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Length of stay and volume of autumn staging Dunlins *Calidris alpina* at the Tipperne reserve, Denmark

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Abstract

Resightings of dyed, staging Dunlins showed that the mean length of stay was 23.4 days. Applying this figure on data from the running bird counts I estimated that 33,928 Dunlins used the area during autumn 1996. Hence Tipperne qualify as a site of international importance with 1% of the flyway population using the area. The maximum number of Dunlins observed in a single autumn count in 1996 was 12,172 individuals. This substantial discrepancy suggests that maximum number is an inadequate measure of volume and with that of site quality. Analysis of a ten years period showed that maximum numbers do not correlate with bird-days, which further underline maximum number as a controversial measure of site quality. Length of stay at six different staging areas in Northern Europe declined with increasing distance to the Wadden Sea; once arrived in its vicinity the migratory urge is reduced and the length of stay is considerably increased. This increasing length of stay will result in an undervaluation of site quality of the eastern staging areas if the criterion is based on maximum numbers from simple head counts.

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Introduction

Twice a year, millions of waders migrate along the east Atlantic flyway, resting and refuelling at different staging areas (Burger & Olla 1984). At these locations ornithologists have carried out simple head counts of birds for many years, whereby the phenology of waders is described, and the maximum number is usually used as an indirect measure of site quality (Prater 1981). Since different sub-populations of shorebirds migrate differently in time (Meltofte & Lyngs 1981), there will be a turnover of individuals at a given staging area, not visible in the data from head counts. Such monitoring will thus only provide an assessment of the net change in numbers but no information about the volume (defined as the actual number of birds using a given area during a given period of time).

Collecting information on volume and, hence, length of stay is essential if the quality of stopover sites has to be assessed. However, information on length of stay among waders is scarce probably because of the time consuming fieldwork involved. One of the first attempts to estimate a mean length of stay was based on hunting recoveries of ringed Dunlins *Calidris alpina* at Amager, Denmark (Nørrevang 1955). Here the adults and juveniles stayed an average of 5.3 and 17.3 days, respectively.

Mascher (1966) found by recaptures of Dunlins, that only a few adults were retaken after 2–3 days and less than 18.3 percent of all juveniles stayed more than 8 days. Holmgren et al. (1993) fitted a simple mark-recapture model to the data on recaptured Dunlins at Ottenby, and estimated a true stopover length ranging between 2.6 and 9.1 days. Another possiblility is to use a capture-resight model based on resightings of colour marked individuals. By marking Dunlins with a dye on the underparts of the plumage and coloured tape around the aluminium ring, Kersten & Smit (1984) obtained an average length of stay of 12.2 days during spring migration at the Atlantic coast of Morocco. In the Bay of Fundy, Hicklin (1987) dyed 1216 Semipalmated Sandpipers *Calidris pusilla* and found a length of stay of 15 days.

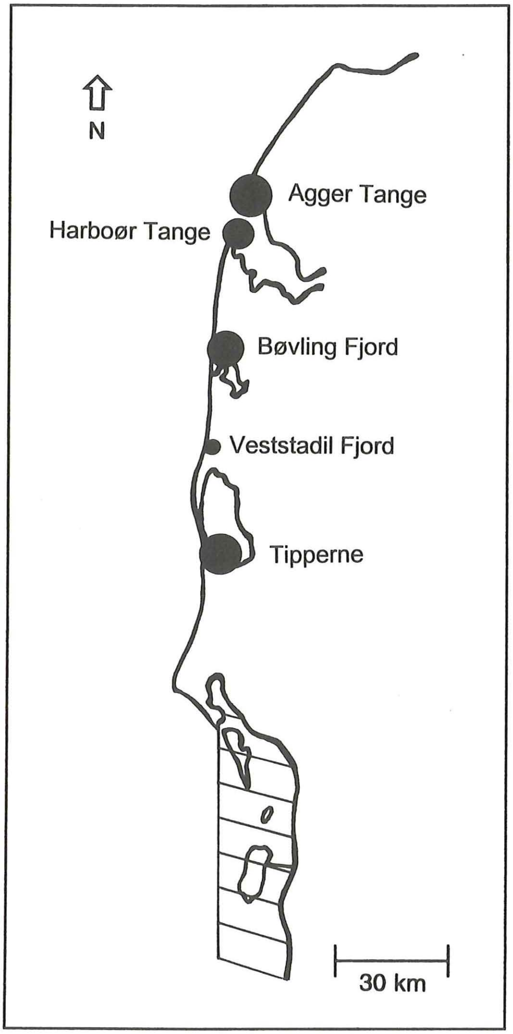

Figure 1. Map showing the Tipperne reserve on the west coast of Jutland and the other major staging areas used by Dunlins during autumn migration. The hatched area indicate the Danish part of the International Wadden Sea and the area of the circles the relative importance of each site (redrawn from Meltofte 1993).

Karta som visar Tipperne-reservatet på Jyllands västkust och övriga betydelsefulla rastområden för kärrsnäppa under höstflyttningen. Det streckade området visar Danmarks del av Vadehavet och cirklarna storlek den relativa betydelsen av varje område (omritat efter Meltofte 1993).

The aims of the present study were to (1) estimate length of stay of autumn staging Dunlins at the Tipperne reserve, Denmark; (2) calculate volume and thereby assess the international importance of Tipperne as a staging area for Dunlins; (3) analyse the relationship between length of stay and the distance to the Wadden Sea for six different staging areas in Northern Europe and (4) discuss the relevance of maximum number, bird-days, and volume as indicators for site quality.

Methods

Study area

The study was performed at the scientific reserve "Tipperne" (55°53'N, 08°14'E), in the southern part of Ringkøbing Fjord, West Jutland, Denmark (Figure 1). The area is composed of reed swamps and meadows, surrounded by mudflats, and is exposed to non-tidal brackish (5–15%) water. The water level is highly influenced by wind conditions, i.e. the mudflats are exposed during southerly winds and flooded during northerly winds. Tipperne is considered an important staging area for shorebirds during spring and autumn migration and is situated in a complex of staging areas along the west coast of Jutland including the northern part of the International Wadden Sea (Figure 1, Meltofte 1987). The birds may alternate between these sites according to wind-induced exposure of mudflats, where the non-tidal fjords can provide long continuous periods of accessible mudflats.

Bird counts and bird-days calculations

Since 1972 a standardised bird counting scheme has been undertaken at Tipperne, with at least one count in each 5-day period (starting from 1 January). From these data a general phenology of Dunlins can be generated and the number of bird-days can be estimated (accumulated number of birds using an area each day during the season). The number of bird-days between two counts was calculated as the average number of Dunlins observed during two counts multiplied by the number of days between them. The bird-days between all successive counts were then summed to give the total number of bird-days over the entire period (20 June – 1 November).

Capture of Dunlins and length of stay

Fourteen walk-in-traps of the Ottenby model (Bub 1991), each connected with a 10 m long and 20 cm high leading fence, were used to capture Dunlins during day-time. Birds were captured during four periods in autumn 1996 (31 July–3 August, 14–17 August, 25–26 August, and on 25 September). Capture events where less than 1% of the staging populations of Dunlins were dyed is excluded from the analysis. Each bird was ringed and colour marked with alcohol dissolved picric acid and/or rhodamine red on the plumage (breast, belly, and vent) resulting in a yellow and red colour, respectively. Dye-codes were used, and individuals captured during the same period were given the same code.

Following colour dying, a sample of at least 500 Dunlins were checked for colour-marked individuals each subsequent 5-day period, using a 20x60mm telescope. The total number of marked individuals in the reserve was subsequently estimated by multiplying the proportion of dyed individuals in the sampled flock with the peak number of Dunlins recorded during that 5-days period. In order to eliminate individuals that leave the study area as a consequence of stress enforced on them during the capture and dying process, the first check was performed the day after the last day of capture in each capture event. This should ensure a reliable zero-point, defined as "day one after capture" where 100% of the non-stressed dyed Dunlins were still present.

Plotting the proportion of dyed birds still present as a function of time, the best linear fit was generated, one for each capture event. Based on the parameters of these lines, the mean length of stay (the mean number of days each individual stage at a site) can be calculated following equation 1 and 2. Here (Figure 3), the area, A, between the line and the two axis represent the total number of bird-days the captured Dunlins spend at Tipperne, and the intercept at the ordinate, b, equals the number of individuals captured during each capture event.

$$A = \frac{b \times (-\frac{b}{a})}{2} = -\frac{b^2}{2a}$$

Where a = slope of the line, and –b/a = intercept at the abscissa. Dividing the total number of bird-days with the number of captured Dunlins gives an estimate of the mean length of stay, LS.

$$LS = \frac{A}{b} = \frac{\frac{-b^2}{2a}}{b} = \frac{\frac{-b}{a}}{2} = -\frac{b}{2a}$$

The estimated mean length of stay will be a minimum value, because an unknown number of Dunlins may have arrived on an unknown date prior to the capture. Furthermore, three assumptions are required: (1) if the Dunlins leave the study site as a consequence of stress, they are expected to do so on the day of capture; (2) the dispersal of dyed birds after capture is random within the study area; (3) the study site act as an isolated staging area under constant water level.

Finally, an overall mean estimate of length of stay for all the capture events combined can be generated for further use in the volume calculation.

Calculation of volume

As described by Hicklin (1987), the length of stay can be applied together with head counts to calculate the volume of birds moving through the area. For example: On day 15 of migration the present Dunlins consist of those individuals that have arrived during the three first 5-day periods (days 1–15). On day 16 (if the mean length of stay is 15 days) the number of the first flock (peak number for days 1–5) is subtracted from the total, assuming that those birds have left the study area. If the number of Dunlins increase the increment is interpreted as new arrivals, and if the number decrease the decrement is ascribed to outgoing migrants. When summing the column of new arrivals, the volume of staging Dunlins can been estimated.

When estimating the volume, periodic low numbers of Dunlins resulting from high water levels have been eliminated from the data due to the observation that birds reappear after short-term high water events. This may be illustrated from direct observations during 1996, when high water levels occurred at Tipperne between 30 August and 1 September due to a north-westerly gale (6 knots). During these days the study area only held a few hundreds Dunlins roosting at the meadows. During the evening September the first, the wind disappeared and the Dunlins reappeared at the site. Before the windy days, 1.53 percent of the present Dunlins (n = 4183) were dyed yellow on their flanks and red on the rump. On 2 September 1.45 percent (n = 3500) had this colour-combination. These two proportions do not differ significantly ($\chi^2 = 0.035$; df = 1; P>0.05). Suggesting that the individuals that leave due to high water level, are the same individuals that also return when the water level again becomes acceptable. This emphasise that short timed wind induced dis-

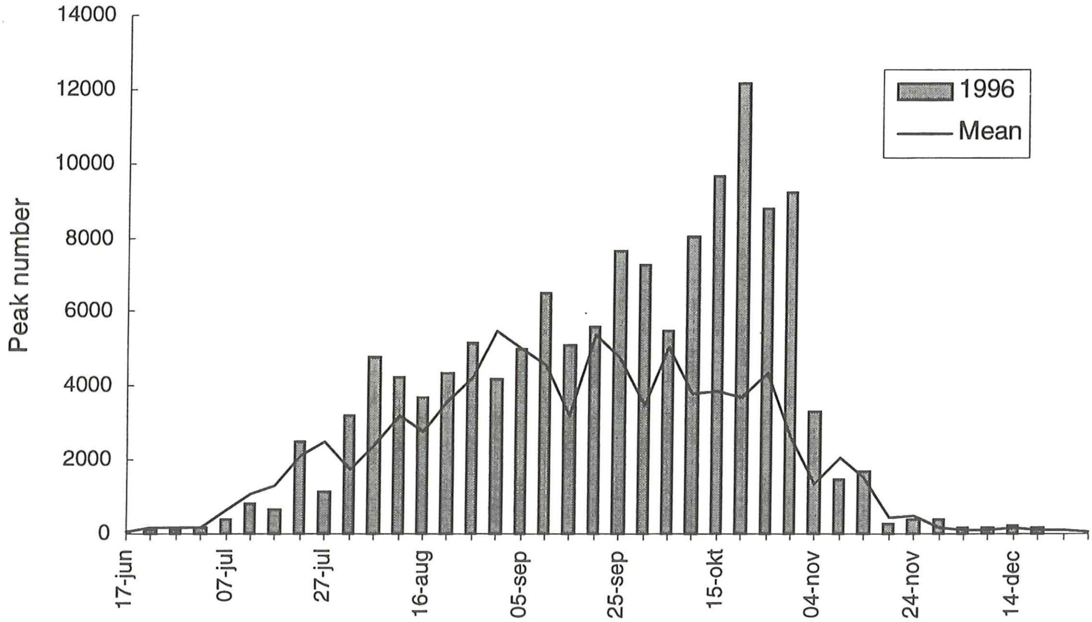

Figure 2. The phenology of Dunlins at Tipperne during 1996 and the mean values representing the autumns 1987–96. In 1996 the autumn maximum number was 12,172 individuals recorded on 18 October, exceeding well the mean maximum of 9542 Dunlins for the autumns 1987–96 (Table 3).

Kärrsnäppans fenologi vid Tipperne 1996 och medelförekomsten höstarna 1987–1996. Hösten 1996 var högsta antalet 12.172 fåglar den 18 oktober, vilket klart översteg genomsnittligt maximum på 9542 kärrsnäppor för höstarna 1987–1996 (Tabell 3).

placement of Dunlins may not significantly affect the length of stay at Tipperne. Local conditions like this, which affect the movements of waders, must be known when estimating volumes in order to interpret the data correctly.

Statistical Analysis

To investigate associations between variables chi-square (χ^2) test was used following Fowler & Cohen (1985). Homoscedasticity was verified using Barttles box and Cochrans' test before MANOVA was applied in SPSS (Norusis 1993). Likewise, Spearman Rank Correlation Coefficients and regression analysis were performed in SPSS as well.

Results

Phenology

Autumn staging Dunlins were present at Tipperne from mid-June to mid-December 1996 with a maximum number of 12,172 individuals on 18 October (Figure 2). The number of bird-days was 671,334 for the period 20 June – 1 November 1996 (Table 3). For comparison, the maximum number of Dunlins for the autumns 1987–96 is ranging between 5410 and 15,065 individuals with a mean of 9542, and the number of bird-days are ranging between 241,424 and 671,334 with a mean of 464,488 Dunlins (Table 3).

The analysis of the relationship between the autumn maximum number and the calculated number of bird-days for the autumns of 1987–96 found no significant correlation (Spearman Rank: r_s=0.21; P=0.56; 2-tailed).

Length of stay and volume

The length of stay for the four capture events were varying between 20.2 and 26.7 days (mean: 23.4

Table 1. For each capture event: the respective period of capture; the number of birds captured; the percentage of juveniles and the r^2 and n-values from the Spearman Rank statistics (see Figure 3) are presented. Based on the four equations for the best fit lines, the length of stay is calculated following equation 1 and 2 (see Methods).

För varje fångsttillfälle anges antal fångade fåglar, andelen juvenila samt r^2 och n från Spearman rank korrelation (se Figur 3). Med utgångspunkt i de fyra ekvationerna för de bäst anpassade linjerna beräknas rastperiodens längd med ekvationerna 1 och 2 (se Metoder).

Capture event *Fångsttillfälle*	Period	No. of dyed birds *Antal färgade fåglar*	% juv.	r^2	n	P	Length of stay (days) *Rastperiod (dagar)*
A	31 July–3 August	48	4.4	0.60	19	<0.01	20.2
B	14–17 August	38	44.7	0.58	16	<0.01	26.7
C	25–26 August	78	87.2	0.61	11	<0.01	22.7
D	25 September	73	100.0	0.52	10	<0.02	24.3

days) (Table 1), and the proportion of juveniles captured during event A and D were 4.4 and 100%, respectively. A comparison of the best fit lines from capture event A and D (Figure 3) showed no significant difference among slopes (MANOVA: $F_{1,25}$ = 0.17; P = 0.68).

The mean probability for a dyed Dunlin to stay at least one day after its capture was 95.1%, based on comparisons between the estimated total number of marked individuals present on day one after capture (see Methods) and the total number caught during each capture event. The mean probability for a dyed

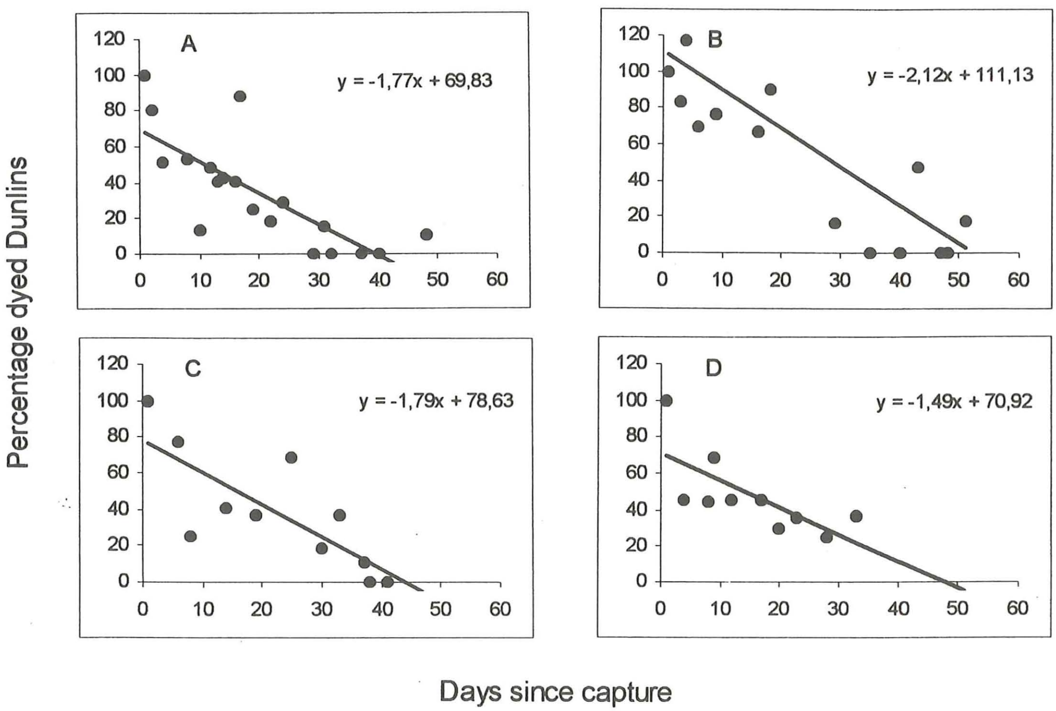

Figure 3. The proportion of dyed birds still present as a function of time after capture for the four capture events A to D (see Table 1). The best fit lines and their equations are given. The r^2-values from the Spearman Rank statistics are presented in Table 1.

Andelen färgade fåglar som fortfarande fanns kvar som en funktion av tiden efter fångsten för de fyra fångsttillfällena A till D (se Tabell 1). De bäst anpassade linjerna och deras ekvationer ges. Korrelationskoefficienterna (Spearman Rank) ges i Tabell 1.

Table 2. Number of arrivals and departures, and the estimated volume of Dunlins at Tipperne autumn 1996, using the method presented by Hicklin (1987). The estimated length of stay of 23.4 days is simplified to 25 days. After 16 November no new arrivals occurred.

Antalet ankommande och avresande kärrsnäppor samt det uppskattade totala antalet kärrsnäppor som rastade vid Tipperne hösten 1996, enligt metod presenterad av Hicklin (1987). Rastperiodens uppskattade längd var 23,4. Efter 16 november ankom inga nya fåglar.

Period	Count *Antal*	Arrive *Ankom*	Stay *Stannade*	Depart *Avreste*
5–9 Jun	85	85	0	0
10–14 Jun	102	17	85	0
15–19 Jun	41	0	41	61
20–24 Jun	132	91	41	0
25–29 Jun	102	0	102	30
30 Jun–4 Jul	180	78	102	0
5–9 Jul	372	203	169	11
10–14 Jul	801	429	372	0
15–19 Jul	657	0	657	144
20–24 Jul	2493	1836	657	0
25–29 Jul	1147	0	1147	1346
30 Jul-3 Aug	3200	2053	1147	0
4–8 Aug	4800	1600	3200	0
9–13 Aug	4212	0	4212	588
14–18 Aug	3700	47	3653	559
19–23 Aug	4350	650	3700	0
24–28 Aug	5138	2841	2297	2053
29 Aug–2 Sep	4183	645	3538	1600
3–7 Sep	5014	831	4183	0
8–12 Sep	6500	1533	4967	47
13–17 Sep	5120	0	5120	1380
18–22 Sep	5597	2588	3009	2111
23–27 Sep	7675	2723	4952	645
28 Sep–2 Okt	7292	448	6844	831
3–7 Okt	7650	1891	5759	1533
8–12 Okt	8007	357	7650	0
13–17 Okt	9635	4216	5419	2588
18–22 Okt	12172	5260	6912	2723
23–27 Okt	8765	0	8765	3407
28 Okt–1 Nov	9200	435	8765	0
2–6 Nov	3285	0	3285	5915
7–11 Nov	1477	0	1477	1808
12–16 Nov	1698	3071	0	2850
XX	0	0	0	1698
Volume		33928		33928

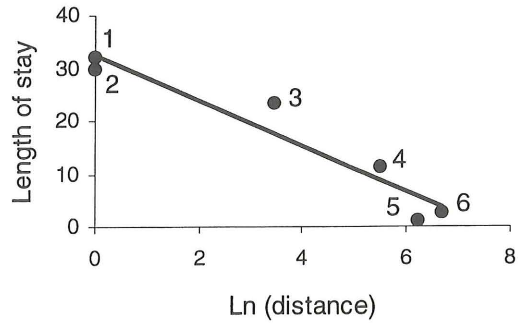

Figure 4. The linear relationship between length of stay (days) and the ln(x+1) transformed minimum distance (kilometre) to the temporary destination in the International Wadden Sea for Dunlins at six different staging areas in Northern Europe (r^2 = 0.924, P = 0.002). (1) Lower-Saxony, German part of the Wadden Sea (Onnen 1991); (2) Eiderstedt, German part of the Wadden Sea (Günter 1995); (3) Tipperne, Denmark (present study); (4) Amager, Zealand, Denmark (mean value between 1yr and 2yr+, Nørrevang 1955); (5) Ottenby, Sweden (mean value between 2yr and 3yr+, Holmgren et al. 1993); (6) Ledskär, Sweden (Mascher 1966).

Det linjära förhållandet mellan rastuppehållets längd (dagar) och minsta avståndet (kilometer, ln(x+1)-transformerat) till det temporära rastområdet i Vadehavet för kärrsnäppor från sex olika rastplatser i norra Europa (r^2 = 0,924, P = 0,002).

Table 3. From the standardized count schedule at Tipperne the maximum-number of Dunlins (max.) and number of birddays are shown for the autumns (20 June – 1 November) of 1987–96.

Högsta dagsssiffra (Max.) och antalet fågeldagar för kärrsnäppa vid Tipperne höstarna (20 juni – 1 november) 1987–1996. Värdena är hämtade från de standardiserade räkningarna.

Autumn *Höst*	Max.	Bird-days *Fågeldagar*
1987	9125	460816
1988	6200	241424
1989	15065	437513
1990	12666	477053
1991	7162	540153
1992	6208	441513
1993	10897	411968
1994	10516	503392
1995	5410	459717
1996	12172	671334
Mean	9542	464488

individual to be observed during a check was 22.6%. This frequency was obtained by dividing the number of checked individuals with the peak number of Dunlins recorded during that 5-days period, and finally averaged for all check events.

Since the estimated mean length of stay is a minimum value (see Methods), and because the bird counts are carried out within 5-day periods, a length of stay of 25 rather than 23.4 days is for simplicity used in further calculations. With a length of stay of 25 days, the volume of Dunlins at Tipperne is calculated to be 33,928 individuals during autumn 1996 (Table 2).

An analysis of data of length of stay from the literature, shows a significant negative linear relationship between the length of stay and the distance to the Wadden Sea for Dunlins at six different staging areas in Northern Europe ($r^2 = 0.924$, $P = 0.002$) (Figure 4).

Discussion

Length of stay

The overall mean length of stay of 23.4 days at Tipperne lies in the upper end of previously published estimates for Dunlins (Nørrevang 1955, Mascher 1966, Kersten & Smit 1984, Holmgren et al. 1993), but lower than the 29.7 days reported by Günter (1995) from the German Wadden Sea. Since Tipperne is situated very close to the Wadden Sea (the autumn destination), the migratory urge among Dunlins staging at Tipperne during autumn migration may be reduced in comparison with individuals staging at areas situated north or east of Tipperne. Hence, the Dunlins seem to stay for a shorter time at staging areas situated far from the temporary destination in the Wadden Sea, and once arrived in its vicinity the migratory urge is reduced and the length of stay is considerably increased (Figure 4). Just off the Wadden Sea Coast, at the island of Helgoland the length of stay of Dunlins is only 4–5 days (Dierschke 1996). Since Dunlins at Helgoland is on route to the British islands (the winter destination, Dierschke 1996) these birds may have a strong migratory urge resulting in a short period of stay.

It has been shown that juvenile Dunlins migrate later and more slowly from the breeding area in northern Eurasia to the Wadden Sea and the Wash than the adults (Nørrevang 1955, Mascher 1966, Dierschke 1996). However, at Tipperne this expected higher turnover among early arrivals (mainly adults) compared with the late arrivals (mainly juveniles) was not found. It must be stressed, though, that the present data do not disentangle the effect of season when comparing adults and juveniles, but it suggests that there is neither any effect of season. Dunn et al. (1988) reported the same conclusions (no difference in length of stay between age groups) for Semipalmated Sandpiper in Eastern Maine, Canada.

The geographic position of Tipperne only 30 kilometre north of the main autumn staging areas in the International Wadden Sea, makes it quite likely, that the area is commonly used by moulting adults (suggested by Meltofte 1987, pers. obs.). This means that some adult Dunlins stay at Tipperne for a prolonged period of time before they later migrate to the wintering grounds in Great Britain and the Atlantic coast of France (Gromadzka 1989, unpublished ring recoveries and resigths of Dunlins ringed at Tipperne), in turn, resulting in a rather long period of stay.

Assessing the international importance of staging areas

Important staging areas for shorebirds have long been identified on the basis of maximum numbers, and the international species criteria is based on proportions of the total numbers of individuals in a flyway population (estimated on the basis of midwinter counts in western Europe), like the 1% rule set down by the Heiligenhafen Conference, Germany, 2–6 December 1974 (Smart 1976, Prater 1981). According to this criterion, areas that support 1% or more of the flyway population of a species is considered of high international importance in a conservation perspective.

The wintering population of Dunlins in Europe has been estimated to 1.5 million (Prater 1981), and if the 1% rule is applied, 15,000 Dunlins at a given stop-over site is needed in order to qualify as a site of international importance. With a mean maximum number of 9542 Dunlins for the autumns of 1987–96, Tipperne does not qualify as a site of international importance, and in fact only one year during this period showed more than 15,000 Dunlins. However, using the estimated volume of 33,928 Dunlins for the autumn of 1996, Tipperne does fulfil the 1% criteria, emphasising the difficulties in using the maximum number as an indirect measure of the volume of waders. As also noted by Prater (1981), these data suggest that the mean maximum number is a highly artificial figure that underestimate the significance of a site, and probably does not relate to the absolute carrying capacity.

The increasing length of stay, when going from the stopover sites in east to the areas in west (Figure 4) will result in an undervaluation, as regards site quality, of the eastern staging areas if the criteria is based on maximum numbers from simple head counts. This is because a long length of stay will build up the staging population of waders to a high maximum number and number of bird-days. The only way to avoid this bias is to apply the volume as a measure of quality of stopover sites. This requires estimates of length of stay when important staging areas along the flyway of shorebirds has to be identified.

It is practically impossible to count the actual number of staging waders at a site during a given period of time due to the unknown turnover of individuals, thus, an estimate of volume will be the best available substitute to the real measure. Unfortunately, the processes involved demands considerable resources both in terms of manpower and time.

The number of bird-days may to some degree relate to the carrying capacity, and could be useful in defining the relative importance of stopover sites. The advantage of this measure is that it could be obtained on the basis of peak numbers from already existing head counts. Applying bird-days as a measure of relative site quality necessitates a discardance of the numerical criteria (e.g. the 1%-rule) and a preparation of other less transparent criteria's (e.g. a ranking criteria, where the most important areas are defined as internationally important).

The recorded maximum numbers of Dunlins at Tipperne from the autumns of 1987–96 was shown not to correlate with the number of bird-days. Furthermore, the maximum number from the autumn of 1996 failed to qualify the study area as a site of international importance, in contrast to the more reliable estimate of volume. Finally, the present study emphasises the bias resulting from different levels of migratory urge among waders at different staging areas along the flyway. So, when applying a simple numerical criterion of international importance of staging areas, knowledge of volume is preferable, leaving bird-days and especially maximum number as insufficient measures in this context.

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Sammanfattning

Rastningslängd och volymen av höstflyttande kärrsnäppor Calidris alpina *på Tipperne naturreservat, Danmark.*

Två gånger om året flyttar miljoner vadarfåglar i den ostatlantiska flyttningskorridoren, där de under vägen stannar och fyller på fettreserverna på flera rastplatser. På många av dessa lokaler har ornitologer av tradition organiserat räkningar av rastande individer. Man har fått en uppfattning om arternas fenologi och maximala antal. De registrerade maximala antalen har sedan använts som ett kvalitetsmått på rastlokalen (Prater 1981). Dylika övervakningsprogram ger oss dock ingen information om volymen (definierat som antalet fåglar som nyttjar en rastlokal under en given tidsperiod), en variabel som borde vara ytterst intressant i samband med en kvalitetsbedömning av rastlokaler. Skattningen av volymen är en relativt tids- och resurskrävande process, då det utöver rena fågelräkningar också kräver kännedom om individernas genomsnittliga uppehållstid i området. Syftet med den här studien var att (1) skatta rastningslängden hos höstflyttande kärrsnäppor i Tippernereservatet, Danmark; (2) beräkna volymen av rastande kärrsnäppor och därefter bedömma Tippernes betydelse som rastlokal; (3) anlysera sambandet mellan rastningslängden och avståndet till Vadehavet på sex rastplatser i norra Europa; (4) diskutera relevansen av att använda maximala antal, fågeldagar och volym som indikatorer på en rastplats kvalitet.

Metoder

Studien genomfördes under sommaren och hösten 1996 på tidvattenbottnarna i Tipperne naturreservat i sydänden av Ringkøbing fjord, Västjylland, Danmark (Figur 1). På Tipperne räknades antalet rastande kärrsnäppor fortlöpande minst en gång per femdagarsperiod. Tio års data på maximala antal och antal fågeldagar (kumulerat antal rastande fåglar under en tidsperiod) från dessa räkningar ställdes till förfogande av Danmarks Miljøundersøgelser (DMU-Kalø).

Under fyra perioder (Tabell 1) fångades och färgmärktes kärrsnäppor med en periodspecifik färg. Andelen av färgmärkta fåglar i de rastande flockarna registrerades efteråt i femdagarsintervaller med start dagen efter sista märkdag i perioden. Genom att anpassa en rät linje till förhållandet mellan andelen färgmärkta kärrsnäppor och tiden efter sista märkdag beräknades antalet fågeldagar enligt ekvation 1 och medelvärdet på rastningens längd enligt ekvation 2. För att skatta volymen användes Hicklins (1987) metod där maximalt antal och genomsnittlig rasttid är nödvändiga variabler. Statistiken beräknades med hjälp av Windowsversionen av SPSS (Norusis 1993).

Resultat

Det maximala antalet räknade kärrsnäppor på hösten 1996 var 12172 (Figur 2), och antalet fågeldagar under samma period var 671334 (Tabell 3). Som jämförelse var medelvärdet av det årliga maximala antalet 9542 individer under perioden 1987–96, medan medlet på fågeldagarna var 464488 (Tabell 3). Det fanns inget signifikant samband mellan maximala antalet och antalet fågeldagar för denna tioårsperiod. Rastningstiden för fåglarna från de fyra olika fångstperioderna varierade mellan 20,2 och 26,7 dagar, med ett snitt på 23,4 dagar. Det var därmed inte heller någon signifikant skillnad mellan linjerna i fångsterna A och C (Figur 3), som nästan uteslutande består av gamla respektive unga fåglar (Tabell 1). En analys av litteraturdata baserad på data från sex rastninglokaler visar ett signifikant negativt samband mellan rastningstidens längd och avståndet till Vadarhavet (Figur 4).

Eftersom den skattade rastningstiden är ett minimum och att räkningarna bara utfördes var femte dag, användes en rasttid på 25 dagar i beräkningarna av volymen. Volymen av rastande kärrsnäppor på hösten 1996 skattades till 33928 individer (Tabell 2).

Diskussion

Den genomsnittliga rasttiden på 23,4 dagar på Tipperne ligger över tidigare skattade rastningstider hos kärrsnäppan i Nordeuropa (Nørrevang 1955, Mascher 1966, Holmgren et al. 1993), men under Günters (1995) skattning från Vadehavet. Eftersom Tipperne

ligger mycket nära Vadehavet (kärrsnäppornas destination på höstflyttningen) så har kärrsnäpporna förmodligen en mycket lägre flyttningsdrift här än på rastplatser längre åt nordost. Det verkar alltså som att kärrsnäppor som är långt från sin destination uppvisar korta rastningstider, men när de kommer nära sin destination reduceras flyttningsdriften och rastningtiden förlängs märkbart.

Det har tidigare visats att juvenila vadarfåglar flyttar långsammare söderut och gör längre rastningsuppehåll på hösten än de adulta (Nørrevang 1955, Masher 1966, Dierschke 1996). På Tipperne rastade dock inte de juvenila fåglarna längre än de adulta, dock skall det nämnas att studien inte medgav någon möjlighet att kontrollera för säsongseffekter.

Viktiga rastplatser för vadare har i regel identifierats på basis av maximala antalet av individer från enskilda räkningar. Det mest använda kvalitetskriteriet har varit 1%–regeln, som säger att rastplatser som används av mer än 1% av den flyttande populationen kan anses som internationellt skyddsvärda. Populationen av övervintrande kärrsnäppor i Europa har skattats till 1,5 miljoner individer (Prater 1981), vilket innebär att en rastplats bör nyttjas av 15000 kärrsnäppor för att betraktas som skyddsvärd ur ett internationellt perspektiv. Med ett genomsnittligt maximalt antal på 9542 kärrsnäppor för höstarna 1987–96 kvalificerar Tipperna inte som en internationellt viktig rastplats, men ser man till den skattade volymen på 33928 kärrsnäppor för hösten1996 är Tipperna kvalificerad med bred marginal.

Den minskande rastningstiderna på rastlokaler längre österut leder till en ökad undervärdering av östliga rastplatsers betydelse om man enbart ser till det maximala antalet som ett kvalitetsmått. En lång rasttid gör att de rastande populationerna byggs upp i antal och att kvalitetsmåttet därmed ökar. Som även Prater (1981) påpekar så är maximala antalet ett opålitligt mått av en rastplats kvalitet, och kan i regel inte relateras till en rastplats absoluta bärförmåga.

Antalet fågeldagar är däremot i någon grad relaterat till rastplatsens bärförmåga, och kan vara användbart för att bedömma ett områdes internationella betydelse som rastplats. Fördelen med detta mått är att det är tillgängligt från de flesta redan existerande fågelräkningar. Man bör i dessa fall dock ej använda kvantitativa regler som 1%-regeln, utan snarare rangordna rastplatserna efter antalet fågeldagar och sedan bedömma de högst rankade som mest skyddsvärda. Slutligen kan man på grundval av föreliggande undersökning dra slutsatsen att när enkla kvantitativa kriterier för värderingen av en rastplats används (som 1%-regeln) är volymen att föredra som kvalitetsmått, medan antal fågeldagar och det maximala antalet är otillräckliga mått i dessa sammanhang.