CHARACTERISTICS OF GREY PARTRIDGE MOVEMENTS FROM THE END OF SUMMER TO THE NEXT SPRING: A COMPARATIVE STUDY

Reitz, F. and Mayot, P.

Office national de la chasse - Direction de la recherche et du développement
Saint Benoist, F-78610 Auffargis, France

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ABSTRACT

REITZ, F. and MAYOT, P. : VARIABILITY OF GREY PARTRIDGE DISPERSION DURING AUTUMN AND WINTER : We studied the movements of female grey partridges, *Perdix perdix*, in four study areas that could be classified by three different patterns of life conditions (diversity of habitat and density of partridge populations). 85 birds were radiotracked daily during at least four months in a period beginning at the end of summer (August) and ending with the location of the first nest site (May or early June). Movements of 153 other females that were radiotracked daily for at least two months starting early spring were also studied. The birds' movements were quantified by the successive positions of the average monthly location and by nest location.

The results show that if great movements occur, even in autumn, i.e. before the broods are breaking up, most of the seasonal shifts of the average monthly location are less than 500m. Movement patterns are highly variable among birds, age classes and areas. We could notice the absence of important movements (more than 1km between the first and the last seasonal mean location) of adult hens and a clear tendency towards smaller movements of birds in the area with the highest partridge density and landscape diversity. We wese also able to show that the average May location is quite far away from the first nest location. A very simplified modelling suggests that the distance separating the average August and the next spring first nest locations would most often be less than 1.5 km.

1. INTRODUCTION

Study of population dynamics and management implies a good knowledge of dispersal behaviour and more generally of animal movements from one reproductive season to the next. Quantitative data on grey partridge (*Perdix perdix* L.) movements from brood rearing to the choice of a nest site the next spring are rather scarse, most of the previously published papers focalizing on the end of winter and beginning of spring (e.g. JENKINS, 1951, BLANK and As 1956, CHURCH *ET AL.*, 1980, BIRKAN and SERRE, 1988, CARROLL *ET AL*, 1995). On WEIGAND (1980) gave results over a large period. None of them, however, studied on lar samples of birds possible variations in these displacements among areas showing differe habitat types and partridge density.

Therefore we intended to take advantage of an important mortality study that w carried out in France involving radiomonitoring of many partridge hens all along the year different areas (REITZ and MAYOT, in press) to analyse the available data for bird movement We will only present a small part of the results that can be obtained, since we restricted t analysis to one sample of birds, and to the position of their successive average month locations and of their first nest.

2. METHODS

Partridges were radiotracked throughout the year in four study areas situated in th Centre-North of France. The areas major characteristics are summarized in **Table 1**. Becaus they were too scarse, area 1 and 2 data were analysed together.

Partridges were captured by night in early spring or in autumn using a spotlight and large drop net. Only females were equipped with a radiotransmitter (Biotrack Ltd or Holohi Systems Inc.) weighing about 10g with a theoric life duration of 6 or 12 months. Distinctio was made between hens less than one year old (which will be called young) and the other (adults). Each bird was located daily at daytime using a handheld antenna. Locations wer transfered to a squared map with a 1-ha grid.

All the present analyses are based on computing the average monthly locations of th birds, i.e. the arithmetic gravity centre of all fixes measured each month from August to Ma (only when more than 10 fixes concerning at least half of the month were available). To thes average locations, the first nest position was added when available. Because of lack of time, w restricted the data set to: i) 85 birds radiotracked during autumn and/or winter, for which a least four successive average monthly locations could be computed (among these birds, som had been radiotracked during the previous reproductive season and some were still bein radiotracked during the following spring), ii) 153 birds marked in early spring (before mid-April) that were radiotracked at least untill the end of May.

Table 1 : Area characteristics

area	landscape and type of crops	mean field size	permanent cover	partridge spring density (pairs/km²)
1 & 2	open field intensive, cereal and industrial crops	8 ha (area 1) 9 ha (area 2)	very few, except for some small woods, dirt tracks without grassy banks	5 to 10
3	id	5.5 ha	id. partly delimitated by a large forest	10 to 13
4	semi-open field mixed-farming	1.5 ha	several hedges, groves, woods and grassy tracks	20

Since very few and only adult birds could be radiotracked during the whole study period (from August to the time at which the first nest was located), we tried to estimate the shifts in the average location of partridges during this whole period by simulating the birds' movements. Modelling was based on the successive seasonal shifts of the average monthly locations and on randomly distributed angles between the directions of movement. The distances we used were actual but randomly selected seasonal shifts: i) the autumn shift (distance between the average August and December locations), ii) the winter shift (distance between the average December and April locations) and iii) the spring shift (distance between the average April location and the first nest location). As autumn shifts were only measured for adults, we considered that the movements of young were similar to those of adults during this period. We ran the model 1000 times for each area and age class. The statistical analyses were carried out using the SPSS 7.5 for Windows package.

3. RESULTS

First of all we studied the relative movements of hens belonging to the same brood. This concerned 13 birds and six broods (**Figure 1**). Although some large movements occurred before the broods broke up, the largest shifts between two successive average locations were recorded afterwards (see broods no 2 and 6). Large shifts from the breaking point also concerned adults (broods no 1 and 2). The breaking-up date varied from January (brood 2) to March (broods 1 and 4).

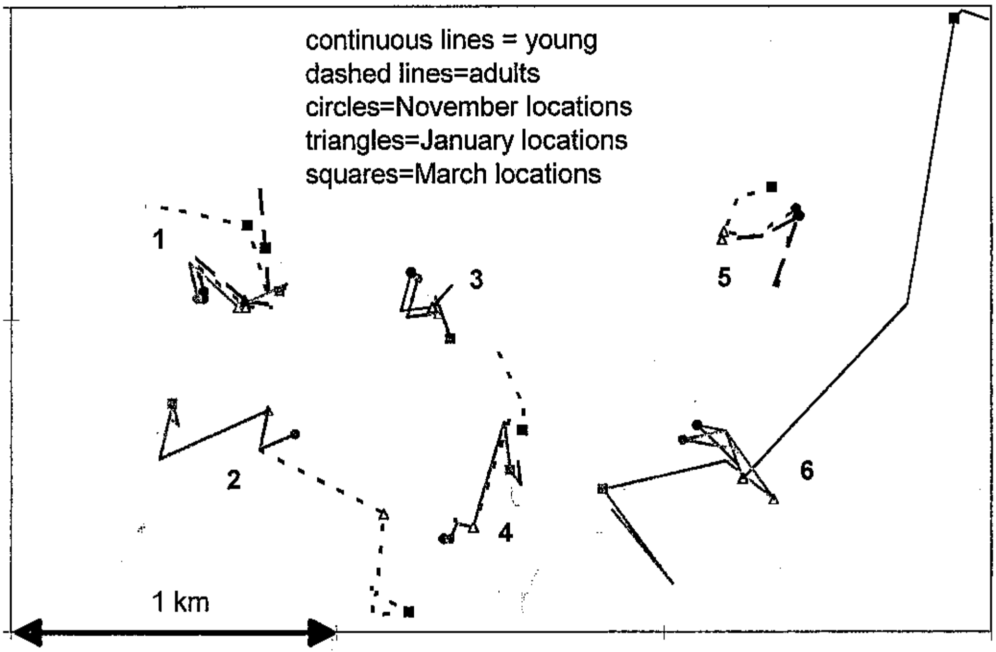

Figure 1: Relative autumn and winter movements of hens seen or captured with the same brood successive positions of the average monthly location.

The distance separating the successive average monthly locations varied greatly among the birds, even when considering only one age class and one area (see the confidence intervals in **Figure 2**). Statistical tests could not be performed because of high heteroscedasticity and dependency of the successive data concerning each bird. However four

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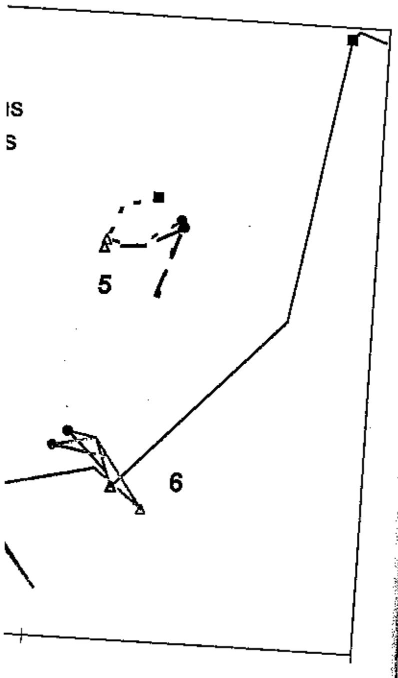

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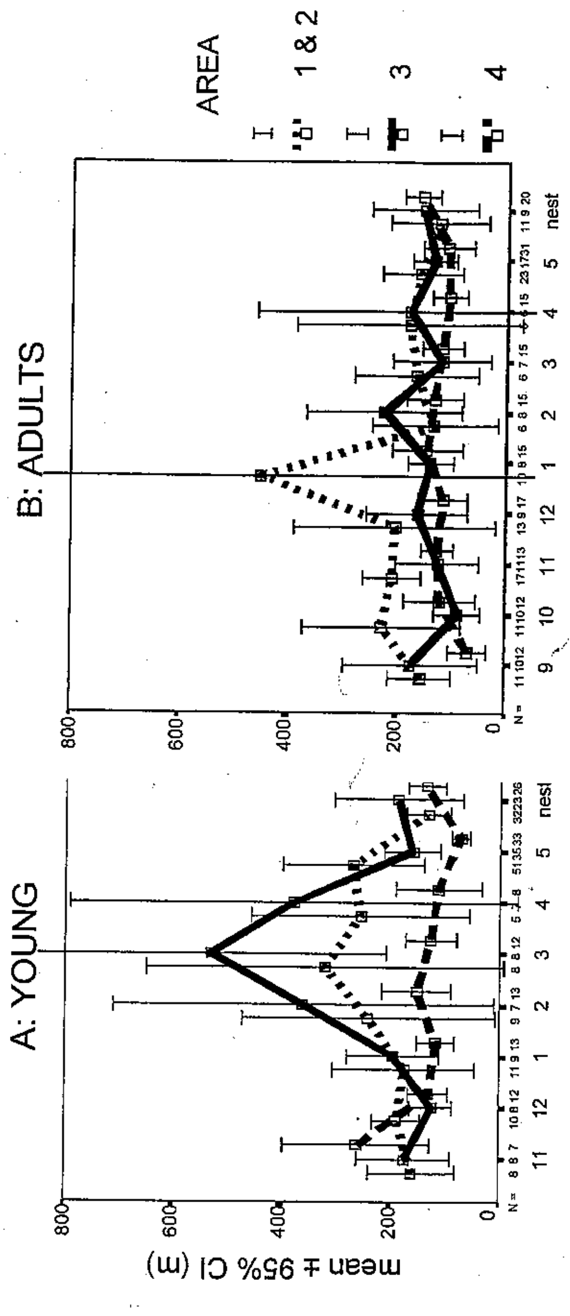

Figure 2: Distance separating the successive monthly average locations and the average may location from the nest site

high tendencies could be distinguished: i) movements of young hens in winter and early spring are smaller in area 4 than in others, ii) great shifts were recorded for adults in areas 1 and 2 in autumn and early winter, iii) there is no evidence of a common peak of movements among age classes and areas: only two age/area groups are showing a real peak which happened between the average February and March locations for the young in area 3 and between December and January for the adults in areas 1 and 2, iv) The average May location and the first nest location were usually not confounded since they were on average separated by nearly 200m (only 51 first nest sites among 121 were distant of less than 100m from the average May location).

Analysed over longer periods, our data show that seasonal shifts were mosly limited to less than 500m during either one of the three study periods (**Figure 3**).

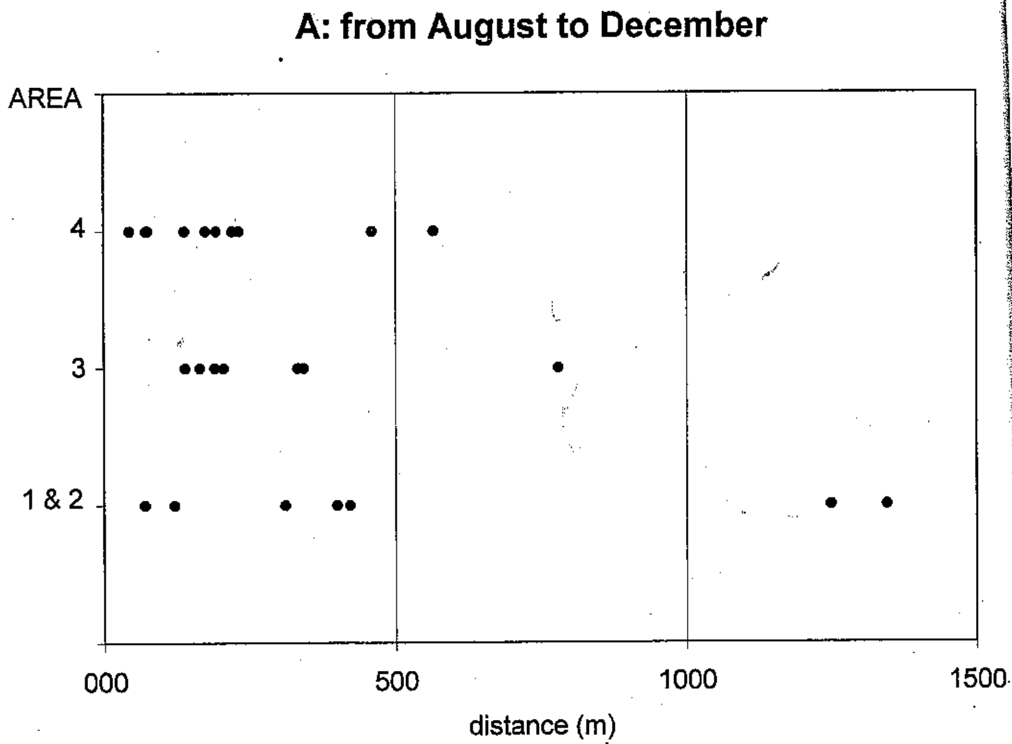

Figure 3: Seasonal shifts of hen average monthly locations. Each point = a monitored partridge.

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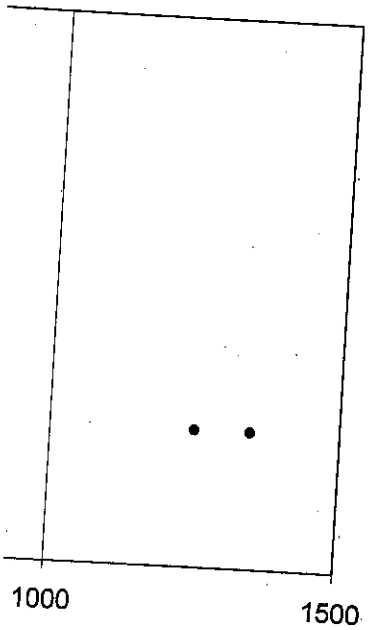

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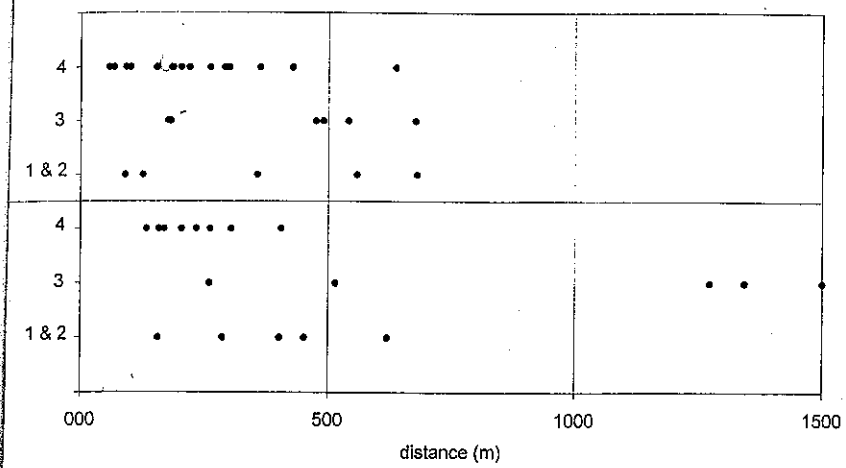
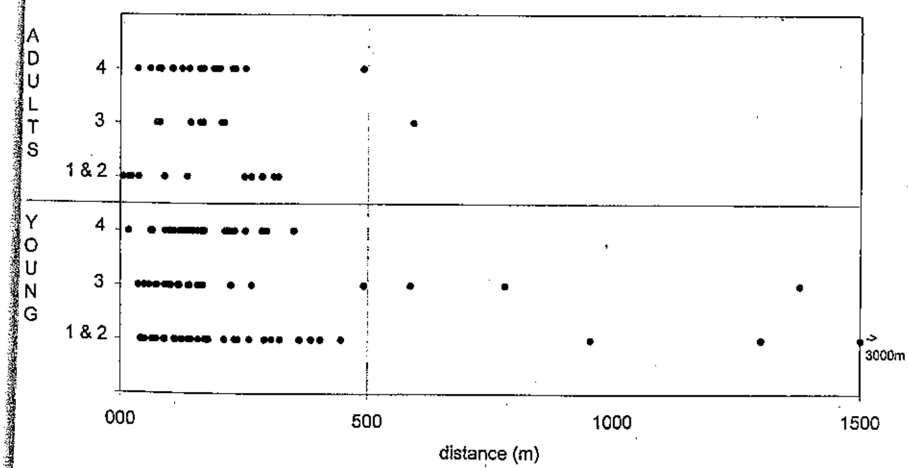
B: December to April



C: from April to the nest site



4. DISCUSSION AND CONCLUSION

Brood break-up and the behaviour of the grey partridges during the weeks following this crucial period are well documented (see BIRKAN & JACOB, 1988 for a review). From this point of view, our data are a simple confirmation. The original results of our study concern the comparison of shift sizes between areas, age classes and periods. They reveal that extensive movements (e.g. shifts in the activity centre of 500m or more from one month to the next) can sometimes occur when partridges are still grouped in broods, i.e. during autumn, but this is not a general rule even in areas where cover protection from predators or bad weather is scarse.

Another notable result is the existence of large shifts after April. CHURCH *ET AL.* (1980) pointed out the existence of an exploration phase throughout April. The latter probably continues up to the beginning of May. However, our present means of investigation do not allow us to be more precise. It would have been necessary to analyse the data day by day. Such an analysis would also allow us to study why the average location of May, i.e. during egg laying is rather distant from the nest location. Where is the nest location compared to the May activity range of the hen?

Surprisingly, the only clear gradient we obtained in movement sizes from areas 1 and 2 to area 4 was for adult global shifts according to our simulation. Adult movements in autumn and beginning of winter appeared to be higher in areas 1 and 2 than in others, while similar movements were recorded after for this age class in the three area groups. On the other hand, we pointed out a very different pattern for the young which dispersed farther in area 3 than in areas 1 and 2. We have no clear explanation for this. However the area 3 where another study took place before (SERRE *ET AL*, 1995) was known to be probably the place of high dispersal phenomena. Nevertheless it shows that partridge density and landscape diversity are not sufficient to explain dispersal behaviour variations.

Our modelling gives some interesting answers to the questions one may ask when managing populations, in particular those concerning the ideal size of management units. Very few data of bird movements from the end of summer to the next spring are available. The only ones we found are given by POTTS (1986) who reported that a mean distance of 420m for 27 young females was recorded at Damerham for the same period. This corresponds to our simulation results for the young in area 4. In other areas our model shows that movements could be much greater but not like those given by CHURCH *ET AL* (1980) for the only dispersal period. However, our results may be biaised in two ways: first, angles between successive directions were randomly chosen. Thus, it excludes a possible behaviour of progressive return of adults to the previous year nesting place. This behaviour is supported by our data in area 4: five adult hens could be located from August to next spring nest laying with a mean shift of 143m while the simulation gives a mean movement of 400m. Secondly, the size of successive shifts for one bird can be correlated (i.e. existence of birds that constantly tend to move more than others). If so, the variance of our estimates should be underestimated.

In conclusion, this work has confirmed or brought some new data to understand partridge movement behaviour outside the reproduction period. However it should be supplemented with all other available data (birds radioed during less than four months, birds monitored from spring to the end of summer in six other areas, data concerning brood movements from hatching to August) and with a range and a day-by-day movement analyses. Establishing relationships between individual patterns of movements and the habitat characteristics should be the ultimate goal.

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