cover a distance of 400 km/ day (in fact a night; Ferrand & Gossmann, 2009), it is likely that unfavorable environmental conditions require a higher performance, and consequently we have no opportunity to observe the migrating birds at the observation points.

The number of contacts in 2009 and 2010 differ in the 5th and 6th 3-day periods values (Figure 2 and 3), probably due to different weather conditions. This could explain why it is possible to detect only half of the birds seen in former years even if the size of the total population did not change that much.

Our objective is to continue our surveys and gather data from further research to improve knowledge on Woodcock migration.

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Country-wide monitoring of the migrating Eurasian woodcock (*Scolopax rusticola*) populations in Hungary

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Eurasian woodcock is a popular game species in Hungary and in several European countries. As it is a migratory species, capturing, hunting, or other activities, can only be allowed if they are in accordance with EU Birds Directive (79/409 EGK).

Spring woodcock hunt is a centuries-old tradition in Hungary. The annual bag has always been less than 10.000 individuals in the last decade (Csányi *et. al*, 2009; http://vmi.info.hu/adattar/index.html).

However, it is problematic from the Directive's point of view, because hunting season coincides with the migration to breeding areas. An autumn hunting season seems to be a legal solution, but in the Hungarian context, it could also cause more difficulties than it would solve.

The Directive allows derogations under controlled conditions and only for a small number of birds [1% of total mortality (natural + hunting) at maximum]. In order to be able to fulfill the requirements of the EU Birds Directive it is essential to initiate and maintain a country-wide monitoring system.

Several migration routes are known among the wintering areas in South-West Europe and the Mediterranean region and breeding areas from Scandinavia to Ural Mountains, and it is likely that two or more flyways cross each other in

our country (Fluck, 2009). Although there are many former observations on the migration, there is still a lack of information. To broaden our knowledge about the species and to estimate the size of the migrating population in Hungary, a monitoring program was initiated by the former Ministry of Agriculture and Rural Development and the Hungarian National Chamber of Hunters (HCH). The program started in 2009. Data collection and processing and assessment of results have been carried out by Szent István University, Institute for Wildlife Conservation (IWC).

Methods

The objective is to collect data from as many observation points as possible at the same period of time. These give us snapshots about different states of the migration. With the comparison of consecutive snapshots we can estimate dynamics, speed and extent of migration.

In spring, the basis of the monitoring program is a roding survey (Bibby *et al.*, 1997; Ferrand *et al.*, 2008; Machado *et al.*, 2008) weekly performed by observers on every Saturday (from 28th February to 2nd May in spring 2009, from 13th February to 1st May in Spring 2010). The observers recorded the following data on standardized forms: number of contacts (birds seen and/or heard), estimated size of the visible area, duration of the survey, weather conditions and habitat types surrounding the observation point.

The monitoring-network can be divided into different levels, each for different tasks: county coordinators, representatives of game management units (GMU) and observers (participating hunters). Observation data recorded by the observers were sent to the GMU representatives each week. The paper forms were collected by the county coordinators (HCH active members) each week. They uploaded the observation data electronically to a web server created and maintained by IWC weekly.

The total number of observation points was 899 in spring 2009 and 908 in spring 2010. Figure 1 shows their distribution.

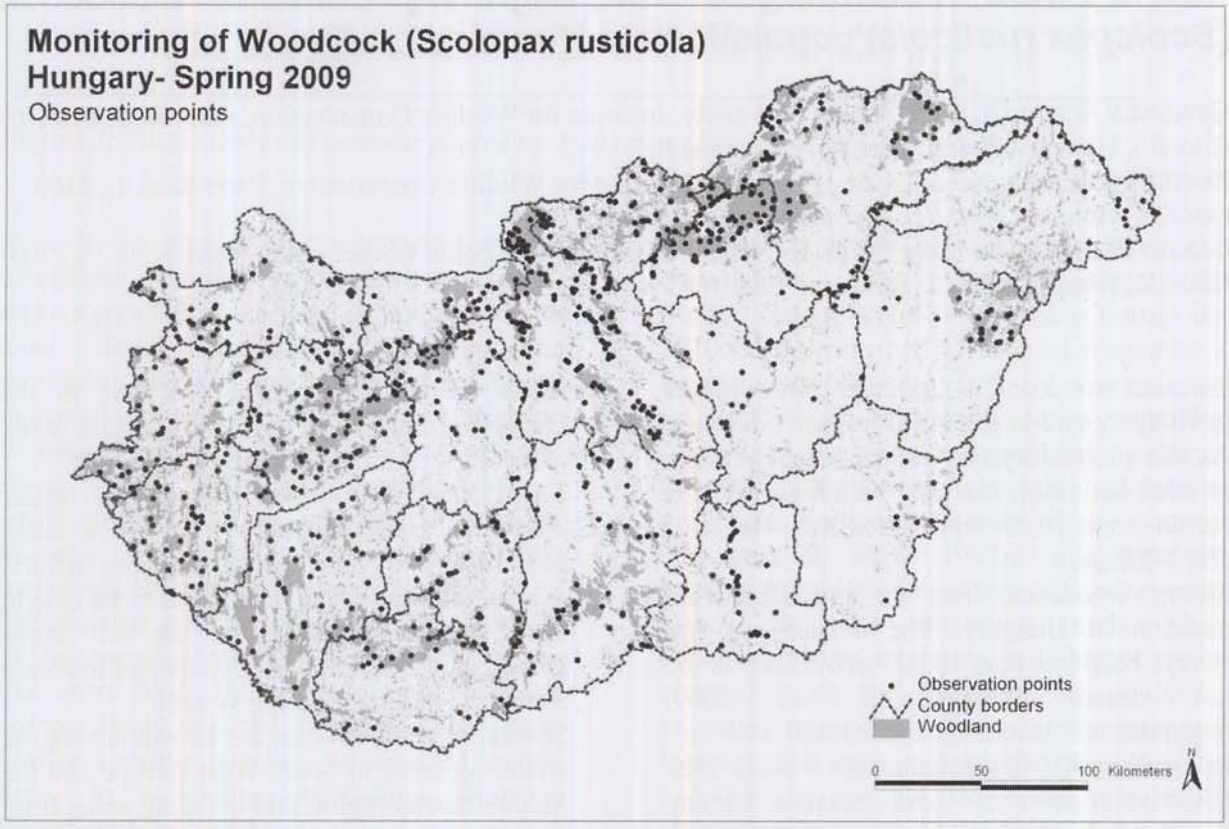

Figure 1. *Distribution of the observation points in spring 2009.*

We calculated the mean densities of contacts (woodcocks seen/hectare/hour) for each observation week in each county. Their distribution represents the temporal dynamics and intensity of migration.

Additional data collection was performed by the participating hunters during autumn migration from 15th September to 15th December in 2009 and from 14th September to 14th December in 2010. The total number of observation points was 755 in autumn 2009, evaluation of 2010 autumn observation data is not complete at the moment.

The aim of autumn surveys is to discover the characteristics of migration in autumn, using very similar methods as for roding surveys in spring.

Observers recorded data at the same points as in spring, on each Tuesday at dusk when woodcocks perform their "connecting flight" from woods to meadows. However, there is a great difference between the seasons in the probability of detection: in spring, woodcocks can be detected by sight and listening but only by sight in autumn, flights are slow in spring but fast in autumn, the same bird can be observed several times in spring, which is not typical in autumn at all. Observations in autumn can provide information about migration, but the comparison with spring data is problematic owing to these differences.

Results

Figure 2 shows the distributions calculated from 2009 and 2010 spring observation data. The distributions of spring season's mean densities followed one-peak curves in both years, however a temporal difference between their peaks is observed. The distributions of values are very similar year by year, but densities were higher in 2010. Such high densities are not typical on a county level, and can also be explained by the fact that the size of the estimated visible areas may vary between distinct years. Besides the mean density values, we also calculated standard deviations. The results show that there are great differences even between results registered at the same period of time.

The temporal dynamics of migration in autumn 2009 is shown in Figure 3. The distribution of mean densities in autumn cannot be described with a one-peak curve. It seems to be long-drawn-out and more balanced than in spring. However, the comparison of spring and autumn values is problematic because the behavior of the birds is completely different in distinct seasons.

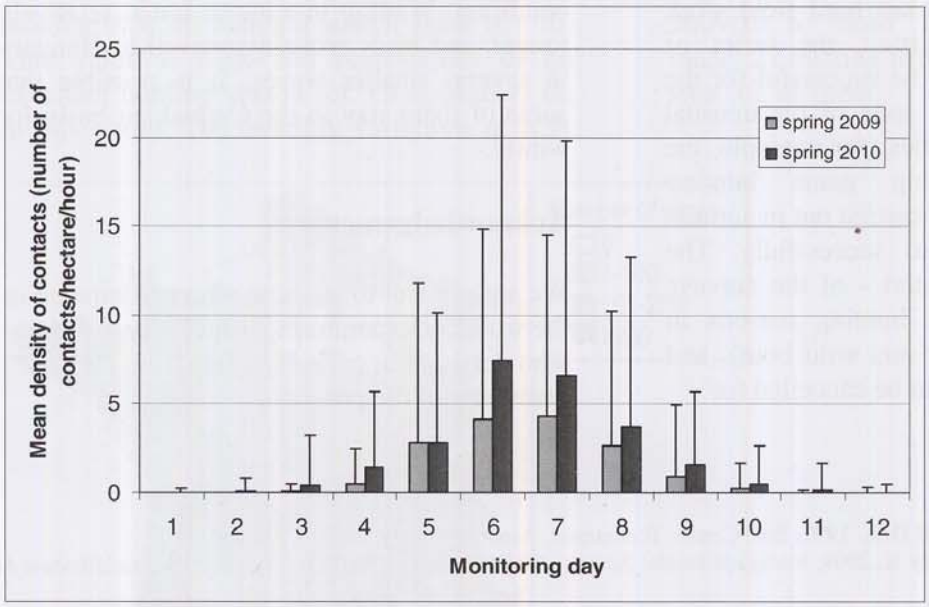

Figure 2: *Mean densities of contacts in spring 2009 and 2010.*

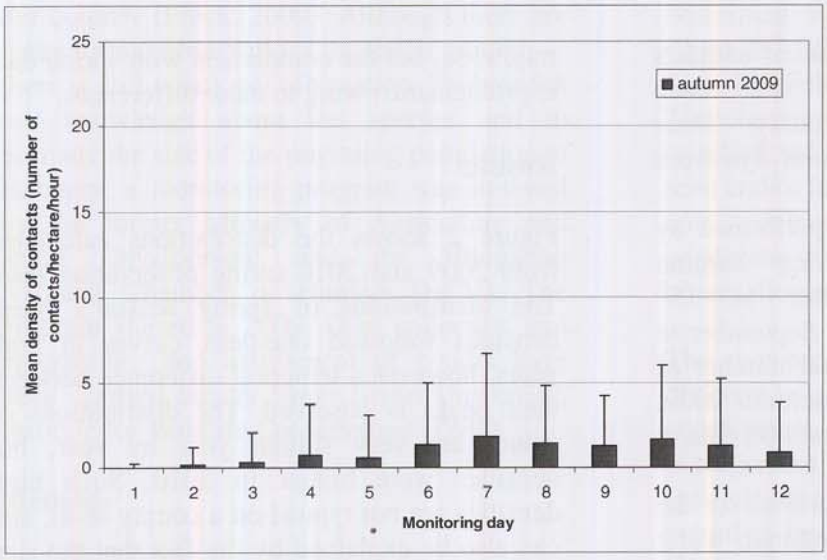

Figure 3: Mean densities of contacts in autumn 2009.

Discussion

One of the greatest results of the program is the design of the methods. Testing the workability, gathering methodology experiences and further development were the most important aims in the first stage. From this point of view the program started successfully. The system of data collection and processing is functional, only a few modifications are needed. The participants work well together in cooperation. It is clear now that the Hungarian hunters are able to cooperate with each other and to achieve a task of such a magnitude.

Although the program takes hard field work and a complex organization, the series of spring surveys proved to be successful for the second time in 2010. In spite of the unusual timing and other difficulties (for example, the incompatibility with big game hunting seasons) the observations carried out in autumn 2009 and 2010 ran also successfully. The season - especially the start - of the surveys overlaps with big game hunting seasons in autumn (mainly red deer and wild boar), and several observations had to be cancelled for this reason. Another difficulty is that the detectability of woodcock in autumn is significantly lower than in spring.

It is obvious that there are differences between the characteristics of migration in spring and in autumn. There was a relative quick and intensive migration activity in spring, which can easily be understood from a biologist's point of view. The birds that reach the breeding areas faster have the opportunity to occupy better quality territories. They can be more successful, they may have more time to raise their broods and the young ones can start the migration to the wintering areas in a better condition. Wading in autumn lasted relatively longer, and birds probably arrived in Hungary in several smaller waves. It is possible that some of them stay in the Carpathian basin for winter.

Acknowledgements

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