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Ornis Hungarica 2019. 27(1): 110–116.
DOI: 10.2478/orhu-2019-0007

Assessment of the breeding and wintering sites of Eurasian Woodcock *(Scolopax rusticola)* occurring in Hungary based on ringing recovery data

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Received: November 26, 2018 – Revised: December 22, 2018 – Accepted: January 07, 2019

Schally, G. 2019. Assessment of the breeding and wintering sites of Eurasian Woodcock *(Scolopax rusticola)* occurring in Hungary based on ringing recovery data. – Ornis Hungarica 27(1): 110–116. DOI: 10.2478/orhu-2019-0007

Abstract Using the latest dataset of the Hungarian Bird Ringing Centre, the aims of this study were to describe the monthly spatial pattern of woodcock occurrence and to assess the main wintering and breeding areas of the birds associated with Hungary in the last decade. Descriptive analyses were performed regarding the annual number of detections (ringing, recaptures and recoveries), and the relation between the annual number of woodcock ringers and the number of ringed birds was tested. Minimum convex polygons (MCP) were calculated for the detections of each month, and the variation of the monthly MCP size was evaluated. Distances of all detection locations were measured from the geographical central point of Hungary, and the distributions of these distances were compared among the months. The annual number of ringed birds increased, however it was not in relation with the number of people involved in ringing. The rate of recoveries was 7.5%. Two types of the recovery circumstances were registered: 89.9% by hunting, 10.1% found dead. MCPs were calculated for eight months. Each MCP overlapped with Hungary, to varying degrees, however remarkable differences were found in the MCP sizes among the different months. The largest areas were covered in December, January and February, while the areas in September and October were less than half of that size. The shortest distances to the country were registered in March, April, October, and November. Moderate distances were recorded in May and September, and the longest distances were found in December, January and February. Large amount of data is available about the wintering areas, and a wide wintering zone can be estimated. In contrast, there is no or only very little information about the areas covered in summer.

Keywords: Eurasian Woodcock, migration, ringing, recoveries, spatial analysis

Összefoglalás A vizsgálat célja a Magyarországon jelölt vagy megkerült erdei szalonkák szezonális előfordulásának elemzése, és az alapján a fő telelő- és költőterületek lehatárolása volt a Magyar Madárgyűrűzési Központ adatainak felhasználásával. Leíró jellemzéssel értékeltem az előfordulások (gyűrűzések, megkerülések és visszafogások) számát, és vizsgáltam a gyűrűzést végző személyek száma és a gyűrűzött egyedek száma közötti kapcsolatot. Az előfordulási helyek alapján minimum konvex sokszögekkel (MKP) előfordulási területeket határoztam meg havi bontásban, és a területek méreteit összevetettem. Az előfordulási helyek Magyarország geometriai középpontjától mért távolságait havi bontásban értékeltem. A szalonka gyűrűzések száma az elmúlt tíz évben jelentős mértékben nőtt, ez azonban nem függött össze a gyűrűzést végző személyek számának alakulásával. A megkerülések aránya 7,5% volt, ebből 89,9% vadászathoz, míg 10,1% egyéb okból történt elhulláshoz köthető. Nyolc hónap pontjai alapján lehetett MKP-t lehatárolni. Ezek mindegyike érintette az ország területét, viszont méreteikben jelentős eltérés mutatkozott. A legnagyobb méretű területeket december, január és február hónapok esetében találtam, míg a szeptemberi és októberi területek kisebb, mint fele akkorának bizonyultak. Az ország középpontjához legközelebb a március, április és október hónapok, legtávolabbra pedig a decemberi, januári és februári előfordulási helyek estek. A nagy mennyiségű téli időszakból származó előfordulási hely alapján egy széles, nagy kiterjedésű telelőterület határolható le, ezzel szemben a nyári előfordulásról semmilyen közvetlen információval nem rendelkezünk.

Kulcsszavak: erdei szalonka, vonulás, gyűrűzés, megkerülés, térbeli elemzés

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Introduction

Ringing data of Eurasian Woodcock *(Scolopax rusticola)* is the most reliable source of information available to date in Hungary about the migration movements of this cryptic and difficult-to-observe species. However, due to the difficulties of capturing, there was a very low amount of data gathered until a methodological change in the last decade. The most effective way to capture woodcock is night trapping with dip nets (Gossmann *et al.* 1988). The method aims to capture individual birds feeding on the ground on open fields (grazed meadows or agricultural lands). Birds are detected and approached silently using spot lamps, and then they are covered with a bell-shaped net (~1 m diameter), which is attached to a 4–8 meter long rod (bamboo or plastic). The capturing method is especially selective, not only for the species but in some cases, even for individuals (Bub 1996). It has been used successfully for capturing other species as well, like Nightjars (Forero *et al.* 2001), Pheasants (Labisky 1959) or sandgrouse (Benítez-López *et al.* 2010). The method was introduced in our country with the kind help of French ringers in 2005 (Fluck 2011). Before that, most captures occurred unintentionally, during the captures of passerines with mist nets. Capturing with mist nets combined with visual and audio lures proved to be successful in special circumstances recently (Heward *et al.* 2017), especially for males during the breeding season, although its importance is still lower.

Thanks to the effectiveness of dip nets, the number of Woodcocks ringed multiplied in the last decade (Schally 2015), therefore now it is possible to assess seasonal spatial distribution of the species.

Using the latest available dataset, the aims of this study were (1) to describe the monthly spatial pattern of woodcock occurrence based on ringing and recovery locations between 2005 and 2017, and (2) to assess the main wintering and breeding areas of the birds associated with Hungary.

Material and Methods

The official data of the Hungarian Bird Ringing Centre was used for all analyses. In total, 732 records of detections (ringing, recapture and recovery) were available from the period between 1913 and 2017, from which the number of birds ringed in Hungary was 475. As 90% (429 records) of the whole dataset belonged to the period 2005–2017, I decided not to use older data for further analyses. This may have also decreased the chance of bias caused by possible long-term changes in the migration patterns. Descriptive analyses were performed regarding the annual number of detections (ringing, recaptures and recoveries), and the relation between the annual number of woodcock ringers (who reported at least one ringed bird in a given year) and the number of birds ringed was tested with Pearson linear correlation.

The location of each detection was displayed on a map, and minimum convex polygons (MCP – an area bordering all points by connecting the most outer ones) were calculated for each month, then the variation of the monthly MCP size was evaluated.

Distances of all detection locations were measured from the geographical central point of Hungary, and the distributions of these values were also compared among different months.

Spatial analyses were performed with Quantum GIS (v2.14) and statistical analyses were conducted using R software (v3.3.1).

Results

Descriptive analysis

The annual number of ringed birds increased during the study period *(Figure 1)*, however it was not in relation with the number of people involved in ringing (r = 0.432 NS). It should be noted, that the number of people was relatively low during the whole period (Mean = 9.846; SD = 3.105).The rate of recoveries compared to the total number of birds ringed (only in the case of woodcocks ringed in Hungary) was 7.5% (32 records). Two types of the recovery circumstances were registered during the study period: 89.9% by hunting, 10.1%

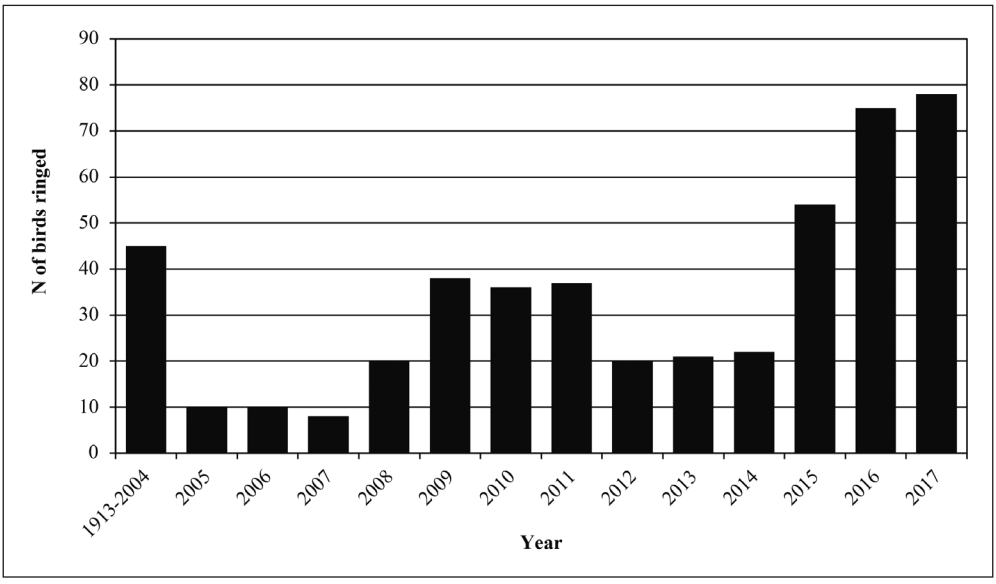

Figure 1. Annual number of the ringed Eurasian Woodcock in Hungary (1913–2017)
1. ábra Az erdei szalonka gyűrűzések évenkénti számának alakulása Magyarországon (1913–2017)

found dead. The rate of recaptures compared to the total number of birds ringed was similar to recoveries (29 records – 6.8%). While most recoveries occurred abroad (27 records – 84.4%), there was only one recapture that was not registered at the exact same ringing site, but 1,132 km further.

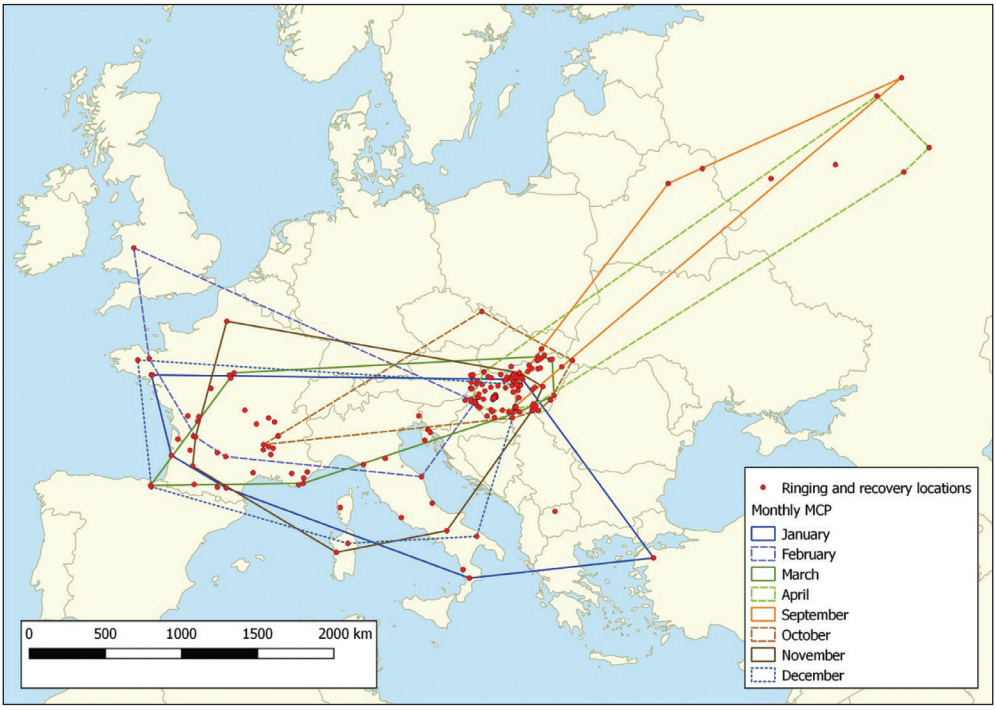

Figure 2. Locations of Eurasian Woodcock ringing and recovery (2005–2017)
2. ábra Az erdei szalonka gyűrűzések és megkerülések térbeli eloszlása (2005–2017)

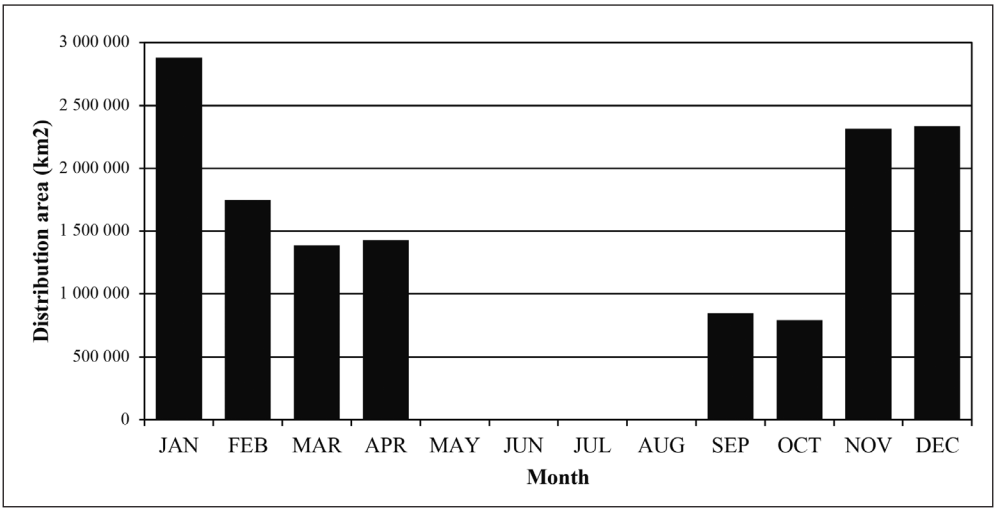

Figure 3. Monthly variation in the size of distribution areas represented by minimum convex polygons
3. ábra A minimum konvex sokszögek által határolt elterjedési területek méretei az egyes hónapokban

MCP sizes

MCPs were calculated for eight months. It was not possible to calculate for June, July, and August, due to the complete lack of data from those months. May was also excluded because of the small amount of points (3 detections). Each calculated MCP overlapped with Hungary, to varying degrees *(Figure 2)*, however remarkable differences were found in the MCP sizes among the different months *(Figure 3)*.

The largest areas were covered in winter (December, January and February – Mean = 2,321,267.26 km^2, SD = 566,788.78 km^2), while the areas in September and October were less than half of that size (Mean = 817,365.86 km^2, SD = 38,407.38 km^2).

Distance from the country centre

Large difference was found among the months regarding the distances of detection locations measured from the central point of Hungary. However the data did not fit the assumptions of either normality, nor the similarity of distributions, therefore no statistical comparisons were performed *(Figure 4)*. According to the distributions of the monthly data, three different groups could be identified: The shortest distances to the country were registered in March, April, October, and November. Moderate distances were recorded in May and September. The longest distances were found in December, January and February.

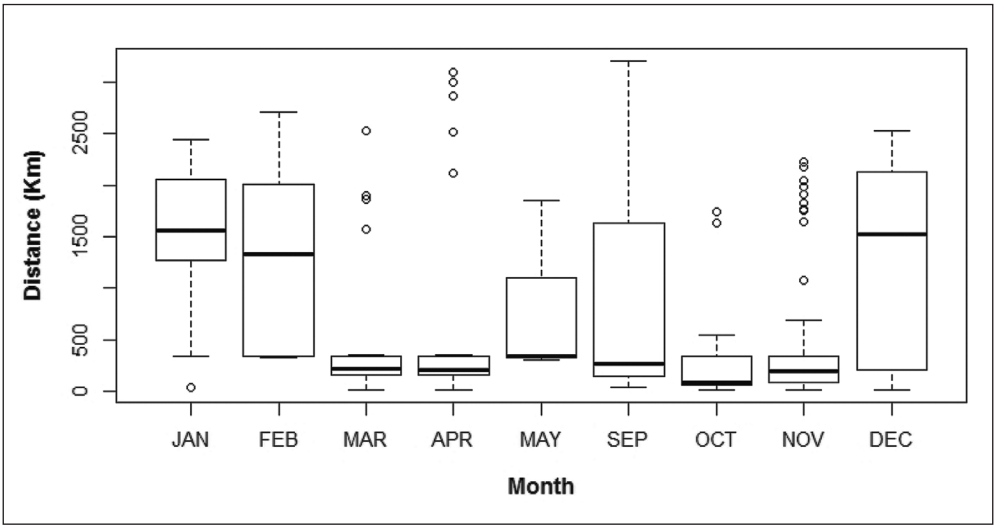

Figure 4. Monthly variation in the distance of ringing and recovery locations to the central point of Hungary

4. ábra A gyűrűzések és megkerülések helyszíneinek Magyarország geometriai középpontjától mért távolságainak alakulása az egyes hónapokban

Discussion

Large amount of data is available about the wintering areas, and a wide wintering zone can be estimated. In contrast, there is no or only very little information about the areas covered in May, June, July or August. We can only guess these locations by the zones assessed using the points of April and September, and by older ringing data (Faragó 2006). Regarding the dominance of hunting among the recovery circumstances, the results might be strongly influenced by regional and seasonal differences in hunting activity. In most countries, hunting seasons are established in winter, and there are some in spring, but not one of course in summer (Ferrand & Gossmann 2009). Therefore, one possible way to get the missing information is raising the activity of ringing in the areas, where woodcocks are most probably breeding according to our knowledge. Ringing activity is also higher in wintering areas, e.g. in France more than 6,000 individuals are ringed annually (Rest *et al.* 2017). Fortunately, the activity has been raised recently also in Russia (Fokin & Fokina 2017). Although finding and ringing of broods would be necessary, recent studies showed that it also has serious drawbacks: finding nests or chicks requires much effort and time, and the incubating females are very likely to abandon their nests even after their first detection (Fokin & Fokina 2017). Capturing in summer might also be more difficult, because the habitat use of the birds might change during warm and dry periods, and they do not leave the forests to search for food on open grounds (Hoodless & Hirons 2007).

The largest areas were covered in winter, which can be surprising. One might expect that the birds are usually moving from large breeding areas to smaller, narrower wintering areas. The results however do not support this assumption. High genetic diversity and weak population structuring was found in the birds associated with Hungary (Schally *et al.* 2018), which can also be explained by a relatively large breeding area.

It is also surprising, that even with the largest maximum monthly distance values, still the detections of April and September generally fell closer to the centre of the country than the detections in winter. Satellite telemetry studies have shown that some birds might breed further as previously stated based on ringing recovery data (Arizaga *et al.* 2015, Rest *et al.* 2018), thus this difference is very likely to be caused only by the lack of data. Another possible cause of this result can be the individual variance in the timing of migration. However, based on the results, the assumption that most woodcocks might breed relatively close to the Carpathian Basin, cannot be excluded. For example, in France, beside a local breeding population (Ferrand *et al.* 2003), stable isotope studies revealed that the Baltic–Western European Russia and the Central-European regions are the most important origins of the birds in that country (Hobson *et al.* 2013).

Conclusion

Although the woodcock ringing activity has raised in many countries in the last decade, there is still a lack of sufficient information about the origins of birds that occur in the country. Despite the low chance of successful detection, woodcock ringing efforts in the summer in Hungary should be improved in order to have more reliable information, but a more proper assessment of the main breeding areas could be best aided by a satellite telemetry project.

Acknowledgements

I would like to express my gratitude to the Hungarian Bird Ringing Centre for providing the ringing data. I am also thankful to Dénes Fluck for his persistent work and efforts supporting the woodcock ringing project in Hungary. Furthermore, many thanks to all professional ringers, who helped data collection with their fieldwork.

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