Monitoring of the wintering and breeding Woodcock populations in France

Yves Ferrand, François Gossmann, Claudine Bastat & Michel Guénézan

France is an important wintering area for the Woodcock *Scolopax rusticola* in Europe but is also a breeding area. To manage this game species wisely we developed an integrated monitoring system for the breeding and wintering Woodcock populations in France, based on a census of roding males, the census of Woodcocks flushed and/or shot during hunting trips, a census of Woodcocks from targeted ringing sessions and other ringing data. The results show that the numbers of breeding and wintering Woodcock in France have remained stable over the last 12 years. To explain the population trends, additional information was gathered: survival rates, and an estimation of the size of hunting bags. A rough estimation of the annual breeding success was obtained through a wing collection from hunting bags. Case studies also improved our knowledge on the behavioural ecology of the Woodcock in winter. Finally, all data will be integrated into predictive models, classic models of population dynamics and behaviour-based models.

Key words: *Scolopax rusticola*, Woodcock, monitoring, wintering period, breeding period, France.

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In the western Palaearctic, the Woodcock *Scolopax rusticola* distribution can be divided into three areas: 1) a *stricto census* breeding area, which includes Scandinavia, Russia and Central Europe; 2) a *stricto census* wintering area, which includes the Mediterranean and Atlantic coastal regions; 3) an intermediate area situated between the two *stricto census* areas, in which France is located (Ferrand & Gossmann 2001). Recent studies show a strong connection between the Russian breeding populations and the French wintering ones, according to ringing data (Gossmann *et al.* 2000, Bauthian *et al.* 2007), and support the hypothesis of only two European flyways: a Scandinavian flyway and an Eastern one.

The Woodcock is an important migratory quarry species in France and in many other European countries. The annual hunting bags have been estimated at 1,200,000 birds in France (Ferrand & Gossmann 2000) and at 3-4 million in Europe (Ferrand & Gossmann 2001).

To ensure a sustainable use of the Woodcock populations in Europe, we decided to carry out an integrated monitoring programme (Baillie 1990) for the breeding and wintering Woodcock populations in France. Such monitoring should be able to estimate the demographic trends, to collect data on the probable causes of change and finally to produce population models that predict population performance. The *Office National de la Chasse et de la Faune Sauvage* (ONCFS) has undertaken such a project since the mid-1980s. Data were collected by a network of mainly professionals (ONCFS and *Fédérations départementales des chasseurs*). About 1,500 people, including 300 specialised ringers, take part every year in this survey work.

This paper: *i*) reviews the methods used to estimate trends and results for the last 20 years; *ii*) gives an estimation of the demographic parameters obtained in the framework of the monitoring, *iii*) shows recent results of case studies to be included in population models.

Trends of Woodcock breeding populations

Methods

During spring and summer evenings, male Woodcocks perform song flights (roding) over their breeding sites (Hirons 1983, Ferrand 1989). The breeding survey is based on a census of roding males (for details see Ferrand 1993). As several birds may be counted at the same listening point where it is not possible to easily distinguish them, the collected data is simply a number of contacts. However, a positive correlation between the number of contacts and the number of different birds was proved by an acoustic analysis (Ferrand 1987). This leads us to consider that the number of contacts is related to Woodcock abundance.

Since 1992, observations have been carried out every year in France at listening points (LPs) randomly chosen in forest habitats. An LP is defined as an open area (clearing, plantation, etc) as close as possible to the centre of a 2x2 centigrade square (approximately 280 Ha). At each LP, observations are made at dusk between mid-May and mid-June (depending on altitude) once only per year. The 1:50,000 IGN maps are used for this survey work. A set of maps is attributed to every French department. The 2x2 centigrade squares for sampling are defined as those with at least 90% of forest cover, estimated with the help of a grid superimposed over the maps. Some 13,000 LPs have been defined for the whole of France. Every year, 10% of LPs are randomly selected in every department, and about 1,000 LPs are visited every spring-summer.

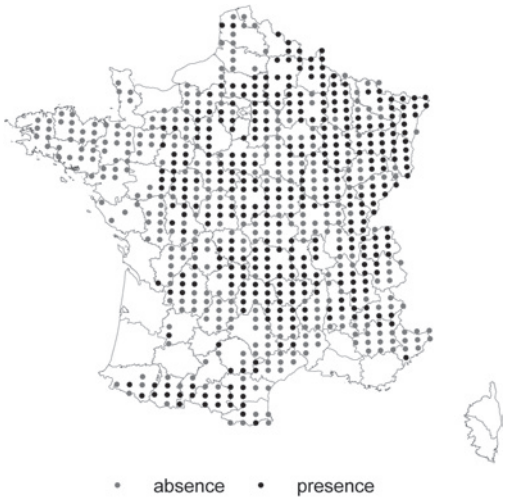

Figure 1. Woodcock breeding area in France (1998-2006). Black points correspond to 1:50,000 maps in which at least one listening point was visited and at least one roding male was recorded. Grey points correspond to maps on which at least one listening point was visited but no roding male was detected. *Distribució de la població reproductora de la Becada a França (1998-2006). Els punts negres corresponen als mapes 1:50,000 en els quals almenys es va visitar una estació d'escolta i almenys es va detectar un mascle cantant en vol. Els punts grisos corresponen als mapes on almenys es va visitar una estació d'escolta, però no es va detectar cap mascle.*

Results

Breeding area

Since we used random sampling with replacement, a high percentage of potential breeding sites can still be visited over a long period of time. A presence-absence map can be drawn from the data collected since the beginning of the 1990s (Figure 1). This map clearly shows that the main Woodcock breeding sites in France are located in the central (Paris basin) and north-eastern (Ardennes, Alsace) regions and in the mountain areas (Pyrenees, Alps, Central Massif, Jura, Vosges). They fit a map of the Woodcock breeding range in France that was produced from nesting records (Ferrand 1994).

Trend

The trend of breeding numbers is expressed as variations of the frequency of occurrence (F) calculated every year. F is the ratio of the LPs with at least one observation of a roding male to the total number of LPs visited in each department. Moreover, two classes of abundance are defined: high abundance with five or more observations, and low abundance with one to four observations (Ferrand 1993). The estimation of trend results in the analysis of the occupation rate of the breeding range, as well as density, i.e. the percentage of high and low abundance points. Departments located outside the usual breeding area are included in the survey occasionally (usually once every three years). Such surveys aim to detect possible range extension.

The trend over a 10-year period is estimated from a set of departments that participated in

the survey continuously. A tendency χ^2 test was applied to estimate the trend.

For the last 10-year period (1994-2003), 47 departments and 750-790 listening points were taken into account (Figure 2). The frequencies of occurrence are stable ($\chi^2 = 2.02$; $p = 0.16$) as are the percentages of high abundance points ($\chi^2 = 0.30$; $p = 0.58$). However, the percentages of low abundance points suggest a slight decrease ($\chi^2 = 4.60$; $p = 0.03$). From these results, we can conclude that the Woodcock breeding population in France is stable and not decreasing slightly.

As wintering Woodcocks in France come mainly from Russia, a similar survey has been carried out in Russia since 2000, under the framework of research agreements between the ONCFS, the St. Petersburg State University and the State Informational-Analytical Center of Game Animals and Environment of Moscow. The previously described random design is applied to 12x12 km squares and not to all forest habitats because of logistic problems. About 400 LPs are visited every year. Their frequency of occurrence appears very high (> 90%), although the survey has not being running long enough to detect any trend yet.

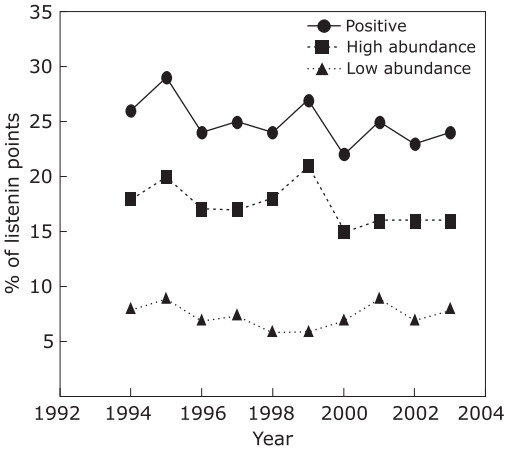

Figure 2: Inter-annual variations of the percentage of positive listening points (number of observations > 0), low abundance listening points (number of observations = 1 to 4) and high abundance listening points (number of observations ≥ 5).
Variacions interanuals en el percentatge de punts d'escolta positius (nombre d'observacions > 0), punts d'escolta de baixa abundància (nombre d'observacions entre 1 i 4), i punts d'escolta d'alta abundància (nombre d'observacions iguals o superiors a 5).

A similar survey also started in Switzerland at the beginning of the 1980s and was extended to the western part of the country at the beginning of the 1990s (Estoppey 2001a). The results show that numbers are stable across Switzerland as a whole, but there has been an alarming decrease in some areas (Moyen-Pays, Pre-Alps, Jura; Estoppey 2001b).

Trend of Woodcock wintering populations

Methods

The methods for monitoring Woodcock wintering populations are based on two types of data.

Nocturnal index of abundance

Ringers in the French Woodcock network undertake 2,000 to 2,500 ringing sessions every autumn-winter at about 1,000 sites. Captures are made at night in open areas close to the forests using a spotlight and a hand-held net (Gossmann *et al.* 1988). A nocturnal index of abundance (NIA) was defined as the number of observations per ringing session (Ferrand *et al.* 2006).

Hunting index

Use of data collected by Woodcock hunters during their hunting trips started in the late 1970s. Hunting indices of abundance were defined based on Woodcocks seen (ICA1) and on Woodcocks shot (ICA2) (Fadat 1979). An index that took into account the number of trips where at least one Woodcock was shot (ICA2p) was retained as a reference index. The ONCFS collected the data until 1996. Since 1993, a Woodcock hunters association (*Club National des Bécassiers* – CNB) started to collect these data from its members. Every year, some 1,000 hunters provide data from about 30,000 hunting trips (Cau & Boidot 2006). Two indices are calculated: ICP [number of Woodcocks shot/standardized hunting trip (i.e., 3.5 hours)] and ICA (number of Woodcocks seen/standardized hunting trip).

Validity of indices

These indices contain several biases that are mainly due to the absence of a robust sampling design. Ringers are requested to ring as many birds as possible, and hunters to flush as many

Woodcocks as possible. Consequently, these trips are not performed at random. Moreover, the quality of the hunter sample, i.e. the ratio of specialists to generalists, varied greatly during the study period, and it was not possible to estimate these variations. Other biases may be identified, such as: intra-annual ringing or hunting effort variations, density-dependence effects, double census, no detection of birds, behavioural changes according to weather conditions.

One could ask whether these indices are representative of the abundance level of the population or not. To answer this question, we analysed the patterns of NIA, ICAs and ICP over the same period of time (Ferrand *et al.* 2006) and found the indices are closely correlated (Spearman rank correlations between NIA and ICA2p: $\rho = 0.964$, $p < 0.001$; between NIA and ICA: $\rho = 0.604$, $p = 0.065$; between NIA and ICP $\rho = 0.47$, $p = 0.171$). Although the data were collected independently during two different periods (day and night), in different habitats, and that they concern the same migrating and wintering Woodcock population, we considered the indices to be a good representation of abundance.

Results

The inter-annual variations of NIA, ICP and ICAs are shown in Figure 3. as Allowing for the

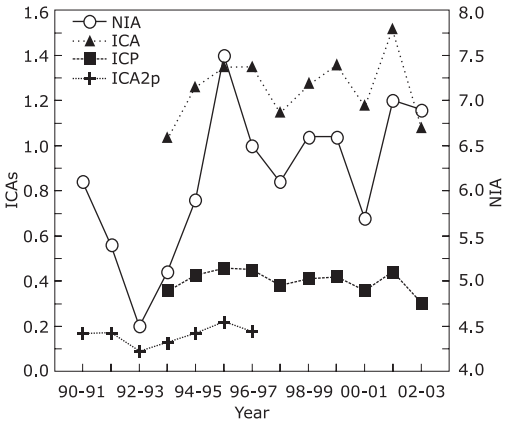

Figure 3: Inter-annual variations of the nocturnal index of abundance (NIA) and hunting index of abundance (ICA, ICA2p and ICP). See text for details.
Variacions interanuals en l'índex nocturn d'abundància (NIA) i l'índex d'abundància de caça (ICA, ICA2, ICA2p i ICP). Per a més detalls vegeu el text.

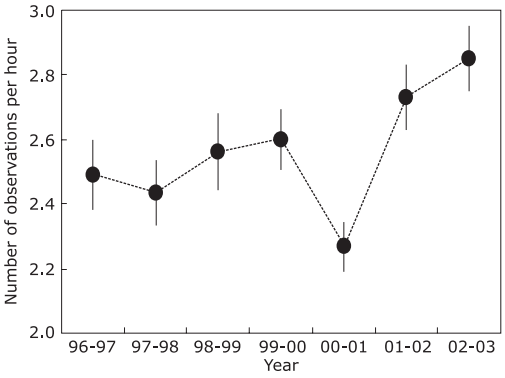

Figure 4: Inter-annual variations of the nocturnal index of abundance calculated by the number of observations per hour (NIAh). Vertical bars denote the 95% confidence interval.
Variacions interanuals en l'índex nocturn d'abundància ajustat al nombre d'observacions per hora (NIAh). Les barres verticals indiquen l'interval de confiança del 95%.

fact that the duration of the ringing sessions are not standardized, an index based on a time unit has been defined: the number of observations/hour (NIAh). The inter-annual variations of this index are presented in Figure 4.

All these indices vary greatly from year to year but no special trend can be detected. However, an increase in NIAh during the 1996-97/2002-03 period was statistically significant (Jonckheere test: $Z = 5.78$; $p < 0.0001$).

In summary, Woodcock wintering population numbers in France were stable, but with noteworthy annual variations.

Estimation of demographic parameters

Survival rates

The estimation of survival rates is based on ringing data. Woodcock ringing in France has increased greatly since the beginning of the 1980s. Now, between 3,500 and 4,000 Woodcocks are ringed every autumn-winter in the whole of France (Ferrand *et al.* 2006). The current dataset includes more than 40,000 ringed birds, 7,000 recoveries and 2,500 recaptures.

Tavecchia *et al.* (2002) analysed the ringing data from 1984 to 1997. The first-year survival

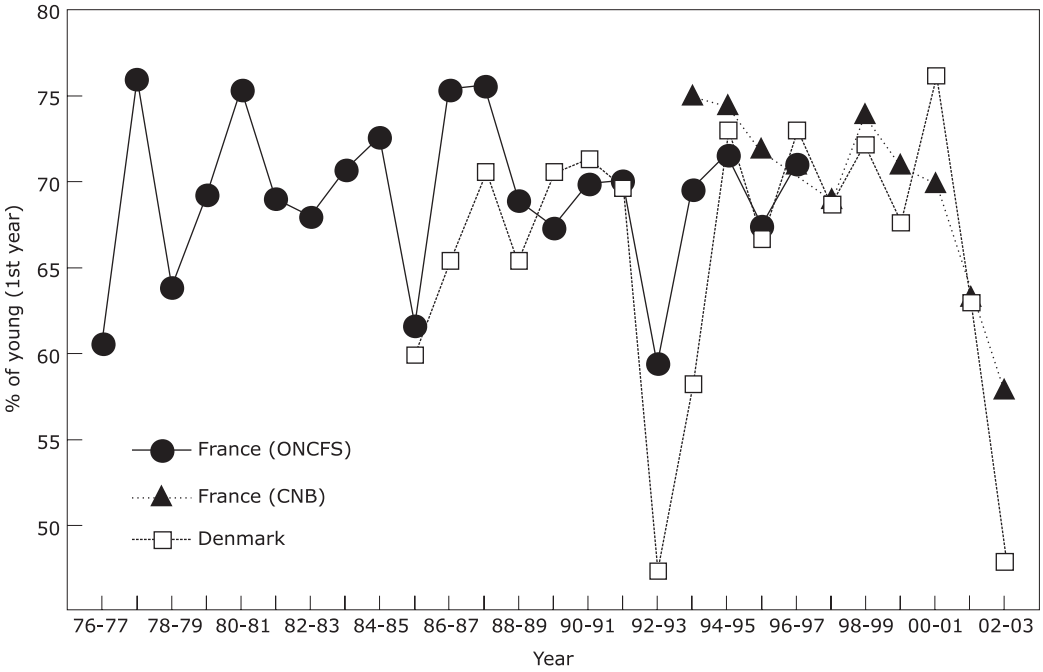

Figure 5: Inter-annual variations of the proportion of young (first year) in the hunting bags in France and in Denmark (data from Clausager 2003).
Variacions interanuals en la proporció de joves (primer any) a les estadístiques de caça de França i Dinamarca (a partir de Clausager 2003).

rate was estimated at 0.34 and the adult survival rate at 0.44. The trend of winter survival rates was considered stable for the study period. Moreover, a negative influence of winter weather conditions was shown.

A new analysis for the 1989-2002 period has shown that the survival rates could be re-evaluated by 15%, when taking into account the differences in regional hunting pressure, i.e. the differences in the probabilities of recovery (Bauthian 2005).

Woodcock ringing has also been developed in Russia every autumn since the beginning of the 1990s. Survival rates of Russian Woodcocks based on 324 recoveries from 2,817 birds ringed between 1993 and 2002 has recently been estimated at 0.52 (Bauthian *et al.* 2006). First-year and adult survival rates were not statistically different. This compares to estimated Woodcock survival rates in Great Britain at 0.47 and 0.58 for first-year and adult birds respectively (Hoodless & Coulson 1994).

Breeding success

As Woodcocks wintering in France come from the whole western Palaearctic, we aimed to get information on the breeding success of the Woodcock populations in the core of the breeding area before post-nuptial migration. Unfortunately, such a demographic parameter is difficult to obtain because: 1) it is very hard to find nests and broods of this secrete species; 2) it is necessary to collect data on nests and broods across a large scale and in many sites for a precise estimate of the breeding success.

An indirect estimation can be given by the percentage of first-year birds (age-ratio) in ringing catches. A similar approach, proportion of juvenile/first-year birds in banding catches, is proposed by Minton (2003) for waders. This can be obtained through the ringing catches that take place every autumn in Russia. However, ringing sites in Russia are few numerous in relation to the breeding area and a differential migration by age classes could be occurring (Fadat

1989). Hunting bags are another opportunity but: 1) breeding success information is only available during the course of migration or during the winter period (i.e. during the hunting period); and 2) age-ratio is linked to breeding success but also to hunting pressure (Fadat 1981) with no possibility to distinguish the relative influence of each factor. A rough estimation can be obtained through the hunting bag age-ratio in Denmark. This country is located upstream from the flyway and the hunting pressure is lower than in France. Furthermore, Woodcock wings have been collected since 1985-86 in Denmark (Clausager 2006). A comparison of inter-annual age-ratio variations between Denmark and France shows that extreme values are registered for the same hunting seasons but that "normal" values may vary differently (Figure 5). In these cases, the Danish age-ratio hunting bags could be used to highlight any abnormal situations.

Weather conditions during autumn migration can also influence the distribution of wintering first-year birds. For example, when temperatures are abnormally warm, first-year birds are more numerous than usual in the north-eastern part of the wintering area. So, age-ratio should be estimated in as many wintering sites as possible, to inform on the breeding success as precisely as possible.

Another approach could be to investigate the influence of weather conditions in the core of the breeding area on wintering Woodcock numbers. Cold temperatures and low rainfall in spring-summer are known to have a negative effect on wader breeding success. Temperatures and rainfall in spring and summer and snow height in late winter, could be taken into account in a predictive model.

Case studies

The building of models, especially behaviour-based models, requires knowledge of population dynamics and behaviour at a small scale. Such research has been carried out for a wintering Woodcock population in Brittany (Duriez 2003), which was based on 95 radio-tagged Woodcocks. Several original results were obtained: energetic needs (Duriez *et al.* 2004); activity rates (Duriez *et al.* 2005a); spatial use and movements (Duriez *et al.* 2005b); influence of earthworm availability (Duriez *et al.* 2005c); and the impact of a free-hunting reserve on survival rate (Duriez *et al.* 2005d). Intra-annual faithfulness of Woodcocks to their wintering site has clearly been confirmed, which leads us to consider a wintering Woodcock population to be a "closed" one, except during cold spells (Gossmann & Ferrand 2000). This fact has important implications in terms of management. A complementary study is now being implemented in another site in Brittany in order to confirm the previous results and to measure the impact of hunting disturbance on Woodcock behaviour.

Hunting bags

In France, hunting bags were estimated by three national inquiries during the last 30 years. The last inquiry was made for the 1998-99 hunting season. The annual Woodcock hunting bag was estimated at about 1,200,000 birds (Ferrand & Gossmann 2000); most of these were birds shot in the Channel-Atlantic and Mediterranean regions. About 300,000 French hunters shot at least one Woodcock every year, and almost 28,800 of them shot more than 10 birds. The total hunting bag of these "specialist" hunters was estimated at about 500,000 Woodcocks. The average annual hunting bag of Woodcock hunters was estimated at 3.3 individuals in 1983-84 and 3.8 in 1998-99. The percentage of "specialists" was 6.6% in 1983-84, but 9.5% in 1998-99. These results may indicate that the hunting pressure on Woodcock in France is increasing.

Habitats

Woodcocks mainly use two habitat types; deciduous and mixed forests throughout the year, and permanent meadows at night in autumn-winter (Ferrand & Gossmann 1995). Due to high earthworm densities, meadows are very important feeding places for Woodcock during the winter (Granval 1988, Duriez *et al.* 2005c). Integrated monitoring requires information on trends of suitable habitat areas; this was obtained through agricultural statistics (e.g., the AGRESTE-SAA in France).

Across the European Union, woodland cover has been increasing in recent decades, mainly due to deciduous tree plantations, so forest habitat does not seem to be a limiting factor for the species. Meadow areas, however, have been dramatically decreasing in Europe because of changes in farming techniques (Potter 1997). About 25% of meadows were lost in France between 1970 and 1995 (IFEN 1996).

Conclusions

The final objective of integrated monitoring is to build models that predict the viability of the population concerned. All data collected on European Woodcock populations should now be integrated in such models.

At least two model types should be investigated: "classic" models of population dynamics (Lebreton 1991) and behaviour-based models (Goss-Custard & Stillmann 2002). Research is ongoing with respect to the first model type and preliminary results should be available in a short time. The second model type needs complementary studies in other habitat types, such as Mediterranean habitats. Indeed, the main expected predictions of such models could concern the impact of loss of habitats and/or food resources. Moreover, a potential response of Woodcock to human activities (e.g., increase in hunting pressure) could be predicted, as may be possible for Wigeon (*Anas penelope*) in the coming years (Guillemain *et al*. 2002).

After more than 20 years of monitoring, we are now able to get a more precise knowledge of the conservation status of the Woodcock populations that are wintering and breeding in France. Both wintering and breeding numbers are roughly stable. Forest habitats are not endangered, while permanent meadow areas are decreasing everywhere in Europe. Hunting bags seem stable but hunting pressure may have increased during the last decade. Finally, survival rates do not appear to be very high with respect to Woodcock size. Following these results, we consider the Woodcock populations are not currently endangered. Nevertheless, this species needs close integrated monitoring in order to be able to highlight any population changes occurring because of human activities.

Acknowledgements

The results presented in this paper are the fruit of the huge amount of fieldwork carried out by hundreds of observers. We thank all professionals (*Office national de la chasse et de la faune sauvage, Fédérations départementales des chasseurs*) and volunteers (*Club national des bécassiers*) who are active in the Woodcock network ONCFS/FNC.

Resum

Seguiment de les poblacions de Becada hivernants i nidificants a França

França és una important zona d'hivernada per a les poblacions europees de Becada *Scolopax rusticola*, alhora que també actua com a zona de cria. Es va portar a terme un seguiment integral de les poblacions reproductora i hivernant d'aquesta espècie cinegètica basat en el cens de mascles que canten durant l'època de reproducció, el cens d'individus aixecats i/o morts durant les caceres, el cens de becades durant campanyes específiques d'anellament i les dades recopilades de l'anellament. Els resultats van mostrar que el nombre de becades, tant hivernants com nidificants, s'ha mantingut estable durant els darrers 12 anys a França. Per estudiar millor les tendències poblacionals també es va cercar informació sobre les taxes de supervivència i les estadístiques de caça. L'èxit reproductor anual es va estimar de forma aproximada gràcies a les col·leccions d'ales obtingudes pels caçadors. Altrament, estudis específics han millorat el nostre coneixement sobre el comportament i ecologia de la becada a l'hivern a França. Tota aquesta informació disponible per a l'espècie s'integrarà en models basats tant en dinàmica de poblacions com en el comportament, per tal de predir de la manera més acurada possible les respostes de la Becada a les influències humanes i fer-ne la gestió més adient.

Resumen

Seguimiento de las poblaciones de Chocha Perdiz invernantes y nidificantes en Francia

Francia es una importante zona de invernada para las poblaciones europeas de Chocha Perdiz *Scolopax rusticola*, a la vez que también actua como zona de cria. Se realizó un seguimiento integral de las poblaciones nidificantes e invernantes de esta especie cinegética basado en el censo de machos que cantan durante la época de reproducción, el censo de individuos levantados y/o capturados durante la

caza, el censo durante campañas específicas de anillamiento y los datos recopilados del anillamiento. Los resultados mostraron que el número de chochas, tanto invernantes como nidificantes, se ha mantenido estable durante los últimos 12 años en Francia. Para estudiar mejor las tendencias poblacionales también se obtuvo información sobre las tasas de supervivencia y las estadísticas de caza. El éxito reproductor anual se estimó de forma aproximada gracias a las colecciones de alas obtenidas por los cazadores. Además, otros estudios específicos han mejorado nuestros conocimientos sobre el comportamiento y ecología de la Chocha Perdiz en invierno en Francia. Toda esta información disponible para la especie se integrará en modelos basados, tanto en dinámica de poblaciones como en el comportamiento, para poder predecir de la manera más fiable posible las respuestas de la especie a las influencias humanas y así poder llevar a cabo la gestión más adecuada.

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