To count or to catch: a comparison of two methods of determining wader migration phenology

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The phenology of wader migration at a stopover site can be studied using regular counts or systematic trapping, but each method may give different results. This issue is addressed by comparing daily counts and daily trapping at a study site in the mouth of the River Reda, Gulf of Gdańsk, Poland, during autumn migration 1996–2000. The discrepancies in migration patterns obtained by the two methods are not related to either the number of migrants that stopped in the study area, or to the total number of birds caught. It seems that the main drawback of using data from birds caught in walk-in traps is that trapping efficiency may differ not only between years, but also within a season. Therefore catching data, at least from walk-in traps, should only be used with caution in studies of migration phenology in waders.

INTRODUCTION

The phenology of wader migration at stopover sites is the subject of many studies (e.g. Dierschke 1994, Harengerd *et al.* 1973, Meissner & Sikora 1995, Pannach 1992, Wójcik *et al.* 1999), and forms the basis of other more detailed studies (e.g. Anthes 2004, Anthes *et al.* 2002, Remisiewicz *et al.* 2007). Usually, regular counts are used to record changes in bird numbers, but in some cases numbers of birds caught during systematic catching is used to describe migration patterns (e.g. Gromadzka 1987, Gromadzka & Serra 1998, Scebba & Moschetti 1996, Teubert & Kneis 1980). These two methods may give different results (e.g. Brening 1986), especially when trapping efficiency is low and variable within a season.

The aim of this paper is to compare patterns of wader migration derived from counts and catching using walk-in traps for two wader species that differ in abundance and foraging method.

MATERIAL AND METHODS

Data used in this paper were collected between 1996 and 2000 at a study site in the mouth of the River Reda, Puck Bay, on the Baltic coast of Poland. Every year daily counts were carried out from 15 July to 27 September along a fixed route through all places where waders could rest or feed. During the same periods, waders were caught in 30–40 walk-in traps that were checked every two hours from dawn to dusk (Meissner 1998). There are virtually no measurable tides in the Baltic, but wind may cause small changes in water level. Therefore the traps were often relocated in order to maintain trapping efficiency. Migration patterns were analysed in five-day periods or pentads (Berthold 1973). Each autumn study period consisted of 15 consecutive pentads. During counts it was impossible to distinguish between newcomers and birds which had been present for several days in the study area, hence short-term retraps were included in the analysis of the trapping data.

Data on Dunlin *Calidris alpina* and Ringed Plover *Charadrius hiaticula* are used to compare the results of catching and counting. Dunlin is one of the most numerous autumn migrants in the study area, while Ringed Plover occurs regularly, but in smaller numbers. More information on the occurrence of these species in the study area is given in Meissner (2007).

Total numbers of Dunlins and Ringed Plovers recorded differed between years. Therefore for each year the number of birds recorded in each pentad was converted into the percentage of the aggregate total of daily counts for the whole 15-pentad study period. Thus the mean percent of birds in consecutive pentads across all years is used in a multi-year analysis of migration dynamics. This approach is applied to the results of both counting and trapping.

The overall differences between migration patterns derived from counts and trapping were assessed by determining a "discrepancy index" which is the mean absolute difference between the two datasets:

$$d = \frac{\sum_{n=1}^{n=15} |P_T - P_C|}{15}$$

where:
d = discrepancy index
n = consecutive pentads from 1st to 15th
P_T = proportion of birds trapped in a certain pentad
P_C = proportion of birds counted in the same pentad
The maximum value of this index (d_{max}) in the case of 15 pentads is 0.133, when the two migration patterns are completely separate. Thus, in this paper the discrepancy index is expressed as a proportion of its maximum possible value:

$$d' = \frac{d}{d_{max}}$$

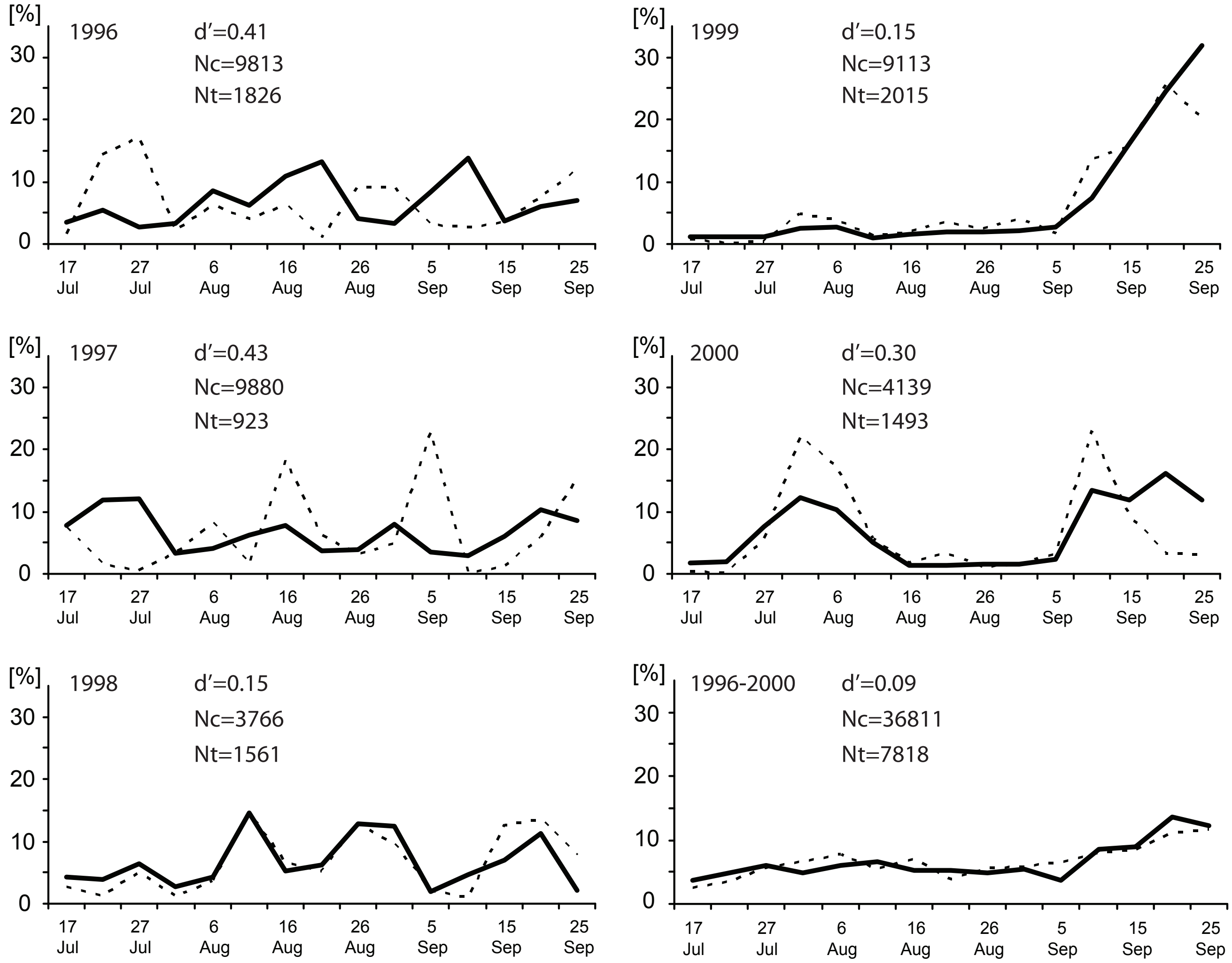

Fig. 1. Autumn migration phenology of Dunlin according to counts (solid line) and trapping (dashed line) at the mouth of the river Reda, Poland, during each of the five years 1996–2000 together with the five-year mean (in each graph the x-axis is the study period divided into 15 five-day periods (pentads); d' = discrepancy index, Nc = aggregate birds counted during the 15 pentads, Nt = aggregate birds trapped during the 15 pentads including retraps; the y-axis is the number of birds counted or caught in each pentad expressed as a percentage of Nc or Nt respectively).

Discrepancy indices were calculated for each season separately and also for each pentad in a multi-year analysis.

For each season and each species the median pentad of the migration period and the pentad of the first and the third quartile of the total number of migrants were calculated to determine whether there were between-year differences in migration phenology revealed by each method.

RESULTS

Migration pattern

In Dunlin the discrepancy index ranged from 0.15 to 0.43 between years. In 1998 and 1999, the results of both counts and trapping showed a very similar migration pattern. In 1998, both methods showed three peaks of bird numbers in the same pentads. Similarly, in 1999 there was close agreement with only a minor discrepancy in the final pentad. Thus the discrepancy index calculated for these seasons was low (0.15 in both cases). In 2000, the discrepancy index was larger (0.30) and there were major differences between the two methods, particularly in the last four pentads, when the relative number of birds trapped decreased despite the fact that counts showed Dunlins were still numerous in the study area (Fig. 1). In the two remaining seasons, 1996 and 1997, there were even greater differences between the migration patterns derived from the two methods. Peaks of Dunlins trapped did not correspond to peak counts and the discrepancy index was even higher (0.41 and 0.43; Fig. 1). Inconsistencies between the two methods were very small in the multi-year analysis, when the discrepancy index was only 0.09 (Fig. 1). However, the pooling of only five years' data is enough to completely obscure the typical pattern of Dunlin migration which is characterised by a series of waves (see Meissner & Strzałkowska 2006).

Although Ringed Plover numbers at the study site are much lower than those of Dunlin, the differences between the migration patterns derived from counts and trapping were similar, with the discrepancy index varying between 0.22 and 0.47 (Fig. 2). In 1998, both methods showed 3 peaks of Ringed Plover numbers, though the first peak was differed by one pentad according to which method was used (Fig. 2). In other years, the timing of migration peaks derived from each method was not the same. As with Dunlin, pooling the data in a multi-year analysis resulted in a low discrepancy index of only 0.20.

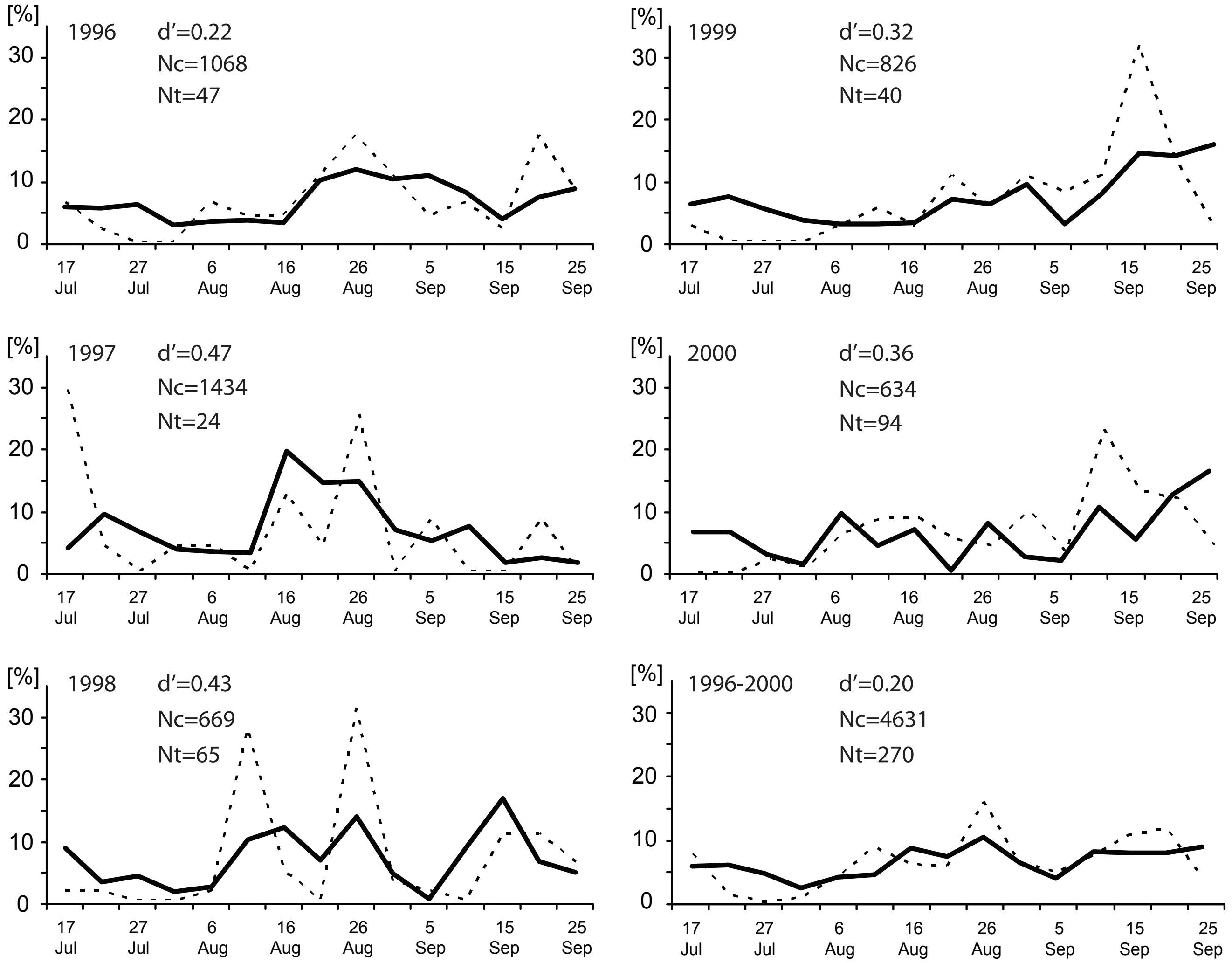

Fig. 2. Autumn migration phenology of Ringed Plover according to counts (solid line) and trapping (dashed line) at the mouth of the river Reda, Poland, during each of the five years 1996–2000 together with the five-year mean (in each graph the x-axis is the study period divided into 15 five-day periods (pentads); d' = discrepancy index, Nc = aggregate birds counted during the 15 pentads, Nt = aggregate birds trapped during the 15 pentads including retraps; the y-axis is the number of birds counted or caught in each pentad expressed as a percentage of Nc or Nt respectively).

There was nowhere near a significant correlation between the discrepancy index and the aggregate number of birds counted or between the discrepancy index and the aggregate number of birds trapped for Dunlin (counted: $r = -0.36$, $n = 5$, $P > 0.05$; trapped $r = -0.55$, $n = 5$, $P > 0.05$) or for Ringed Plover (counted: $r = 0.19$, $n = 5$, $P > 0.05$; trapped: $r = -0.11$, $n = 5$, $P > 0.05$).

Migration phenology

In both species there were conspicuous differences according to method in the median pentad of autumn migration and in the pentads when 25% and 75% of migrants passed through the study area (Fig. 3). The position of the median differed by up to 6 pentads in Dunlin and by up to two pentads in Ringed Plover, but for both species the median was the same pentad in 1998 and the greatest difference occurred in 2000 (Fig. 3). However, in the case of the pooled multi-year analysis, the median pentad differed by only one in Dunlin and in Ringed Plover it was the same. For Ringed Plover, the time span between occurrence of 25% and 75% differed by just one pentad according to method, but in Dunlin trapping indicated a much earlier passage than counts (Fig. 3).

DISCUSSION

The size of discrepancies in migration patterns obtained according to counts and trapping differed between years and was not related to either the aggregate number of migrants counted or the total caught. However, it would seem likely that in the case of a very scarce species the dates on which birds are trapped would show little correlation with migration pattern.

The main problem in using data from walk-in traps is that trapping efficiency can differ between years and also within a single migration season. Such changes might be caused by frequent moving of traps to take account of fluctuating water levels, and/or changes in the distribution of waders across the foraging site. Therefore caution should be exercised in using results from walk-in traps to study migration phenology. In any one season, the difference between migration patterns derived from trapping and counting might either be large or very small. Probably this will depend on a variety of local factors. If data for several years are pooled, these differences may be reduced. However, the resulting pattern may not be representative of what happens in a single year because waves of migration are obscured if they do not occur at exactly the same time in different years.

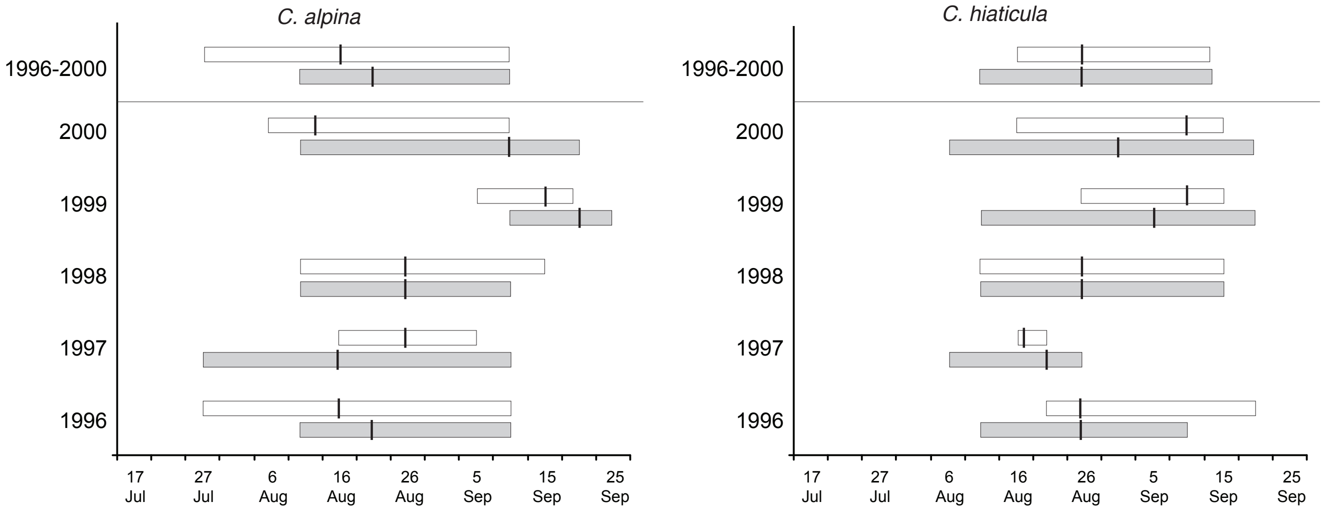

Fig. 3. Comparison of autumn migration phenology of Dunlin *Calidris alpina* and Ringed *Charadrius hiaticula* Plover according to of counts (grey bars) and trapping (white bars) in the mouth of the River Reda, Poland, during each of the five years 1996–2000 and the five years combined (vertical line = median pentad, rectangle = period between the occurrence of 25% and 75% of migrants i.e. inter-quartile range).

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REFERENCES

Anthes N. 2004. Long-distance migration timing of *Tringa* sandpipers adjusted to recent climate change. *Bird Study* 51: 203–211.

Anthes N., Harry, I., Mantel, K., Müller, A., Schielzeth, H. & Wahl, J. 2002. Notes on migration dynamics and biometry of the Wood Sandpiper *(Tringa glareola)* at the sewage farm of Münster (NW Germany). *Ring* 24: 41–56.

Berthold, P. 1973. Proposals for the standardisation of the presentation of data of animal events, especially migratory data. *Auspicium, Suppl.*: 49–57.

Brenning, U. 1986. Zum Durchzug nordischer Watvögel *(Limicolae)* auf der Insel Langenwerder (Wismar-Bucht). *Tiere der polaren regionen.* VEB Gustav Fischer Velag, Jena, pp. 86–96.

Dierschke, V. 1994. Phänologie und Fluktuation des Rastvorkommens der Strandläufers *Calidris*-Arten auf Helgoland. *Vogelwelt* 115: 59–68.

Gromadzka, J. 1987. Migration of waders in Central Europe. *Sitta* 1: 97–115.

Gromadzka, J. & Serra, L. 1998. Differential migration of juvenile and adult Grey Plovers *Pluvialis squatarola* at the mouth of the Vistula River, Poland. *Ornis Fennica* 75: 193–199.

Harengerd, M., Prünte, W. & Speckmann, M. 1973. Zugphänologie und Status der Limikolen in den Rieselfeldern der Stadt Münster. *Vogelwelt* 94: 81–147.

Meissner, W. 1998. Some notes on using walk-in traps. *Wader Study Group Bull.* 86: 33–35.

Meissner, W. 2007. To count or to catch? Do walk-in traps lead to a biased measure of wader productivity? *Wader Study Group Bull.* 113: 53–56.

Meissner, W. & Sikora, A. 1995. [Spring and autumn migration of waders *(Charadrii)* on the Hel Peninsula] *Notatki Ornitologiczne* 36: 205–239. (In Polish with English summary)

Meissner, W. & Strzałkowska, M. 2006. Autumn migration dynamics of the Dunlin *(Calidris alpina)* at the Reda Mouth (southern Baltic). *Ring* 28: 3–13.

Pannach, G. 1992. Phänologische Untersuchungen des Limikolenzuges 1979 bis 1991 in den Braunschweiger Rieselfeldern. *Braunschw. naturkdl. Schr.* 4: 27–57.

Remisiewicz, M., Meissner, W., Pinchuk, P. & Ściborski, M. 2007. Phenology of spring migration of Wood Sandpiper *Tringa glareola* through Europe. *Ornis Svecica* 17: 3–14.

Scebba, S. & Moschetti, G. 1996. Migration pattern and weight changes of Wood Sandpiper *Tringa glareola* in a stop-over site in southern Italy. *Ringing & Migration* 17: 101–104.

Teubert, W. & Kneis, P. 1980. Rastphänologie des Flußuferläufers *Actitis hypoleucos,* nach Beringungsergebnissen aus dem nordsächsischen Tiefland bei Riesa. *Actitis* 18: 33–44.

Wójcik C., Rydzkowski, P. & Ściborski, M. 1999. The spring migration of waders *(Charadrii)* in the lower Vistula valley. *Ring* 21: 79–90