Does the use of playback affect the estimated numbers of red–legged partridge *Alectoris rufa?*

P. Tizzani, E. Negri, F. Silvano, G. Malacarne & P. G. Meneguz

Abstract

Does the use of playback affect the estimated numbers of red–legged partridge Alectoris rufa*?*— The red–legged partridge *Alectoris rufa* lives in a situation of potential conservation risk for its long–term preservation in Italy as its habitat is increasingly threatened by the disappearance of traditional agriculture–related environments. In such a situation, it is important to use effective and appropriate monitoring methods to assess population changes over time and to identify potential conservation threats. The objective of this study was to evaluate the effectiveness of the playback method to estimate the density of calling males. We compared playback method with spontaneous calling of males at dawn and direct observations along transects. The results on raw count data of playback counts revealed a strong underestimation rate compared to the method that gave the best results: count of spontaneous calls at dawn. Our study provides a critical evaluation of a method that is widely used even though data about its effectiveness are scarce. Our data do not evaluate detection probability of the three methods. Our aim was only to evaluate which methods give the best results in term of population size estimation under the same field condition (same population density, same period, same monitoring area). The results raise some doubts about the ability of the playback method to monitor red–legged partridge populations. The implications of our results for red–legged population management are discussed.

Key words: Red–legged partridge, Census technique, Playback, Underestimation, Population monitoring, Raw count data.

Resumen

¿Afecta el uso de playback a las cifras estimadas de perdiz roja, Alectoris rufa*?*— La perdiz roja, *Alectoris rufa*, vive en una situación de riesgo potencial en cuanto a su conservación a largo plazo en Italia, dado que su hábitat se ve cada vez más amenazado por la desaparición de los ambientes tradicionalmente relacionados con la agricultura. En tal situación, es importante aplicar métodos de control efectivos para estudiar los cambios poblacionales a través del tiempo, y la identificación de amenazas potenciales a la conservación. El objetivo de este estudio era evaluar la efectividad del método de playback para estimar la densidad de machos que vocalizaban. Comparamos el método del playback con las llamadas espontáneas de los machos al amanecer, y las observaciones directas a lo largo de transectos. El resultado de los datos sin procesar de los recuentos mediante playback revelaron una gran tasa de subestimación, comparados con el método que rindió los mejores resultados: el recuento de vocalizaciones espontáneas al amanecer. Nuestro estudio proporciona una evaluación crítica de un método que está ampliamente extendido, aunque los datos sobre su eficacia son escasos. Nuestros datos no evalúan la probabilidad de detección de los tres métodos. Nuestra intención era únicamente evaluar qué métodos arrojan los mejores resultados en términos de la estimación del tamaño de la población en las mismas condiciones de campo (misma densidad de población, mismo periodo, misma área de monitorización). Los resultados arrojan algunas dudas sobre la capacidad del método del playback para monitorizar las poblaciones de perdiz roja. Se discuten las implicaciones de nuestros resultados para su aplicación en la gestión de poblaciones de perdiz roja.

Palabras clave: Perdiz roja, Método de censo, Playback, Subestimación, Monitorización poblacional, Datos de recuento sin procesar.

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Introduction

The red–legged partridge *Alectoris rufa* is widely distributed in Europe, with natural populations reported in Portugal, Spain, Andorra, France and Italy (Birdlife International, 2009). The IUCN Red List classifies this species as 'Least Concern'*, i.e.*, species without conservation threats (Birdlife International 2009). Red–legged partridge belong to the Galliform order, however, an order that is highly threatened, with 27% of species threatened with extinction, and about 60% of unthreatened species in decline (Rands, 1992; Potts & Aebischer, 1995; UNEP–WCMC, 2001). In Europe, the red–legged partridge is classified as SPEC 2 (Species of European Conservation Concern) for the following reasons: i) marked population decline in recent years and ii) population present only across Europe. The species has declined throughout its whole range, and it can be now considered vulnerable (Aebischer & Potts, 1994; Tucker & Heath, 1994; Aebischer & Lucio, 1996; Borralho et al., 1999). In Italy, in particular, the species showed a dramatic decline; it lives in a situation of potential conservation risk (Meriggi et al., 2007) for its long–term preservation as its habitat is increasingly threatened by the disappearance of traditional agriculture–related environments (Falcucci et al., 2006). In such a situation, it is important to use effective monitoring tools to assess population changes over time and to identify potential conservation threats (Kasprzykowski & Goławski, 2009). Many techniques are available to acquire estimates or relative indices of bird population sizes (*e.g.* Granholm, 1983; Verner, 1985; Zuberogoitia & Campos, 1998; Tryjanowski et al., 2003). But one of the most common methods is the point count of birds within hearing distance (Blondel et al., 1981). The problem related to this method is the uncertainty of detection probability of calling males, which is an important source of data variability (Pollock et al., 2002). The work of Jakob et al. (2010) established that the point count method with the use of song playback (playback call count) highly increases the detectability of calling males. This method is widely used to monitor many secretive species (*e.g.* Conway et al., 1993; Zuberogoitia & Campos, 1998; Brambilla & Rubolini, 2004) and in particular for Galliformes (*e.g.* Evans et al., 2007; Serrani et al., 2005; Cattadori et al., 2006; Amici et al., 2009).

Our work aimed to evaluate the sensitivity of a census method widely used to monitor red legged partridge (Jakob et al., 2010). Even if it is considered a good method, as shown by Jakob et al. (2010), we wanted to test its effectiveness in the particular condition of a low density population, as occurs n Northern Italy where populations are declining (Meriggi & Mazzoni della Stella, 2004).

It is important to consider that competition between males can be reduced at low densities, and so their urge to call could also be reduced (Lampe & Espmark, 1987; Penteriani et al., 2002; Penteriani, 2003). Our hypothesis was that in this case the method could be less precise. Spontaneous call, not being an expression of competition, would therefore be less affected by this problem.

Materials and methods

Figure 1 shows the range of red–legged partridge in Italy, with a particular focus on the Alessandria Province (Piedmont Region). As for other species at the border of their distribution range (Hanski & Gaggiotti, 2004), the presence of low density populations is a normal condition.

Our research was carried out in three study areas, each of 1,000 hectares, with the following characteristics: 1) hunting activity not allowed; 2) presence of low density populations, 3) particular conservation importance for red–legged partridge.

The first study area was the typical Italian habitat for red–legged partridge, the traditional agricultural landscape. This habitat is seriously threatened by land abandonment and by the extension of wooded areas (Falcucci et al., 2006). In particular, this area is very important for conservation management of partridges because it is the only area in Italy where red–legged partridge populations are non–hybridized (Negri et al., in prep.). This area is located in the western part of Alessandria Province.

The importance of the second and third study areas lies in the fact that in the last 10 years, red–legged partridge have colonized a completely new habitat, that it, the river bank, where it has never been reported before in Italy (Tizzani et al., 2011). So while the species is disappearing from its traditional habitat, it is progressively migrating to the North. These areas are located along the Scrivia River, one of the main rivers in the Alessandria province.

Table 1 shows characteristic land use in the study areas.

In view of the described situation, we have to survey populations at low density, either due to traditional habitat reduction, or to expansion in new, unusual habitat for Italy.

We tested the sensitivity of the playback method along transects, as described by Jakob et al. (2010) and we compared the results to those obtained using two census methods: mapping calls at dawn (Pepin & Fouquet, 1992) and direct sighting along a transect (Borralho et al., 1996). Below we report the protocol used for the monitoring activities.

Playback method

The protocol is the same as that described in Jakob et al. (2010): (i) the playback is used along a transect; (ii) each transect consists of 8 playback stations; (iii) the playback stations are at least 500 m apart to avoid double counting; (iv) the playback repetition lasts from one hour before, to one hour after dawn; (v) the operators perform four calling sessions at each station for a total of 10 minutes; each session last two minutes and 40 seconds with a brief interval after each call; and (vi) this protocol is repeated on three consecutive days of the survey in April (peak of calling activity of males) in good meteorological conditions (no wind or rain).

As control methods, first we mapped the spontaneous calling of males at dawn (Pepin & Foquet, 1992), This method exploits the spontaneous calling activity of males before dawn and localizes them on a map.
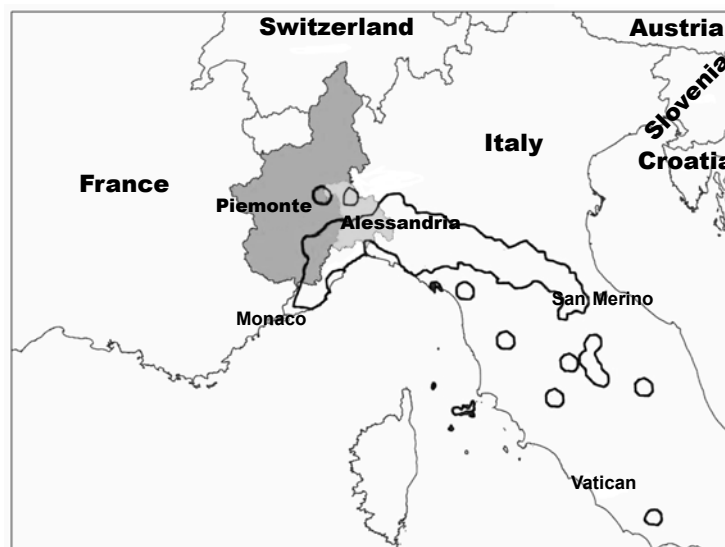
Fig. 1. Red–legged partridge Italian range (in black) and study area (in light gray).

Fig. 1. Distribución geográfica en Italia de perdiz roja (en negro), y área de estudio (en gris claro).

For mapping we used the same points that we used for playback calling, but in this case we needed more operators as all points had to be monitored at the same time. The spontaneous calling activity was recorded from 70 minutes before dawn till sunrise. The second control method was direct observation of partridges (from a car) along transects. Using this method all pairs seen on a transect in the same area of playback were recorded. After rain, more direct observations can be made because partridges come out to dry and they group on the roads. The transect method was applied along four transects (20 km) in area A, four transects (17 km) in area B, and three transects (13.4 km) in area C. The transects were monitored after rainfalls.

Results and discussion

Monitoring effort

We monitored the three study areas for two years (2010 and 2011). Eleven transects were monitored each year for a total of 87 stations sampled three times (261 stations sampled). We monitored 31 stations in area A (sample area 608.4 ha), 32 stations in area B (628 ha) and 24 stations in area C (471 ha). The same stations were used for monitoring spontaneous calling.

For direct observation we monitored transects for a total of 50.4 km.

Playback results
Data from playback monitoring showed very low male density in each study area, ranging between 1.48 males/100 ha and 3.78 males/100 ha (table 2).

Comparison of methods
Comparing the number of partridges estimated using each of the three methods, spontaneous calling always showed the best results, followed by direct observation, then playback. We have to take into account that in our analysis we worked only with raw data, without correction for estimating detectability. In every case, considering that all data were obtained under similar field conditions, we can consider that the absolute comparison between methods is realistic. In particular, in figure 2 we report the method which gave the best results in each of the study areas in 2010 and 2011.

The number of animals estimated with playback compared to numbers obtained with spontaneous calling varied between a minimum detection value of 34.6% of estimated animals to a maximum detection value of almost 70%.

The underestimation value of playback decreases with the number of repetitions (fig. 3). From the first repetition to the last, there is, in fact, a strong increase in the number of new animals detected. This increase occurs above all between the first and the second repetition. This situation leads to i) a higher underestimation value if we consider the single repetition, and on the other hand, to ii) a low repeatability of the results (the coefficient of variation of the results is always very high, ranging from a minimum of 32% to a maximum of more than 100%, and it is always above the value considered reliable using standard census methods (Marchandeau et al., 2006).

In our study the most important factors that affected repeatability of the playback method were the influence of daytime, and the attitude of males to reply to playback.

Table 1. Land use characteristics of the study areas.

Tabla 1. Características del uso del terreno de las áreas de estudio.

Land use cover	Area A	Area B&C
Banks	0%	11.6%
Cultivation	46.1%	60.3%
Pasture	1.9%	5.5%
Urban area	1.4%	1.7%
Vineyard	10.8%	
Water	0%	3.1%
Wooded area	39.8%	17.7%

Table 2. Number of males and density (males/100 ha) of red–legged partridge in the three study areas.

Tabla 2. Número de machos y densidad (machos/100 ha) de perdiz roja en las tres áreas de estudio.

Study area	Calling 2010	Calling 2011
A	9 (1.48)	23 (3.78)
B	10 (1.59)	11 (1.75)
C	10 (2.12)	12 (2.55)
Total	29 (1.70)	46 (2.69)

Daytime can influence detectability because spontaneous calling activity varies throughout the day and the year, as demonstrated by Pepin & Fouquet (1992). In our study the peak activity was reached between 60 and 50 minutes before dawn (84% of spontaneous calling registered within the range). This trend iwas even reflected in the different number of induced calls (65 *vs.* 47) and their frequencies (135 *vs.* 85) recorded between the first and second hour of monitoring. From these observations it can be assumed that males have a higher probability of being detected in the first hour.

Daytime not only influences the birds' response, but also the attitude of males to reply at playback. During our study only 10% of the males replied constantly to playback on all three monitoring days while a large proportion (almost 60%) replied only one time. This observation confirms that males of this species have a low tendency to call compared to other bird species (Eraud et al., 2007; Pagano & Arnold, 2009).

Conclusion

The results of our study confirm that in the case of low–density populations, the use of playback affects
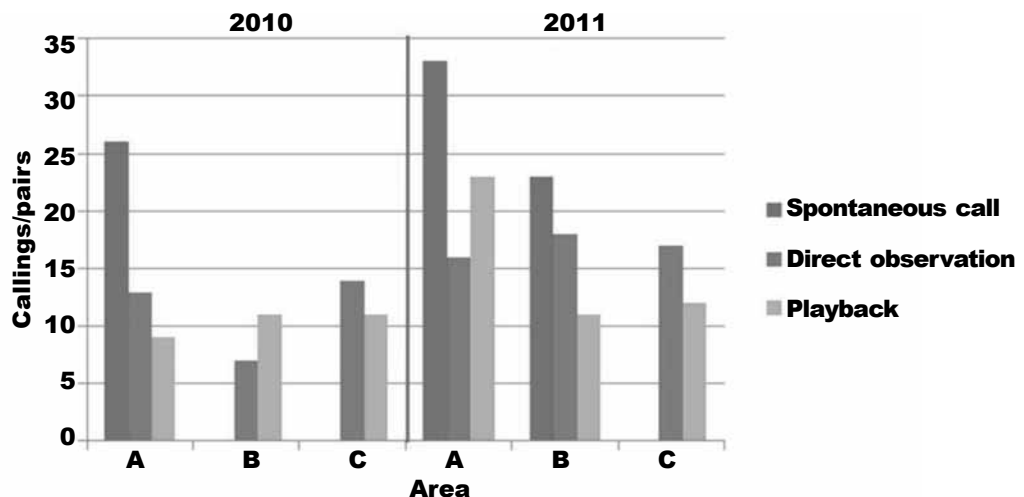

Fig. 2. Comparison of the three count methods in the three study area. Data for spontaneous call in 2011 for area C, and for 2010 in area B and C are lacking.

Fig. 2. Comparación de los tres métodos de recuento en las tres áreas de estudio. Faltan los datos de las vocalizaciones espontáneas en 2011 para el área C, y los de 2010 para las áreas B y C.
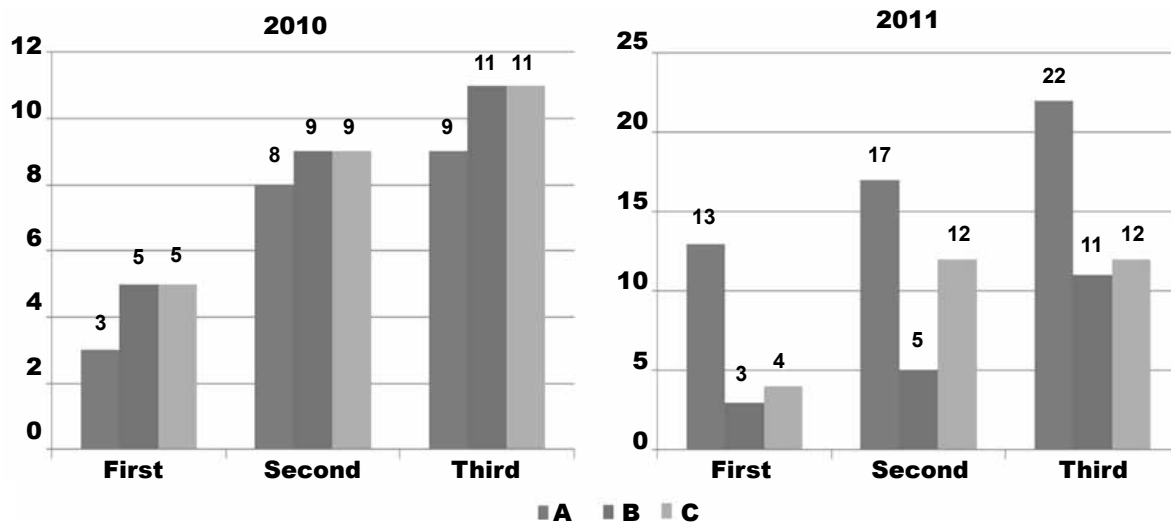
Fig. 3. Variation in number of calling males betweenh the three repetitions in the different study area. The three study areas are represented with different colours.

Fig. 3. Variación entre las tres repeticiones en las distintas áreas de estudio, en el número de machos que emitían llamadas. Las tres áreas de estudio se representan con distintos colores.

the census estimates of red–legged partridge. This method can affect their estimation because raw data from monitoring a large proportion of males could not be detected using the count only. In low density populations, therefore, the use of spontaneous calls seems to be the best method with the lower underestimation value. Another valuable aspect of this method is that it can be used not only in spring but all year round, as spontaneous calling activity is not limited to a single season (Pepin & Fouquet, 1992). This method can thus be used to monitor male densities during spring and reproductive success of populations in August. A negative aspect is that many operators are needed to apply the method in large areas. Direct observation, however, can be a useful tool to integrate information derived from other methods as the male can be seen as well as heard and so it is possible to discriminate between paired and unpaired males.

Even if playback highly increases detectability of calling males from red legged partridge (Jakob et al., 2010) and other partridge species (Kasprzykowski & Golawski, 2009; Novoa, 1992; Schoppers, 1996), the method shows a loss of sensibility in low density populations due to a higher incidence of confounding factors such as: i) lower attitude of males to reply to playback call; and ii) variation of calling activity during the day. Therefore, as although the method is good when detectability of males is high (Blondel et al., 1981) its capacity worsens as detectability decreases. Its limitations should be kept in mind when it is used to monitor population trends for low density and threatened populations. Nevertheless, it remains a useful tool to monitor large areas rapidly and with few operators.

References

Aebischer, N. J. & Lucio, A. J., 1996. Red–legged Partridge *Alectoris rufa*. In: *The EBCC Atlas of European Breeding Birds. Their distribution and abundance:* 208–209 (W. J. M. Hagemeijer & M. J. Blair, Eds.). European Bird Census Council, T. & A. D. Poyser, London.

Aebischer, N. J. & Potts, G. R., 1994. Red–legged Partridge *Alectoris rufa*. In: *Birds in Europe, their conservation status.* Birdlife Conservation Series, 3: 214–215 (G. M. Tucker & M. F. Heath, Eds.). BirdLife International, Cambridge.

Amici, A., Pelorosso, R., Serrani, F. & Boccia, L., 2009. A nesting site suitability model for rock partridge (Alectoris graeca) in the Apennine Mountains using logistic regression. *Ital. J. Anim. Sci.*, 8(2): 751–753.

BirdLife International, 2009. *Alectoris rufa*. In: *IUCN 2011. IUCN Red List of Threatened Species*. Version 2011.2. <www.iucnredlist.org>. Downloaded on 01 February 2012.

Blondel, J., Ferry, C. & Frochot, B., 1981. Point counts with unlimited distance. *Stud. Avian biol.*, 6: 414–420.

Borralho, R., Carvalho, S., Rego, F. & Vaz Pinto, P., 1999. Habitat correlates of red–legged partridge Alectoris rufa breeding density on Mediterranean farmland. *Revue d'Écologie (La Terre et la Vie)*, 54: 59–69.

Brambilla, M. & Rubolini, D., 2004. Water Rail Rallus aquaticus breeding density and habitat preferences in Northern Italy. *Ardea*, 92: 11–18.

Cattadori, I. M., Ranci–Ortigosa, G., Gatto, M. & Hudson, P. J., 2006. Is the rock partridge *Alectoris graeca saxatilis* threatened in the Dolomitic Alps? *Animal Conservation*, 6(1): 71–81.

Conway, C. J., Eddleman, W. R., Anderson, S. H. & Hene Bury, L. R., 1993. Seasonal changes in Yuma clapper rail vocalization rate and habitat use. *Journal of Wildlife Management*, 57: 282–290.

Eraud, C., Boutin, J.–M., Roux, D. & Faivre, B., 2007. Spatial dynamics of an invasive bird species assessed using robust design occupancy analysis: the case of the Eurasian collared dove (*Streptopelia decaocto*) in France. *J. Biogeogr.,* 34: 1077–1086.

Evans, S. A., Mougeot, F., Redpath, S. M. & Leckie, F., 2007. Alternative methods for estimating density in an upland game bird: the red grouse *Lagopus lagopus scoticus*. *Wildlife Biology*, 13: 130–139.

Falcucci, A., Maiorano, L. & Boitani, L., 2006. Changes in land–use/land–cover patterns in Italy and their implications for biodiversity conservation. *Landscape Ecology*, 22(4): 617–631.

Granholm, S. L., 1983. Bias in density estimates due to movement of birds. *Condor*, 85: 243–248.

Hanski, I. A. & Gaggiotti, O. E., 2004. *Ecology, Genetics and Evolution of Metapopulations*. Elsevier Academic Press, New York.

Jakob, C., Ponce–Boutin, F., Besnard, A. & Eraud, C., 2010. On the efficiency of using song playback during call count surveys of Red–legged partridges (*Alectoris rufa*). *European Journal of Wildlife Research*, 56(6): 907–913.

Kasprzykowski, Z. & Goławski, A., 2009. Does the use of playback affect the estimates of numbers of grey partridge *Perdix perdix*? *Wildlife Biology*, 15: 123–128.

Lampe, H. M. & Espmark, Y. O., 1987. Singing activity and song pattern of the Redwing *Turdus iliacus* during the breeding season. *Ornis Scandinavica*, 18: 179–185.

Marchandeau, S., Aubineau, J., Berger, F., Gaudin, J–C., Roobrouck, A., Corda, E. & Reitz, F., 2006. Abundance indices: reliability testing is crucial – a field case of wild rabbit *Oryctolagus cuniculus*. *Wildl. Biol.*, 12: 19–27.

Meriggi, A. & Mazzoni della Stella, R., 2004. Dynamics of a reintroduced population of red–legged partridges *Alectoris rufa* in central Italy. *Wildl. Biol.,* 9: 1–9.

Meriggi, A., Mazzoni della Stella, R., Brangi, A., Ferloni, M., Masseroni, E., Merli, E. & Pompilio, L., 2007. The reintroduction of grey and red-legged partridges (*Perdix perdix* and *Alectoris rufa*) in central Italy: a metapopulation approach. *Italian Journal of Zoology*, 74.3: 215–237.

Negri, A., Pellegrino, I., Mucci, N., Randi, E., Tizzani, P. & Malacarne, G. (in prep.). Mitochondrial DNA and microsatellite markers demonstrate the occurrence of pure and chukar–introgressed Red–legged partridge (*Alectoris rufa*) populations in NW Italy.

Novoa, C., 1992. Validation of a spring density index for Pyrenean grey partridge, *Perdix perdix hispaniensis* obtained with playbacks of recorded calls. *Gibier Faune sauvage*, 9: 105–118.

Pagano, A. M. & Arnold, T. W., 2009. Estimating Detection Probabilities of Waterfowl Broods From Ground–Based Surveys. *J. Wildlife Manage.,* 73(5): 686–694.

Penteriani, V., 2003. Breeding density affects the honesty of bird vocal displays as possible indicators of male/territory quality. *Ibis*, 145(3): 127–135.

Penteriani, V., Gallardob, M., Cazassusc, H., 2002. Conspecific density biases passive auditory surveys. *Journal of Field Ornithology*, 73(4):387–391.

Pépin, D., Fouquet, M., 1992. Factors affecting the incidence of dawn calling in red–legged and grey partridges. *Behav. process*, 26: 167–176.

Pollock, K. H., Nichols, J. D., Simons, T. R., Farnsworth, G. R,. Bailey, L. L. & Sauer, J. R., 2002. Large scale wildlife monitoring studies: statistical methods for design and analysis. *Environmetrics*, 13: 1–15.

Potts, G. R. & Aebischer, N. J., 1995. Population dynamics of the Grey Partridge Perdix perdix 1793–1993: monitoring, modelling and management. *Ibis*, 137: 29–37.

Rands, M. R. W., 1992. The conservation status and priorities for threatened partridges, francolins and quails of the world. *Gibier Faune Sauvage,* 9: 493–502.

Schoppers, J., 1996. Cassetterecorder goed hulpmiddel bij inventarisatie Patrijs *Perdix perdix* in het broedseizoen. *Limosa,* 69: 180–181. [In Dutch with an English summary].

Serrani, F., Sabatini, A., Amici, A., Fabiani, L. & Calò, C. M., 2005. A modified method of playback census for rock partridge (*Alectoris graeca*) in central Apennine, Italy: preliminary results. In: *Proceedings of 4th International Symposium on Wild Fauna*: 151. Tatranská Lomnica, Slovakia.

Tizzani, P., Negri E., Silvano, F., Pellegrino, I., Malacarne, G. & Meneguz, P. G., 2011. Expansion of Red legged Partridge's habitat in the southeast of the Alessandria Province: the rivers as ecological corridors? First Conference on Mediterranean population of the genus *Alectoris* Alessandria, Italy, 14–15 November 2011.

Tryjanowski, P., Hromada, M., Antczak, M., Grzybek, J., Kuz´niak, S. & Lorek, G., 2003. Which method is most suitable for censusing breeding populations of red–backed (*Lanius collurio*) and great grey (*Lanius excubitor*) shrikes? *Ornis Hungarica*, 12–13: 223–228.

Tucker, G. M. & Heath, M. F., 1994. Birds in Europe, their conservation status. *Birdlife Conservation Series No. 3*. BirdLife International, Cambridge.

UNEP–WCMC, 2001. *Animals of the World Database*. http://www.unep–wcmc.org/species/02–037 Merigianimals/animal_redlist.

Verner, J., 1985. Assessment of counting techniques. *Current Ornithology,* 2: 247–302.

Zuberogoitia, I. & Campos, L. F., 1998. Censusing owls in large areas: A comparison between methods. *Ardeola*, 45: 47–53.