Does the Use of Playback Affect the Estimates of Numbers of Grey Partridge Perdix perdix?

Authors: Kasprzykowski, Zbigniew, and Goławski, Artur

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Original article

Does the use of playback affect the estimates of numbers of grey partridge *Perdix perdix*?

Zbigniew Kasprzykowski & Artur Goławski

Methods of estimating bird numbers differ with regard to the results obtained and time required. A usual method of counting grey partridge *Perdix perdix* consists in counting calling males in the period with their highest vocal activity. This method was tested in our study with the additional use of playback. The number of males calling after playback was significantly higher than before playback. We found a positive relationship between the increase in the number of males calling after playback and their maximum numbers at the study site. However, after playback, the mean number of recorded males was significantly smaller in sites with the presence of red fox *Vulpes vulpes* burrows than in locations where this predator was absent. Without playback, there was no difference in the number of males between these two types of sites. The results of this study show that the use of playback improves the ability to detect grey partridges (as was similarly found with many other species). The use of playback in estimating the numbers of grey partridge may also allow further analyses, on e.g. site selectivity.

Key words: density, farmland, fox, grey partridge, Perdix perdix, playback, vocal activity, Vulpes vulpes

Zbigniew Kasprzykowski, Department of Ecology and Nature Protection, University of Podlasie, Prusa 12, PL-08-110 Siedlce, Poland - e-mail: zbykas@ap.siedlce.pl
Artur Goławski, Department of Zoology, University of Podlasie, Prusa 12, PL-08-110 Siedlce, Poland - e-mail: artgo1@ap.siedlce.pl

Corresponding author: Zbigniew Kasprzykowski

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Knowledge of the abundance of a population of birds is essential for studies of avian population biology, community ecology and conservation. One of the critical issues is, however, that species abundance (or density) estimation methods must be validated and reliable. Many techniques exist for acquiring estimates or relative indices of bird population sizes (e.g. Granholm 1983, Verner 1985, Zuberogoitia & Campos 1998, Tryjanowski et al. 2003). Several methods of determining population density may exist for one species, and the grey partridge *Perdix perdix* is a good example. The most popular methods include: a thorough search of the site (Bro et al. 2004, Šalek et al. 2004), line transect sampling of calling birds (Rotella & Ratti 1986), strip-census estimates (Pepin & Birkan 1981) and counts with the help of a trained dog (Panek 1992). To estimate the numbers of this species, counting calling males in the period of their highest vocal activity is used very frequently (Panek 1998, Klansek 2002, Wübbenhorst & Leuschner 2006), but, to our knowledge, only one study has used playback (Schoppers 1996). This latter method is, however, used frequently for many other species, in order to study whether song playback influences settlement patterns (Hahn & Silverman 2007), territorial behaviour (Petrusková et al. 2007) or the numbers of birds captured during migration (Kearns et al. 1998). In addition, playback is employed to increase the detection of many secretive bird species (Conway et al. 1993, Zuberogoitia & Campos 1998, Brambilla & Rubolini 2004), such as Galliformes (Evans

at al. 2007). Increasing detection, which is likely to result in increasing sample size, may further allow detection of minor differences, e.g. a 'change' of habitat selection when analysing data collected with and without the use of playback (Jenkins & Ormerod 2002, Surmacki 2003).

Because of the catastrophic decline of grey partridge populations in many European countries (Aebischer & Kavangh 1997), precise data on their population biology and ecology are also useful in managing populations of this species (Aebischer & Ewald 2004). Vocal activity could be used to estimate winter survival, when the number of families observed in autumn is compared with the number of birds calling the following spring (Klansek 2002). Furthermore, it could also be used to analyse the parameters of reproduction in a given year, when the spring numbers of calling males are compared with the number of family flocks observed in autumn (i.e. brood production rate; Potts 1986, Panek 2005).

In our study, we aimed to determine: 1) whether male partridges react to playback of a male territorial call, and 2) whether playback methods increase detection by comparing spontaneous vocal activity and playback response. Additionally, we analysed whether the estimated numbers of grey partridge differed according to the presence of a predator, comparing results with and without voice stimulation. Red fox *Vulpes vulpes* is a predator responsible for great losses in grey partridge broods (Tapper et al. 1996, Parish & Sotherton 2007). During recent years, the number of foxes in Poland has increased dramatically and this species' utilised burrows are currently often found in the farmland landscape (Panek & Bresiński 2002, Gołdyn et al. 2003).

Material and methods

Our study was conducted in extensively used farmland in central-eastern Poland. The study area was located northeast of Siedlce (52°12'N, 22°31'E). The use of pesticides and mineral fertilisers is relatively low, and narrow fields are separated with distinct, wide balks in this region (Goławski & Meissner 2008). We selected 57 listening points, from which we reported spontaneous vocal activity and responses to playbacks. Each listening point was defined as a circle of a ca 500 m radius around a study point. The defined radius of audibility guaranteed the detection of all active males, because a grey partridge call can be heard from a distance of 800 m (Wiegand 1980). We used a shorter distance than that suggested in the literature because of various kinds of extraneous noise (e.g. vehicle sounds, barking dogs) related to the small size of farms in eastern Poland, which could hamper the detection of more distant males. The calls of this species were audible from a maximum distance of ca 500 m in other studies of grey partridge populations in open farmland landscapes (Goławski & Kasprzykowski, unpubl. data). Because of the relatively low numbers of grey partridge at most of the listening points, it was possible to count all calling males within the audible distance. Large fields with winter (mainly rye) and spring cereals predominated around listening points within these areas. Fallows, meadows and pastures did not exceed 10% of the total area. Detection of calling birds was noted by two independent observers simultaneously and compared.

We selected observation points located at least 500 m from the closest farm buildings and woodlands, since the density of the grey partridge decreases as forest coverage increases (Panek 1994). Listening points were located at road sides or maximum 200 m from roads, and traffic intensity at the selected locations was low. We travelled by car between consecutive listening points, located at least 1.6 km apart (similarly to Rotella & Ratti 1986). During one evening, depending on the time needed to travel between subsequent points, we listened at a maximum of five locations. A few days before the stimulation, we penetrated the area of audio monitoring to search for fox. We surveyed all open farmland habitats, paying particular attention to fallows and balks, where fox burrows are most often found. This procedure was conducted at all 57 listening points. The criterion of fox presence was finding utilised burrows with fresh tracks nearby and an intense scent from a burrow. In a given site, fox burrows (1-4 entries to the burrow up to 30 m apart) were always located in only one place. Penetration by foxes looking for food is most intensive in the vicinity of utilised burrows (Blanco 1986).

Fieldwork was conducted during the early spring of 2006 and 2007. In 2006, we performed counts between 3 and 27 April at 26 listening points, and in 2007, between 27 March and 23 April at 31 listening points. These dates were related to the retreat of snow cover, which in 2006 was later than in 2007. Because of the distinct influence of weather on the vocal activity of grey partridges (Panek 1998), we only conducted fieldwork in good weather, i.e. rain-

less and windless weather, and when temperatures were above 0°C.

We estimated the number of calling grey partridge males based on 5-minute stays at each listening point. During the first two minutes (pre-playback period), we listened for calls to estimate the numbers of males before stimulation. Then we played grey partridge calls from a tape for one minute, and conducted a second listening session during the last two minutes to estimate numbers after playback. During the control period, we noted the total number of calling males. Some individuals had moved between the pre-playback and after-playback period, but in all cases, when this was detected, it was accounted for when calculating the final count in order to avoid double counts. It was of course possible that some movement occurred and remained undetected. However, because the total number of males at a given point was rather small, we considered that the potential error in the total number of grey partridge males would be negligible. We played the call of a territorial grey partridge male from the recordings of Roché (1990). Two cycles of grey partridge male territorial calls were played during playback. Grey partridge males called most intensively shortly after sunset and at sunrise. The morning counts might have been biased by the intense song of skylark *Alauda arvensis*, which began during the period of partridge vocal activity (Panek 1998). Because partridge vocal activity is very similar in the morning and evening (Rotella & Ratti 1986, Panek 1998), we limited the studies to evening counts. Vocal activity of the partridge began ca 15 minutes after sunset (Rotella & Ratti 1986), and at higher partridge densities, neighbouring males started calling almost simultaneously. In the few cases where there was no spontaneous vocal activity of grey partridges during the pre-playback period (seven cases), we started playing the tape 25 minutes after sunset. We waited for 25 minutes to ensure that the birds would not begin vocalising spontaneously.

The Wilcoxon test (Z) was used to compare the numbers of grey partridge males before and after playback. The Mann-Whitney test (U) was used to compare numbers of partridges at listening points with and without the presence of red fox. To test the relationship between the number of partridges, the advancement of the season, and the sequence of listening points in an evening, we used Spearman Rank Correlation (Sokal & Rohlf 2001). Because the numbers of grey partridge did not differ between 2006 and 2007, data from both seasons were combined in the analysis (numbers before stimulation: $N = 57$, $U = 0.65$, $P = 0.503$; numbers after stimulation: $N = 57$, $U = 0.79$, $P = 0.428$). We used Statistica 6.0 (StatSoft 2003) software for the statistical tests.

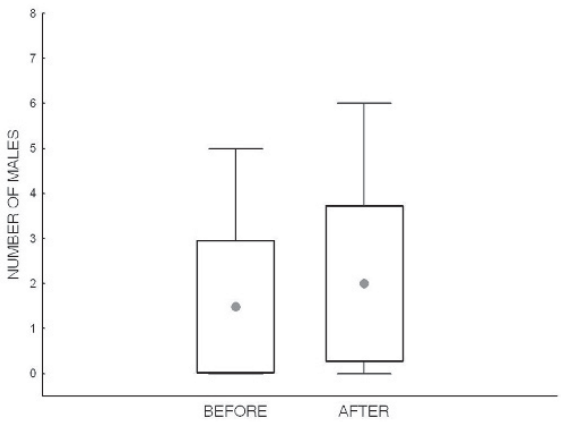

Figure 1. Comparison of the mean (●) number of calling males of the grey partridge before and after playback. Boxes indicate SD, and bars show minimum and maximum values.

Results

Playback experiments

The mean number of calling grey partridge males in the pre-playback period was 1.5 ± 1.4 (SD), while after the playback it was 2.0 ± 1.7 ($N = 57$, $Z = 3.49$, $P < 0.001$; Fig. 1). The maximum number of grey partridges heard during five minutes at a site was 2.2 ± 1.7 males ($N = 57$). The number of males after playback decreased at five listening points, remained the same at 25, and increased at 27 points. Maximum numbers of calling males were not related to the time during the season ($N = 57$, $r_s = -0.13$, $P = 0.333$) nor to the sequence of listening points checked during one evening ($N = 57$, $r_s = -0.10$, $P = 0.474$). There was a positive and significant relationship between the number of males and the difference of calling males before and after playback ($N = 57$, $r_s = 0.43$, $P < 0.001$).

Influence of fox burrows on grey partridge vocal activity before and after playback

When no fox burrows were found, 1.7 ($N = 39$) grey partridge males were recorded during the pre-playback period on average, whereas when fox was present, the average was 1.1 ($N = 18$). However, these differences were not statistically significant ($N = 57$, $U = 1.30$, $P = 0.195$; Fig. 2). After playback, the mean number of calling males was 2.4 with no foxes, but only

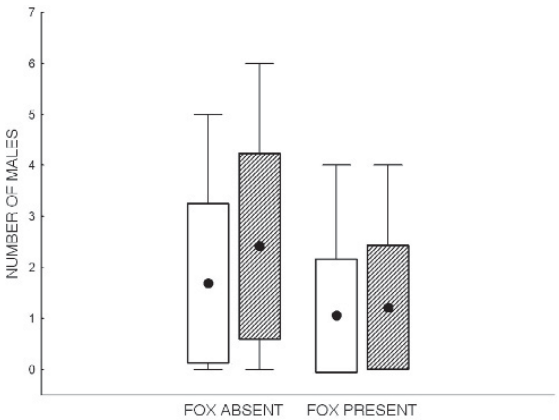

Figure 2. Comparison of the mean (•) number of calling males of the grey partridge before (white bars) and after (dashed bars) play-back at sites where no utilised fox burrows were found (fox absent) and with utilised burrows (fox present). Boxes indicate SD, and bars show minimum and maximum values.

1.2 in sites with foxes; the difference being statistically significant ($N = 57$, $U = 2.34$, $P = 0.019$; see Fig. 2).

Discussion

Playback stimulation increased the detection of male partridges by 33%. The use of this method to determine the number of grey partridges was already used by Schoppers (1996), who noted a 1.6 times increase, a close result compared to our result (1.3-fold increase). At least in western Poland, vocal activity of the grey partridge is relatively stable between mid-March and mid-April, and therefore, there is no reason to repeat counts in order to estimate acuracy (Panek 1998). We also found this as we did not detect any decrease in the number of calling male grey partridges with season or time. Increasing detection (and numbers) by using playback has been found in many other bird species. Increasing the detection of the water rail *Rallus aquaticus* enabled researchers to determine its actual habitat preferences (Jenkins & Ormerod 2002). In the case of the bearded tit *Panurus biarmicus*, using playback showed that these birds occupied many other sites and habitats than previously thought without playback (Surmacki 2003).

Similarly, we found that the playback effect was affected by the presence of foxes, with actually no effect being detected when fox were present. Smaller numbers of grey partridges in sites with fox may be interpreted as avoidance of fox or as a consequence of the pressure of fox predation. Because fox activity is highest at dusk and at night (Cavallini 1996, Pandolfi et al. 1997), we cannot rule out that grey partridges, whose peak vocal activity occurs after sunset, may have been shunning sites near fox burrows or at least avoiding vocal activity at this time of day. Confirmation of this may be the smaller increase of calling male partridges after playback in sites with fox burrows compared to locations where such burrows were not present. Most grey partridge brood losses in western Poland are caused by fox (Panek 2005), and an experimental reduction of the number of predators (including fox) improved the breeding success and increased densities of the grey partridge (Tapper et al. 1996). The strong predation pressure of fox on the grey partridge is confirmed by the significant proportion of Galliformes species in its diet (Gołdyń et al. 2003, Baker et al. 2006). The negative impact of fox presence has also been shown on other ground nesting birds in open farmland (Tryjanowski et al. 2002). The results obtained in our study are also important in the context of determining whether changes in the numbers of grey partridge are based on habitat preferences or the intensification of farming practices (Panek & Kamieniarz 1998, Klansek 2002, Wübbenhorst & Leuschner 2006). The observed increase in fox numbers may possibly be an alternative cause of decreasing numbers of grey partridges.

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