Review on Agriculture and Rural Development 2022 vol. 11 (1-2) ISSN 2677-0792
DOI: 10.14232/rard.2022.1-2.168-175

EURASIAN WOODCOCK MONITORING IN HUNGARY BETWEEN 2009–2021

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ABSTRACT
To preserve the traditional spring hunting of the Eurasian Woodcock (*Scolopax rusticola*) in Hungary while also assuring its sustainability, a monitoring program was maintained with the coordination of the Hungarian Hunters' National Association. The program's primary goal was to estimate the size of the migrating population in the country based on synchronised census data and track its long-term changes. The program was maintained successfully with national coverage in the last 13 years, and it was based on synchronised roding surveys performed weekly, 12 times each spring. The observers used standardised paper forms to record the number of contacts (Woodcocks seen and/or heard). Hunting of Woodcock between 2010–2021 was only allowed for the monitoring program participants with strict regulation and obligatory sample collection from each bird. The primary purpose of sample collection was to assess the sex- and age structure of the population and to evaluate their trends. According to the results, no significant trend could be observed either in the annual detection rates (successful observations) or the sex- and age composition between 2009 and 2021. The proportion of males was above 75% each year, while the proportion of 2nd year birds and adults was almost identical in the annual hunting bags. The measure of harvesting was low, and it had no significant, detectable impact on the examined population parameters.

Keywords: Woodcock, monitoring, observation, population estimation

INTRODUCTION

Due to their camouflage and behaviour, the detectability of Eurasian Woodcock (*Scolopax rusticola*) is very low; thus, the amount and the quality of information about the population size and trend are generally low as well. To ensure the sustainable management of the species, it is essential to regularly collect data on the population with reliable methods.

The regulation of Woodcock hunting in Hungary has changed several times in the last half-century. From 1970, the method of hunting was limited to posting, and the season was limited to spring. The reasons for this regulation were that this hunting method is likely to have the least adverse effect on the population and that this season has no overlap and therefore no conflict with big game hunting (OROSZI, 1996). However, according to the European Union Council Directive 79/409/EEC on the conservation of wild birds, hunting in spring is prohibited because it is the season when breeding and the migration to breeding grounds takes place. Although national and EU legislations aim to protect the species, they formally contradict each other. The possible effects and risks caused by the derogation from the EU legislation can only be adequately evaluated when scientific research and data are available. To preserve the traditional spring hunting in Hungary, a monitoring program started in the spring of 2009 with the coordination of the Hungarian Hunters' National Association. The program's primary goal was to estimate the size of the migrating population occurring in the country based on synchronised census data and to track its long-term changes. The continuous and regular data collection makes it possible to evaluate the sustainability of hunting in the Hungarian context and its potential effects on the population. In addition to the basic information, the monitoring program also provided an opportunity to carry out further research through samples collected by hunting, to

understand better the population's structure and the biological background of the behaviour of the birds.
This study aimed to analyse the occurrence and the population structure of the migrating Eurasian Woodcock in Hungary between 2009–2021, based on the data of the monitoring program. We have evaluated the possible changes and trends in the given period.

MATERIALS AND METHODS

Data collection

For this study, we used the observation and sampling data of the Hungarian Woodcock Monitoring Program. The program was maintained with national coverage and was based on synchronised roding survey counts performed weekly, 12 times each spring. The observers chose the locations of the observation points and carried out the observations every Saturday evening. As the dates of the observations fell on different calendar days in each year, we determined their sequence numbers based on the sequence numbers of the calendar weeks (weeks 6–18). There was a difference in the starting week numbers among some years, so we were finally able to split the data into 13 observation dates. The data recorded on the standard paper forms were the identification number of the observation point, its geographical coordinates, the number of birds detected (seen and heard), the estimated size of the observed area, the exact duration of the observation, the weather characteristics and the land cover of the area. Coordinates of observation points were also available, making it possible to perform spatial analyses. Between 2009 and 2021, we collected and processed data from 856–1 237 observation points per year, in total, 135 819 (7 140–13 054 / year) observation forms were collected.
The shooting of Woodcock between 2010–2021 was only allowed for the monitoring program participants with strict regulation and obligatory sample collection from each bird. The primary purpose of sample collection was to assess the sex- and the age structure. Still, it also allowed us to examine factors that affect the observations and also the genetic relationships among the birds. Since 2015, samples from the birds had to be sent to the Hungarian University of Agriculture and Life Sciences, Department of Wildlife Biology and Management (formerly: Szent István University, Institute for Wildlife Conservation). The sample collection was conducted at the national level between 2015–2021; in this study, we examined the data derived from that period. The hunters registered the data of the taken birds (place, time with year-month-day-hour-minute accuracy, body length, body weight, sex of the individual) on standardised paper forms. In addition, wing samples had to be sent with each paper form, which was needed to estimate the age ratio of the population. Based on the moult stages of the wing feathers the bird’s age (2^{nd} year bird or adult) was determined (FERRAND and GOSSMANN, 2009a). We processed the data of 19 773 individual spring shot bird samples (2 021–3 953 / year) between 2015–2021.
It would be tough to determine precisely how large an area they characterise for each observation point, but a general approximate value is worth determining. Based on the reported distances covered by the birds during movements between habitats at dawn and dusk (DURIEZ ET AL., 2005; HOODLESS and HIRONS, 2007; GUZMÁN ET AL., 2017) and the radius of the area used during roding flights (HIRONS, 1980), we chose 1 km^2 as the size of the area characterised by the observation points. We covered the entire country with GIS software with a 1 km^2 cell-size grid (93 832 in total). Based on their location, we assigned the observation points to the cells encompassing them. Further data processing based on observation numbers (calculation of weighted spatial means and population size estimation) was performed using the data projected on the 1 km^2 grid. In the case of annual

observation data, the number of cells covered by the points varied between 809–1 092. While there was no significant variation in the number of cells covered over the years, there was considerable variability in their locations. We were able to link the bird sampling data to 606–811 cells per year.

Data analysis

Statistical evaluations were performed with Microsoft Excel 2016 and PAST (v3.24) software. Spatial analyses and data mapping was made with QGIS (v2.18.24).
We prepared a descriptive characterisation of the number of Woodcocks detected (seen / observation point/observation date) for the observation data grouped by years.
Detection rates (the ratio of successful observations to total observations) were calculated to eliminate discrepancies from multiple observations for each observation time point. To determine the proportions, we used only the number of Woodcocks seen. The number of birds heard was not considered during this process due to their presumably high periodic variability. Detection rates were also calculated annually (total number of successful observations / total number of observations). We have analysed the temporal trend in the annual peaks of detection rates using a general linear regression model.
To characterise the spatiotemporal aspects of the detections, we connected the data to the cells of the 1 km^2 cell-size grid using GIS software. The number of points in each cell was not uniform, so only the point with the maximum detection value was included in each cell. Spatial mean points weighted by the number of Woodcocks seen were calculated for each observation date (separately per year). The temporal trend of the X and Y coordinates of the spatial means was examined using a general linear regression model.

Analyses of sampling data of shot birds

We prepared the descriptive characterisation of the number of birds taken at one point and one event. We calculated the total number of takings at one point in a year.
We characterised the development of sex and age composition within the years. We examined their changes within the years with a linear regression model and their possible correlation with the size of the hunting bag with the Pearson correlation test.
To characterise the spatiotemporal changes of the takings, we connected the hunting bag data to the cells of the 1 km^2 cell-size grid with GIS. Each cell contains the weekly sum of the number of takings for each point within. To ensure comparability with observation data and the proper sample sizes required for spatial processing, we summarised the numbers of birds taken every week according to the schedules of observation dates. Spatial mean points weighted by the number of takings were calculated for each (observation) date. We examined the temporal trend of the spatial means of each year with a general linear regression model.

RESULTS

Observation data

The number of sightings (Woodcocks seen) registered by observers during spring observations ranged from 0 to 28 ($\bar{x}$ = 0.8; sd = 1.5) (*Figure 1*). The lower quartile and mean number of birds seen was also the highest at the 7th observation date (*Figure 2*). In 65.1% of all observations (88 367 / 135 819), no Woodcock was seen.
A single-peak bell curve can characterise the temporal dynamics of detection rates in each year. The detection rates rose steadily from 0 to 70–90% until 20 March, after which they

fell to around 0% by 15 April. Variability was lowest at the peak. We have not found any temporal trend in the annual peaks of detection rates ($r^2 = 0.28$; NS).
There was a spatiotemporal shift in the weighted spatial means of the spring detections toward both North and East. The mean values for both X and Y coordinates showed a continuously increasing trend (X: $r^2 = 0.31$; $t = 8.212$; $p < 0.001$; Y: $r^2 = 0.40$; $t = 9.869$; $p < 0.001$). In the case of the sampling data, a trend with a similar direction and slope was observed in spring, and the strength of the linear relationship was also similar (X: $r^2 = 0.22$; $t = 4.1915$; $p < 0.001$; Y: $r^2 = 0.65$; $t = 10.645$; $p < 0.001$).

Sampling of shot birds

During the spring periods, data forms of 1–8 birds taken ($\bar{x} = 1.2$ specimens; sd = 0.5 specimens) were received from each point. The number of Woodcocks taken in one year at one observation point varied between 1–30 specimens ($\bar{x} = 3.5$ specimens; sd = 2.9 specimens). Between 2015–2021, the proportion of males was 3–6 times higher than that of females; the proportion of females ranged between 15.3–24.9%. The ratio of females in the total annual hunting bag did not show any trend-like change over the years ($r^2 = 0.10$; $t = –0.76$; NS). There was no correlation between the annual sizes of the hunting bag and the proportions of females within them (Pearson r = –0.38; NS). Between 2015–2021, the proportion of 2nd year birds in the annual hunting bag ranged between 48.3–57.6%, and in the examined period, it did not show a trend-like change over the years ($r^2 = 0.0005$; $t = –0.05$; NS). There was no correlation between the annual size of the hunting bag and the proportion of 2nd year birds (Pearson r = 0.37; NS).

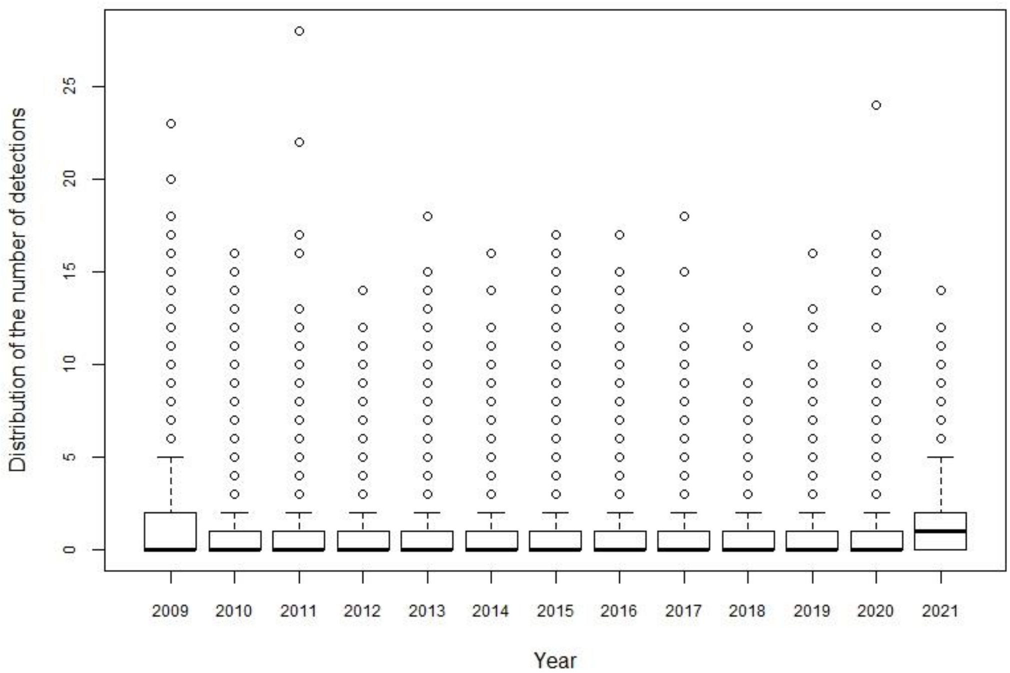

Figure 1. Distribution of the number of Woodcock detections at the observation points grouped by year (empty dots represent outlier values exceeding 1.5 × interquartile range)

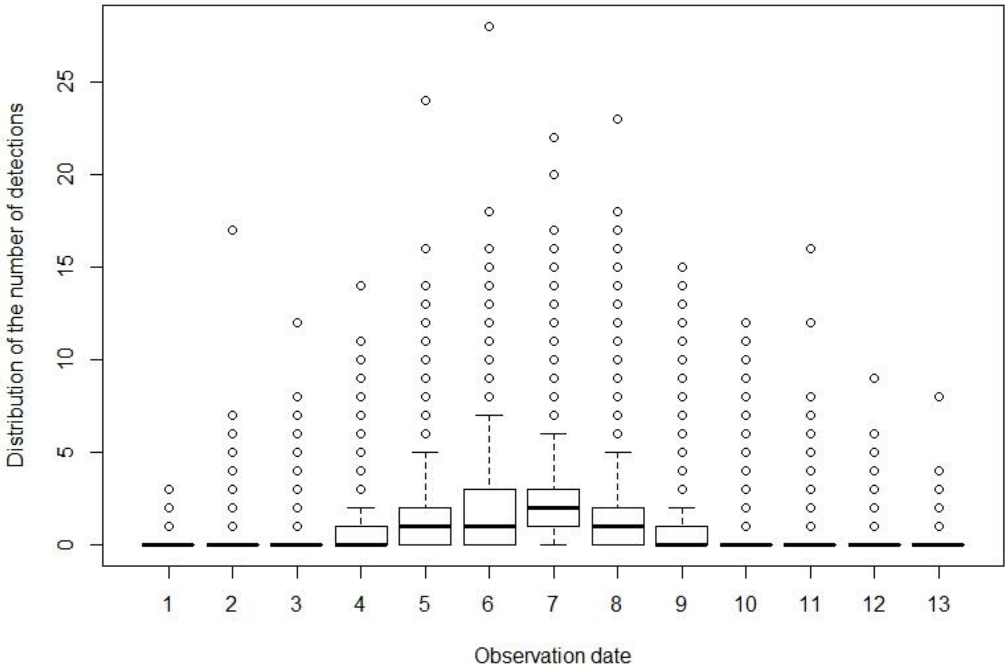

Figure 2. Distribution of the number of Woodcock detections at the observation points grouped by observation date (empty dots represent outlier values exceeding 1.5 × interquartile range)

DISCUSSION

Observation data

During the spring periods, most successful observations were occasionally limited to 1–5 detections, regardless of the year. The proportion of detections of more than 5 did not exceed 10% in each year; however, the most considerable differences between the years can be caused by such outstanding values. In the case of high detection numbers, the multiple detections of some individuals presumably also played an important role.
The changes in the spatial concentration of the detections confirmed the previous assumption that there was a difference between the south-western and north-eastern regions of the country at the time of the appearance of the Woodcock. The spatial progress presumably does not reflect the spatial progress of the appearance of roding as a behavioural pattern within a population. Still, it actually reflects the displacement of the population in space. This assumption was mainly confirmed by the spatial progression of autumn detections, which occurred opposite to the spring data in a previous study (SCHALLY, 2020). The spatial shift reflects the progress of the majority of the migrating population.

Sampling of shot birds

The maximum values of individuals taken at one point in an evening were in line with past hunting experience and the observation data. It is important to note that while detections were recorded above 10 in several cases, the number of takings did not exceed them. In addition, the takings were, of course, limited to only 1–2 specimens in the majority of the cases. This can be explained by the fact that shooting is a challenge for hunters, and they

Review on Agriculture and Rural Development 2022 vol. 11 (1-2) ISSN 2677-0792
DOI: 10.14232/rard.2022.1-2.168-175

cannot take all birds. However, it may also confirm that repeated observations of individuals are usually common during observations. Assuming that the maximum values of the takings were derived from cases in which the hunters could shoot all roding individuals, these can be considered the maximum registered densities in a given area.

One of the most important questions about the composition of the shot samples is why it comprises mainly males. According to the most obvious and generally accepted explanation, during spring roding, males search for females, so they fly more and can be shot more often. However, this behaviour may make sense if mating can occur during the migration period. According to the data of previous studies of reproductive organs from other countries (STRONACH, 1983; MACHADO ET AL., 2006), it might be possible for some degree, but that also raises several further questions. To better understand the processes strongly affecting observation data, it would be essential to have more precise knowledge of the Woodcocks' breeding biology and mating system.

There are two possible explanations for the nearly 50% proportion of 2nd year birds in the hunting bag. One answer is that 2nd year birds are more likely to be shot during spring hunts than adults because older individuals are more experienced. In this case, the proportion of 2nd year birds in the hunting bag was higher than their actual proportion within the population. Based on the ringing data, the ratio of birds aged as 2nd year was slightly lower (41%) (SCHALLY, 2017); however, that was not a remarkable difference between the results of the two methods. The other explanation is that the probability of Woodcocks being shot or detected during roding is independent of their age. In this case, their proportion in the hunting bag shows their actual proportion within the population. The proportion of 2nd year birds in the hunting bag was lower than the proportions registered in autumn hunting bags in western Europe (FERRAND and GOSSMANN, 2009b; CHRISTENSEN ET AL., 2017) or in ringing data reports from the European part of Russia (FOKIN ET AL., 2020). If the method of hunting has no significant effect on the age structures of the hunting bag, than the differences can be explained by the higher mortality of young birds during the winter period. We did not find a clear temporal trend in the proportions of the age groups within each year.

The size of the total European population of Woodcock has been determined in a wide range (13 800 000–17 400 000 individuals) (BIRDLIFE INTERNATIONAL, 2019). The part of the population migrating through Hungary is probably only a fraction of this, given the location and size of the country. The population in Hungary in the spring period, according to a recent calculation, has also ranged within wide limits (SCHALLY, 2020). However, absolute population estimation, with the influencing factors known so far, can only be done with very high uncertainty. Specific critical points, such as the size of the areas considered potentially suitable for the birds, largely determine its outcome. Instead of an absolute population estimate, we think it more reliable to use relative indices such as the "detection rate" and the "rate of high-density sites" to characterise the trend of the population (FERRAND ET AL., 2008).

We found a moderate fluctuation in the annual detection rates but based on our results, no clear increasing or decreasing linear trend could be identified. Based on the available data, the measure of the takings was very small compared to the size of the population. Takings in Hungary in its current form presumably does not affect the population trend. Monitoring must be continued so that a given condition can continuously be re-assessed based on up-to-date data and can be better understood by supplementing it with the results of further studies.

ACKNOWLEDGEMENTS

We are grateful to everyone who persists in collecting data of Woodcock from the beginning of the program. We thank the Hungarian Hunters' National Association, the Hungarian National Chamber of Hunters and the Ministry of Agriculture for coordinating and supporting the monitoring.

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