroborated by data on departure fuel loads of Bar-tailed Godwit at the Wadden Sea, where Afro-Siberian birds put on more fuel than the European birds (Drent & Piersma 1990, Scheiffarth et al. 2002).

Different routes

Bar-tailed Godwits were reported from almost all provinces of Sweden; by far the largest numbers were, however, recorded in the southern part of the country (Figure 3). This might partly be due to regional differences in the number of active ornithologists, but certainly also reflects true differences. In some areas of central (eastern Svealand) and northern Sweden (Västerbotten), the main migration sites are well covered, but the numbers of birds observed are nevertheless comparatively low. Also, obvious differences in the time pattern were found in different parts of the country (Figure 5), which cannot be explained by different observer intensity. Distinctly bimodal peaks were found in Götaland, whereas in Svealand and Norrland one single large peak was recorded.

This regional difference in time pattern suggests that the two populations of Bar-tailed Godwit observed in Sweden follow different migration routes (Figure 6). The mid-May peak was recorded in all six regions (Figure 5). In Skåne, at the West Coast, in Inner Götaland, Svealand and Norrland this peak was relatively large, suggesting that the European population is a large fraction of the birds passing these areas. In contrast, the end-of-May peak (Figure 4) was found primarily in Skåne and Southeast Götaland; with the West Coast and Inner Götaland forming a transition area (Figure 5). Hence, the Afro-Siberian population of Bar-tailed Godwit seems primarily to cross Sweden in the south and southeastern part of the country.

The outlined route patterns of Bar-tailed Godwits over Sweden (Figure 6) are similar to the ones of the Red Knot (Blomqvist & Lindström 1992). However, in contrast to the Godwits flying up along Sweden to breeding areas in northwestern Europe, the Knots following this route are heading for transit staging areas in Finnmark, north Norway (Strann 1990, 1992, Blomqvist 1991), before entering a non-stop, transoceanic flight to the Nearctic (Davidson et al. 1986, Uttley et al. 1987). As to the Siberian route (Figure 7), the Bar-tailed Godwit (Green et al. 2002a)

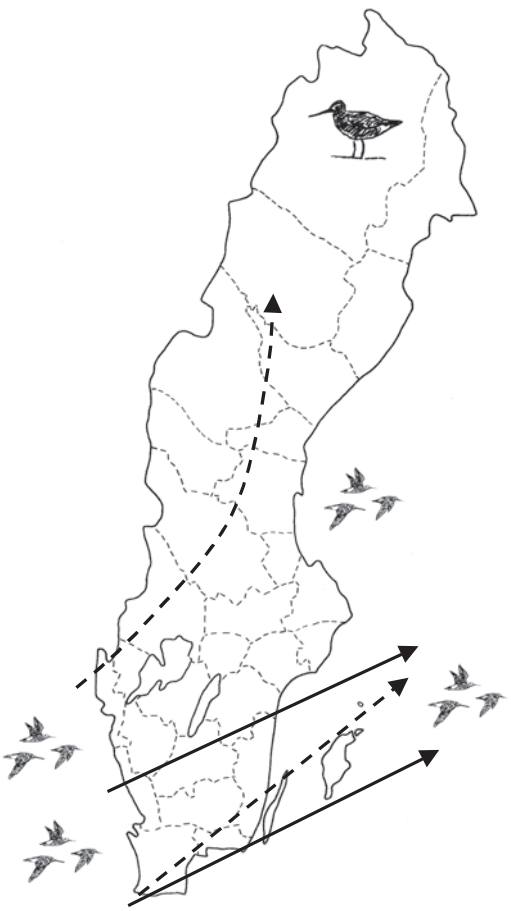

Figure 6. Suggested spring migration routes of the European Bar-tailed Godwit *Limosa l. lapponica* (between dashed arrows) and the Afro-Siberian Bar-tailed Godwit *Limosa l. taymyrensis* (between solid arrows) over Sweden.
Vårflyttningsrutter för europeiska myrspovar (mellan streckade pilar) och afro-sibiriska myrspovar (mellan heldragna pilar) över Sverige.

Figure 7. Spring migration routes from the Wadden Sea to the breeding areas, along constant compass (rhumb line) courses for the European Bar-tailed Godwit *Limosa l. lapponica* (between dotted arrows) and the Afro-Siberian Bar-tailed Godwit *Limosa l. taymyrensis* (solid arrow). Map projection: Mercator.
Vårflyttningsrutter med konstant kompasskurs för europeiska (mellan prickade pilar) och afro-sibiriska myrspovar (heldragen pil) från Vadehavet till häckningsområdena.

as well as the Red Knot (Gudmundsson 1994) recorded in Sweden seem to follow constant compass (rhumb line) courses, much like arctic geese breeding in Russia (Green 1998, Green et al. 2002b).

Early arrival

At the earliest, European Bar-tailed Godwits arrive at their breeding grounds in mid-May (Glutz et al. 1977). This coincides in time with mean day temperatures above the freezing point in northern Scandinavia and the White Sea area (Gray 1996, SMHI 2001). However, some birds have been observed to pass south Sweden already in March and April (Figures 4 and 5), which is when the breeding areas are still inhospitable. Birds stopping over in early spring seem to stay for a few days only, and are often seen foraging (Green 1999). Also, up to a couple of hundred Bar-tailed Godwits per spring have been observed overflying, suggesting that these birds are on their way to intermediate stopover areas further north and east. Although the overall numbers observed during March and April were comparatively small (about 6% of the grand total), the magnitude of this early occurrence is surprising, considering that no major staging area is known between south Sweden and the breeding grounds. These early birds most likely belong to the European population, as the Afro-Siberian birds remain in West Africa until late April–early May (Drent & Piersma 1990, Piersma & Jukema 1990). The early occurrence of birds in Sweden might reflect an alternative migration strategy within the European population, in addition to the strategy followed by most European Bar-tailed Godwits, fuelling in the Wadden Sea and a direct flight to the breeding areas.

Dividing the migratory journey into several short flight steps, with relatively small fuel loads, reduces the overall cost of migration, compared with a long non-stop flight, carried out on one large fuel load (Alerstam 1979, Piersma 1987). The former strategy will be beneficial if it is possible to refuel along the route. Furthermore, birds which can minimize the remaining distance to the breeding area early in the season, will probably arrive early when weather conditions permit, and therefore, will have first access to the best nesting territories (Alerstam & Högstedt 1980). Early, but not too early, arrival to the breeding grounds has been claimed to favour the evolutionary fitness among competing birds (e.g., Price et al. 1988, Kokko 1999). The finding of small flocks of staging Bar-tailed Godwits along the coast of the Gulf of Bothnia, suggests that there may be other, yet undiscovered, small scale stopover sites, permitting migration by short steps up along the Flyway.

A selective advantage of early arrival in spring is challenging, considering the recent increase, most marked in the 1990s, in the observed number of Bar-tailed Godwits in south Sweden during March and April. Even though the number of birds involved is low, there is a marked change from earlier decades. This increase in the number of early birds coincides with warm winters in the North Atlantic Region (Hurrell 1995), which may have promoted the early arrival of Bar-tailed Godwit in Sweden.

An advancement in the spring arrival of the European Bar-tailed Godwit has been previously reported from Tipperne, in the Danish part of the Wadden Sea, for the period 1920s–1980s (Meltofte 1987). In Britain, where a large fraction of the European Bar-tailed Godwits overwinter (Prater 1981, Evans 1986, Atkinson 1996), a reported trend of more birds found farther north and east in 1995/96 compared with 1969/70, was attributed to warmer winter climate (Austin et al. 2000).

Comparison with other species

In Sweden, the Bar-tailed Godwit is the most numerous spring migrating arctic-breeding wader, with 160,300 birds reported. During roughly the same period of years, 55,000 Red Knots, 2 000 Sanderlings, 2 000 Little Stints and 700 Curlew Sandpipers were recorded (Blomqvist & Lindström 1992, 1995). The Bar-tailed Godwit and the Red Knot have indeed larger populations than the other species, but there are also differences in migration routes. At least the Curlew Sandpiper and the Little Stint use continental migration flyways in spring, crossing the Mediterranean basin and the Middle East, reducing the numbers actually passing Sweden (Blomqvist & Lindström 1995). The overall number of Sanderlings staging in the Wadden Sea, and migrating towards breeding areas in arctic Russia, has been estimated to some 50,000 birds (Meltofte et al. 1994), compared to several hundred thousands of Red Knots and Bar-tailed Godwits migrating the same way. Large birds like Godwits are also more conspicuous, and therefore easier to recognise, in particular if they gather in large flocks. The many records of Bar-tailed Godwits observed in migratory flight are in agreement with this notion (Figures 3b and 4). In contrast, nearly all observations in Sweden of the smaller wader species were birds on the ground (Blomqvist & Lindström 1995).

The mid-May peak of Bar-tailed Godwits recorded in Sweden was earlier than the corresponding spring peaks of the other arctic-breeding waders analysed (Blomqvist & Lindström 1992, 1995). This probably reflects differences in the onset of the phenological spring in the breeding areas. However, the mid-May peak coincides well in time with the small peak of the Nearctic breeding Red Knots *C. c. islandica* passing Sweden, *en route* for staging areas in north Norway (Blomqvist & Lindström 1992). In fact, the latter staging sites are not far from the Norwegian breeding areas of the European Bar-tailed Godwits. Except for a small number of the Little Stints (Hildén 1978, Frantzen et al. 1991, Väisänen et al. 1998), the breeding areas of the other waders are situated farther east, where spring is later (Grey 1996).

The end-of-May peak of Bar-tailed Godwits in Sweden coincides with the spring peak of Sanderlings and Curlew Sandpipers (Blomqvist & Lindström 1995), which breed in the same region as the Afro-Siberian Bar-tailed Godwits. The Little Stints migrate earlier than the Sanderlings and the Curlew Sandpipers (Blomqvist & Lindström 1995), as can be expected for a species breeding in large number on the tundra between the White Sea and Taimyr (Morozov 1998). The Siberian Red Knot is the last wader to pass Sweden in spring (cf., Blomqvist & Lindström 1992), about a week after the late peak of Bar-tailed Godwits. Even though both Red Knots and Bar-tailed Godwits breed on Taimyr, the Knots breeds farther north on the peninsula, while the Godwits are mainly found in the zone where tundra meets taiga (Dementev & Gladkov 1969, Rogacheva 1992, Lappo 1998).

To sum up, there is a similarity in the migration pattern of the arctic/subarctic wader populations passing Sweden in spring, suggesting natural selection pressures in common. Except for Nearctic Red Knots, which are heading for transit staging areas in north Norway, the timing and migration dynamics of the arctic waders studied appear to have evolved in relation to two critical factors in the Palaearctic breeding areas: (*i*) the timing of the phenological spring, and (*ii*) their geographical position in relation to staging opportunities along the East Atlantic Flyway.

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Sammanfattning

Vårflyttningen hos två populationer av myrspov Limosa lapponica *över Sverige*

Varje vår samlas stora mängder arktiska vadare i Vadehavet (Nederländerna, Tyskland, Danmark) för att bygga upp sina fett- och proteinförråd inför den avslutande flyttningen mot häckningsområdet. Dessa fåglar ger sig därefter av på en i många fall flera hundra mil lång direktflygning upp till arktiska trakter. När vadarna ger sig av från Vadehavet går flyttningsvägarna i allmänhet i riktningar mellan norr och öster mot Norra ishavets tundraområden. Detta gör Sverige, som den stora flygvägen passerar, väl lämpat för studier av flyttningens tidsmässiga och geografiska förlopp. I två tidigare artiklar har våruppträdandet av några arktiska vadararter i Sverige behandlats, nämligen kustsnäppa *Calidris canutus*, respektive sandlöpare *C. alba*, småsnäppa *C. minuta* och spovsnäppa *C. ferruginea* (Blomqvist & Lindström 1992, 1995). I den här artikeln fortsätter vi denna serie av presentationer med att redovisa våruppträdandet av myrspov *Limosa lapponica* i Sverige.

Myrspovens utbredning och flyttning

Två populationer av myrspov förekommer regelbundet i Europa (Prokosch 1988, Drent & Piersma 1990). Dels den europeiska populationen som häckar i ett bälte från norra Skandinavien österut till Vitahavsområdet i nordvästra Ryssland, och dels den afro-sibiriska populationen med häckningsområde längre österut, troligen med tyngdpunkt mellan halvöarna Yamal och Taimyr i Sibirien (Figur1). Den europeiska populationen övervintrar i huvudsak på Brittiska öarna och kring Nordsjön, medan afro-sibiriska fåglar övervintrar i Västafrika, främst i Mauretanien och Guinea-Bissau (Figur 1). De europeiska myrspovarna samlas för vårrastning i Vadehavet under mars–april, innan de i mitten av maj ger sig av mot häckningsområdena. Flera tusen europeiska myrspovar långtidsrastar även i andra delar av Danmark (Meltofte 1993). Afro-sibiriska myrspovar lämnar Västafrika i månadsskiftet april–maj för en direktflygning till Vadehavet. Sedan spenderar de ungefär en månad i Västeuropa innan de ger sig av mot Sibirien i slutet av maj – början av juni.

Den afro-sibiriska populationen hyser flest fåglar, närmare 700.000 i slutet av 1980-talet, men idag troligen färre än så. Det totala antalet europeiska myrspovar är ca 125.000. Båda populationernas

flyttningsvägar följer i stort den atlantiska ostkusten upp till Vadehavets östra del för att därefter vika av nordostvart över Sverige mot häckningsområdena norröver. Myrspoven uppträder regelbundet i Sverige under april–maj i varierande antal (SOF 2002). Stora rastplatser saknas, men regelbunden rastning i mindre skala förekommer i Skåne (Green 1999). Ett fåtal par häckar i landets nordligaste delar, troligen ungefär 5–25 par årligen, under vissa år kanske så många som 100 par (Svensson et al. 1999).

I denna uppsats beskriver och analyserar vi myrspovens vårflyttning över Sverige, baserat på observationer från lokala rapportkommittéer, fågelstationer och enskilda observatörer.

Material och metoder

Insamling av data

Våra data härstammar framför allt från svar på förfrågningar hos landets 30 regionala rapportkommittéer (rrk), men också från direkta kontakter med vissa observatörer och fågelstationer, samt litteratursökning i nationella och regionala tidskrifter. Observationer till och med 1995 har tagits med (för några områden även 1996, och för Skånes del har uppgifter till och med 1999 inkluderats).

Vi har erhållit uppgifter från landets alla rrk (Figur 2). Vårobservationer av myrspov har varit föremål för systematisk rrk-registrering, förutom i vissa kusttrakter: norra Halland, Öland och Gotland, Bohuslän under åren 1993–1995, samt i Västerbotten före 1990. Vad gäller Öland har vi erhållit uppgifter från Ottenby (Ottenby fågelstations dagbok), en plats som normalt står för en stor del av de öländska vadarobservationerna. Från norra Halland har vi fått uppgifter från fågelstationerna på Getterön och Nidingen. Dessutom har spontan rapportering av större ansamlingar och sträcksiffror från Öland, Gotland och Västerbotten förekommit. Sammantaget tror vi därmed att en övervägande del av de i Sverige gjorda vårobservationerna av myrspov kommit till vår kännedom.

Observationer från 1 mars till och med 20 juni har räknats som vårsträckande myrspovar. För fåglar som stannat på rastplatser mer än en dag har vi använt första rapporterade datum. Uppgifter från alla tillgängliga år har räknats samman och totalsummor för olika perioder, rapportområden, större regioner och landet som helhet har beräknats som summan av alla rapporterade fåglar under alla år. Detta innebär att alla antal som nämns avser totalsummor för en ungefärlig 20-årsperiod, om inget annat anges. Vi har bedömt risken för dubbelräkning mellan rapportområden (landskap/län) som minimal och har därför inte korrigerat några siffror för denna eventuella felkälla. Däremot har vi efter bästa förmåga korrigerat summorna inom varje enskilt rapportområde för eventuella dubbelräkningar.

Resultat

160.300 myrspovar ingår i analysen (Figur 3 och 4). Årssummorna varierade stort från några få tusen upp till mer än tio tusen fåglar. Vi har inte gjort något försök att utvärdera mellanårsvariationen för landet som helhet, men vid Ottenby (den enda lokalen med en någorlunda jämn observationsintensitet) fanns ingen signifikant trend i antalet observerade myrspovar under perioden 1951–1995. Två tredjedelar av alla vårfåglarna i Sverige sågs under rastning och en tredjedel under aktiv flyttning (Figur 4).

Geografiskt mönster

Myrspovar rapporterades från alla rapportområden utom Dalsland och Härjedalen (Figur 3). Den stora majoriteten fåglar (81%) noterades i de sydligaste kustlandskapen (Figur 5), där det årligen inräknades mellan några hundra och några tusen fåglar per landskap. Skåne, Öland och Halland stod för huvuddelen av de observerade fåglarna med 30, 21 respektive 20% av totalsumman. Även i Götalands inland sågs myrspovar i princip årligen, men i betydligt lägre antal. Relativt höga antal noterades kring de större sjöarna i Mellansverige (främst Vänern och Vättern), med upp till 500 fåglar per år. I Stockholmsområdet inräknades ca 10% av totalsumman. I regel noterades här årssummor på hundratals fåglar, men under vissa år rapporterades flera tusen. Även längs norra delen av norrlandskusten (Ångermanland, Västerbotten, Norrbotten) förekom myrspovar årligen; 3% av totalsumman rapporterades från denna kuststräcka.

Det geografiska mönstret skilde sig något mellan rastande och sträckande fåglar (Figur 3). Större antal rastande fåglar noterades endast i de sydligaste kustområdena. Bland dessa var Skåne det enda landskapet med regelbunden vårrastningen i större skala. Övriga delar hyste i regel endast små antal av regelbundet rastande fåglar, dock med tillfälligtvis mycket stora antal i samband med dåligt väder under flyttningsperioden åren 1976 och 1987. Regelbunden vårrastning i mindre skala förekom även längs Norrlandskusten. Större antal sträckande fåglar sågs också längs kusterna i syd, men höga totalsiffror

noterades likaledes kring de stora mellansvenska sjöarna, samt i Stockholmsområdet och i Västerbotten (Figur 3b och 5).

Tidsmönster

De första myrspovarna dök upp längs de sydligaste kusterna, främst i Skåne och på Öland, under mitten av mars (Figur 4). En halv procent av det total antalet vårfåglar noterades i mars. Både i Skåne och vid Ottenby ökade antalet marsfåglar under de senaste 25–30-årsperioden. I april sågs myrspovar regelbundet i hela Götaland. Totalt sex procent av alla vårfåglar observerades under april (Figur 4). Likt i mars sågs majoriteten av fåglarna i de sydligaste kustlandskapen (Figur 5). Antalet fåglar sedda i april ökade under de senaste 20–25-årsperioden både vid Ottenby och i Götaland som helhet.

Hela 85% av totalsumman rapporterades från maj månad. Två distinkta toppar framträder, en i mitten av månaden och en vid månadens slut (Figur 4). Antalet rapporterade myrspovar sjönk sedan snabbt i juni, men höga antal noterades även under den första juniveckan. Totalt stod juni för 9% av totalsumman. Om materialet delas i två delar (mitt emellan de två topparna), före respektive efter 22 maj (Figur 4), hamnar 59% av totalsumman i den tidiga gruppen och 41% i den sena gruppen. Mediandatum för den första gruppen var 13 maj och för den andra gruppen 29 maj.

Regionala mönster

Vi delade in Sverige i sex större regioner för att utreda regionala skillnader i uppträdandet av myrspov (Figur 5). I Skåne noterades en skillnad mellan rastande (mediandatum 14 maj) och sträckande fåglar (mediandatum 30 maj). I det sydöstra hörnet av landet (Blekinge, Öland, Gotland) återfinns en mindre topp i mitten av maj, följt av en betydligt större topp i slutet av månaden. Mediandatum för rastande och sträckande fåglar skilde bara en dag (28 maj respektive 29 maj). Även längs Västkusten (Halland, Bohuslän) noterades två toppar, men här var den första toppen i mitten av maj den största. Ingen större skillnad mellan rastande och sträckande fåglar fanns i detta område (mediandatum 13 maj och 15 maj). Inre delarna av Götaland uppvisade i princip samma mönster som längs Västkusten. I Svealand och Norrland var uppträdandet entoppigt, eftersom toppen i slutet av maj saknades i dessa delar. Mediandatum för rastande och sträckande fåglar var i båda dessa landsdelar 13 maj.

Diskussion

Säsongsmönster

De två distinkta topparna i tidsmönstret (Figur 4) sammanfaller väl med rapporterade avfärdsdatum för de två myrspovpopulationerna som lämnar Vadehavet (Prokosch 1988, Drent & Piersma 1990, Pierma & Jukema 1990, Meltofte 1993, Salvig et al. 1994, Scheiffart 2001, Green et al. 2002a). Majoriteten av de europeiska myrspovarna lämnar Vadehavet i mitten av maj, i överensstämmelse med den första toppen i Sverige. De afro-sibiriska myrspovarna lämnar Vadehavet i slutet av maj – början juni, i god överensstämmelse med den andra toppen i södra Sverige (Figur 5). Rapporterade ankomstdatum till häckplatserna stämmer även de väl överens med de två passagetopparna över Sverige (Glutz et al 1977, Dementev & Gladkov 1969). Vi drar därför slutsatsen att den första (tidiga) majtoppen i Sverige (Figur 4) motsvarar passagen av europeiska myrspovar på väg mot häckplatser i norra Skandinavien och nordvästra Ryssland, medan den andra (sena) majtoppen utgörs av afro-sibiriska fåglar på väg mot häckplatser längre österut.

Har de två myrspovpopulationerna skilda strategier?

Tidsfördelningen av antalet observerade fåglar i Sverige (Figur 4), med en majoritet (59%) av fåglarna sedda under den första toppen (europeiska fåglar), skiljer sig markant från fördelningen av det totala antalet fåglar då majoriteten (>75%) av alla myrspovar som flyttar genom Europa tillhör den afro-sibiriska populationen. Då allt tillgängligt bakgrundsmaterial tyder på att huvuddelen fåglar i de båda populationerna faktiskt flyttar över Sverige tolkar vi detta som att det kan finnas en skillnad i flyttningsstrategi och beteende mellan grupperna. Det funna mönstret tyder på att de afro-sibiriska fåglarna i hög grad använder sig av långa non-stop flygningar på hög höjd, med liten chans för observationer med konventionella metoder, medan de europeiska fåglarna förefaller vara mer benägna att göra kortare flygningar, avbrutna av korta stopp längs svenska stränder, och blir därmed även lättare att observera under pågående flyttning.

Skillnader i flygrutter

Det fanns uppenbara skillnader i det storskaligt regionala flyttningsmönstret i Sverige (Figur 5). De två distinkta topparna noterades enbart i Götaland. Längre norrut fanns endast en topp, den (tidiga) i mitten av

maj. Detta tolkar vi som att de storskaliga flygrutterna skiljer sig mellan de två populationerna (Figur 6). De afro-sibiriska (sena) fåglarna passerade endast över de sydligaste och sydöstligaste delarna av Sverige, medan de europeiska fåglarna passerade över en stor del av landet (Figur 5). Även för sistnämnda population observerades dock huvuddelen av alla individer i den sydligaste delen av landet.

Bakgrunden till det funna regionala flyttningsmönstret i Sverige hänför sig troligen till häckningsområdenas geografiska belägenhet. Det har tidigare visat sig att andra fåglar med samma avfärdsområde och häckningsområde som myrspovarna i stort följer flygrutter som ligger nära en konstant kompasskurs (Gudmundsson 1994, Green 1998, Green et al. 2002a, b), snarare än storcirkelrutter (en storcirkelrutt är den kortaste rutten mellan två punkter på jordens yta). De funna vårflyttningsmönstret för myrspovar i Sverige stämmer väl överens med flygning längs konstanta kompasskurser från Vadehavet mot respektive häckningsområde (Figur 7). Att flest fåglar av den europeiska populationen ses i södra Sverige (Figur 5) stämmer bra överens med att de högsta tätheterna av häckande fåglar återfinns i den östra delen av utbredningsområdet (kring Vita havet).

Tidiga fåglar

Ankomst av myrspov till häckningsområden har noterats i mitten av maj som tidigast. Det är därför förvånande att en relativt stor andel fåglar (>6%) observerats i Sverige redan i mars–april. Eftersom häckningsområdena vid denna tid ej är tillgängliga (ännu frusna) tyder dessa iakttagelser på att denna grupp tidiga fåglar kan vara på väg mot ännu så länge okända rastplatser belägna nordostöver. Detta indikerar även att det inom den europeiska populationen kan finnas alternativa strategier; några tar sig fram i korta etapper medan huvuddelen gör långflygningar från Vadehavet till häckningsområdena. Antalet tidiga myrspovar i Sverige ökade under senare år och det kan vara så att de mildare vintrarna/tidigare vårarna i Nordvästeuropa under senare år lett till att tidiga inidivider med korthoppsstrategi gynnats.

Jämförelse med andra arter

Under vårflyttning har i Sverige iakttagits betydligt fler myrspovar än andra arktiska vadare, d.v.s. kustsnäppa, sandlöpare, småsnäppa och spovsnäppa (Blomqvist & Lindström 1992, 1995). Skillnaden kan till viss del förklaras av skillnader i de totala populationernas storlek samt i olika flyttningsvägar. Småsnäppa och spovsnäppa flyttar båda under våren i stor utsträckning över den Euro-Asiatiska kontinenten, istället för längs Atlantkusten, och passerar därför Sverige endast i mindre utsträckning. Antalet sandlöpare som flyttar via Vadehavet mot Sibirien, och därmed över Sverige, utgör endast en bråkdel av de stora antal kustsnäppor och myrspovar som flyttar samma väg (ca 50.000 sandlöpare jämfört med åtskilliga 100.000 för de två andra arterna). Att fler myrspovar (160.300) än kustsnäppor (55.000) iakttagits, beror troligen främst på att många europeiska myrspovar regelbundet rastar i Sydsverige. De afrosibiriska myrspovarna och kustsnäpporna flyger däremot bara förbi Sverige utan att rasta.

Skillnaderna i tid och rum mellan de olika vadararternas vårflyttning över Sverige kan huvudsakligen (med undantag för nearktiska kustsnäppor; se Blomqvist 1991) förklaras med hur tidigt om våren häckningsområden blir tillgängliga för fåglarna, samt häckningsområdenas belägenhet i förhållande till lämliga rastplatser längs flygvägarna.