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**THE MOVEMENT PATTERNS
AND BEHAVIOUR OF UNPAIRED MALE GREY
PARTRIDGE (*Perdix perdix*)
IN THE MIDLANDS OF IRELAND.**

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ABSTRACT

The grey partridge (*Perdix perdix*) is endangered in Ireland with two remnant populations in the Irish midlands. Three radiotracking studies were reviewed, Lullymore (52 km²), 1992-93; Boora (19 km²), 1995; and Boora (9 km²), 1997-98. The original data was analysed and information for five radio-tracked unpaired males is presented. Spring movements from day to day were often greater than 1 km and four out of the five birds left their respective study areas in search of females. Spring home range (Multiple Convex Polygon) was calculated for two birds at 309 ha and 109 ha. Several core areas were identified in each home range using cluster analysis. Some of these core areas were known to contain breeding pairs. Interactions between unpaired males and paired males were observed occasionally. One unpaired male was radio-tracked for 8 months. Movement patterns after mid-June were influenced in part by social interactions with other unsuccessfully breeding birds. The information gathered in this study confirms earlier published material, that unpaired males tend to be nomadic, their numbers fluctuate locally and they move several km. By moving between different breeding pairs they may displace a less dominant paired male or replace him in the event of mortality. In the Irish midlands there are a number of partridge meta-populations separated by several km. Unpaired males provide potential genetic flow between these populations. Their close association with pairs within the pair home range may allow extra-pair copulation to occur.

KEY WORDS

Behaviour, Ireland, Movement patterns, *Perdix perdix*, radiotracking, extra-pair copulation.

INTRODUCTION

Grey partridge spend the winter in coveys. These usually comprise the family unit of parents and young of the previous breeding season and one to several other adult birds that failed to breed or the lost their partner during the year (Potts 1980). Covey break-up begins in late December, continues throughout January, and is most rapid in early February (Blank and Ash 1956). If both members of a pair survive to the following Spring they usually reform. Siblings do not pair and young males leave the covey to attract females from other coveys (Jenkins 1961a). There is an imbalance in sex ratios of adults due to greater female mortality from the previous breeding season (Potts 1980). This leads to a surplus of unpaired males when most pairing has been completed at the end of February. The movement patterns and behaviour of these unpaired males is the subject of this paper.

STUDY AREAS AND METHODS

The grey partridge is endangered in Ireland (Whilde 1993). A national conservation strategy to increase numbers of partridge in Ireland has been in place since 1992 (Kavanagh 1998). Two low density populations of wild grey partridge remain in the Irish midlands, in Lullymore, Co. Kildare and Boora, Co. Offally. The larger population (autumn count of 24 birds in a 54 km² area in 1998) in Boora has been the focus of conservation efforts since 1996 with intensive predator control and the provision of nesting and brood rearing habitat (Kavanagh et al. In press). Three Irish grey partridge radio-tracking studies have been conducted to date. Capture and radio-telemetry methods are published elsewhere (Hearshaw 1996, O' Goman, In press, O' Goman and Kavanagh, In press). The original data from these studies was reviewed and radio-telemetry data for five unpaired males were analysed. An index of movement patterns is illustrated by joining lines to successive radio-fixes during the tracking period. Home ranges are calculated using two methods, 100% Multiple Convex Polygons (M.C.P.) to indicate the outer limits of the area used and 90% Cluster Analysis (C. A.) to indicate core areas used. Ranges V used for all analysis (KENWARD 1996).

RESULTS

Twenty-seven birds were radio-tracked in three studies, five of which were unpaired males (Table 1).

Figure 1 illustrates the movement pattern of an unpaired male during the period of covey break-up in Lullymore. A home range of 22 ha (MCP) was used from 6 December 1993 to 28 January 1994, followed by a displacement of over 7 km in 18 day period after which contact was lost with the bird.

Figure 2 shows movement patterns for two unpaired males in the Boora study area from March to June 1998. Male A was observed with three females on 1 April and a single female on 4 April. For the rest of the tracking period the bird remained unpaired until contact was lost on 12 May. Interaction with a radio-tracked pair was observed on several occasions.

Male B remained in the vicinity of a known pair for several days before moving over 1 km to a radio-tracked pair (with young chicks) on 25 June. Contact was lost with Male B on 29 June. Over a year later in August 1999 one of these birds with a radio-collar still attached was sighted with three other adults in Boora.

Spring home ranges were calculated for two unpaired males. In both cases (Figs. 3-4) an outer M.C.P. was calculated with several core areas calculated using cluster analysis.

During tracking of unpaired male in Boora in 1997, radio-tracking data was also collected for a pair breeding nearby. The core area overlap for these birds is illustrated in Fig 5. Several aggressive interactions between the unpaired male in Fig. 5 occurred in the core overlap area with much calling, resulting in the unpaired male to be driven out of the pair's territory on occasion. A second breeding pair was sighted in another of the unpaired male's core areas but no interactions were observed.

The unpaired male moved to an area containing no known breeding pairs in mid-June (see Fig 6.) Another unpaired male began to associate with this bird from July 16 onward. A third bird of unknown sex joined the unpaired males from August 21 and the covey moved to a new location within the study area. On

October 9 the group was reduced to two unpaired males again. They moved again to a new location where they were joined by a pair known to have bred unsuccessfully nearby. The group was reduced to three when one of the male birds was predated by a fox on November 5. Contact was lost with the group on November 30 when the battery on the radio-collared bird expired. The home ranges of the unpaired male during this time were divided into 4 time periods based on movement patterns and presented as core areas using cluster analysis in Fig 6.

DISCUSSION

An excess of males in the partridge population at covey break is a feature of grey partridge populations (Potts 1980). In England, Jenkins (1961a) estimated that 10% of the spring population consisted of unpaired males. In Montana (Weigand 1977) an excess of males was found in the late winter, with 16% more males than females in the trapped population and 11% more in the observed population. In France (Aufradet. In press) 12% of marked partridge were observed as unpaired males. During the three Irish studies 19% of the radio-tracked birds were unpaired.

Weigand (1977) suggested that this excess led to movement of males, particularly subadults, to remote winter ranges for mate selection. The winter density of one bird per 20-42 ha was regarded as a very low density when compared to Jenkins' (1961a) limitation of greater than or equal to one bird per 2 ha for low density. In Boora the density of birds in autumn 1998 was one bird per 225 ha. Weigand (1977) proposed that the movements of unpaired males was one of a number of factors preventing inbreeding in low density populations. The movement of unpaired males contributes to genetic flow between metapopulations which can be separated by several km. The observed movement of unpaired males in the Irish population would support this hypothesis.

Aufradet (In press) observed unpaired males from February to July 1968-88. Thirteen of these males left the study area, 10 paired with a hen that had lost its mate and 6 remained unpaired and joined a covey. By moving from one pair to another, an unpaired male can become available to a hen in the event that her mate is predated. This is beneficial to the female. In some cases unpaired males will dominate over the resident male and displace

him and where a pair is attended by a succession of males, the resident male may become totally exhausted through continuous vigilance (Cramp & Simmons 1980).

In a small partridge population on the verge of extinction, such as in Ireland presently, it would be hugely beneficial if the unpaired males could be used to contribute to the breeding stock. When extra females were provided by the release of hand-reared pairs in France they paired off with the surplus males and bred only 11% less successfully than the original pairs (Potts 1980). This is a management option in Boora.

However, sometimes an unpaired male is not driven away by the resident male (Cramp & Simmons 1980) and remains in the vicinity of a pair for several weeks (Fig 5). This raises an intriguing question: Is it possible that the unpaired male may sometimes sneak a mating opportunity with a paired female! Mixed genetic paternity of broods due to copulation with additional males, termed extra-pair copulation, is proving to be more common in birds than previously thought (Westneat et al. 1990). In the case of grey partridge this has yet to be researched. If proven, it could explain why some unpaired males join family groups (vested interest) while others choose to join other unpaired males and unsuccessful breeders. Further radio-tracking of unpaired males and DNA analysis of a sample of nests in a partridge population would address this speculation.

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Table 1. Results from Irish grey partridge radio-tracking studies to date

Study	Year	Area (km ²)	Birds radio-tracked	Unpaired males
Lullymore	1992-93	52	12	1
Boora	1995	19	6	1
Boora	1997-98	9	9	3

- ▣ 6 Dec-28 Jan, M.C.P. = 22 ha
- ▣ 29 Jan-15 Feb, Displacement of 7 km

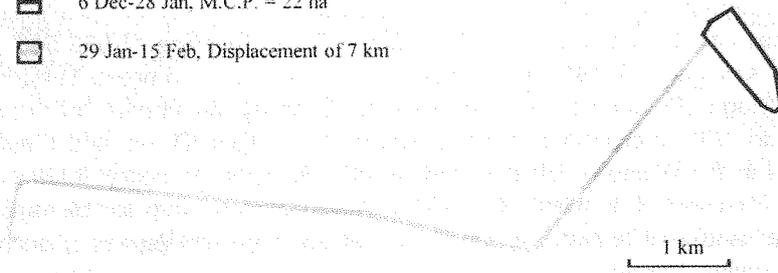


Figure 1. Winter/spring movements for an unpaired male grey partridge in Lullymore, Co. Kildare, 1993-94

- ▣ Male A: 13 radio-fixes, 30 Mar-12 May
- ▣ Male B: 14 radio-fixes, 13 Jun-26 Jun

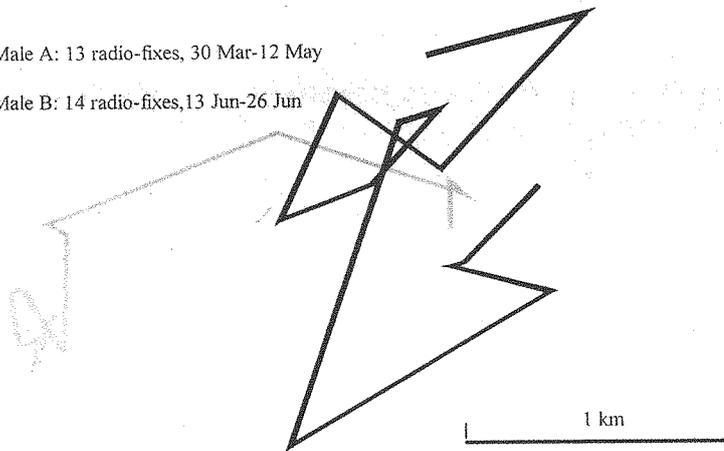


Figure 2. Movement patterns for two unpaired male grey partridge in Boora, Co. Offaly in 1998

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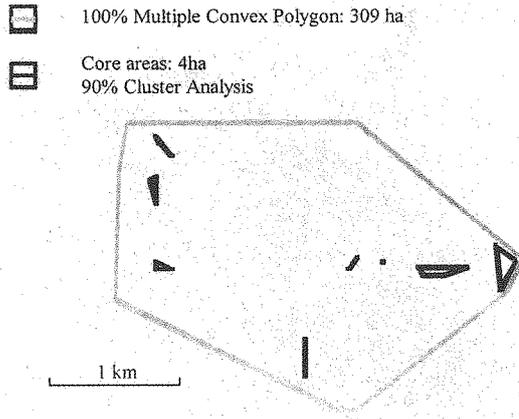


Figure 3. Home range (M.C.P.) with several core areas (C.A.) for an unpaired male (47 radio-fixes) from 27 February to 25 April in Boora, Co. Offaly 1995.

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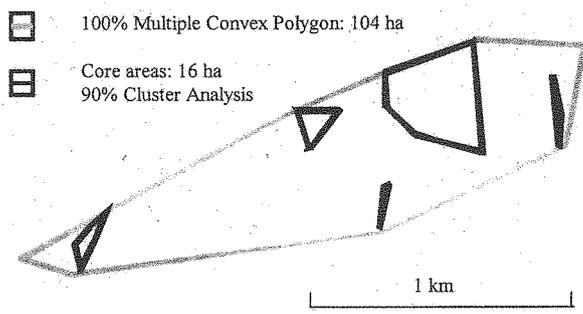


Figure 4. Home range (M.C.P.) with several core areas (C.A.) for an unpaired male (62 radio-fixes) from 9 April to 16 June in Boora, Co. Offaly 1997.

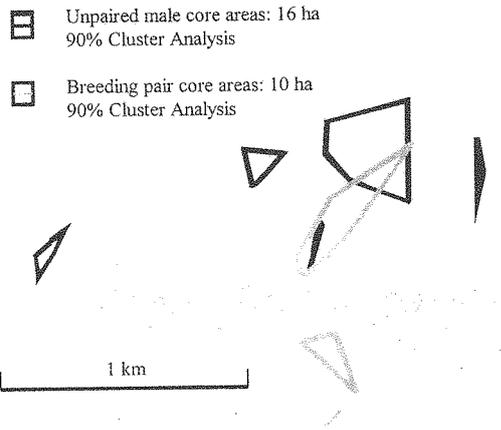


Figure 5. Core area (90% C.A.) overlap between an unpaired male (62 radio-fixes) and a breeding pair (61 radio-fixes) radio-tracked from 9 April to 16 June in Boora in 1997.

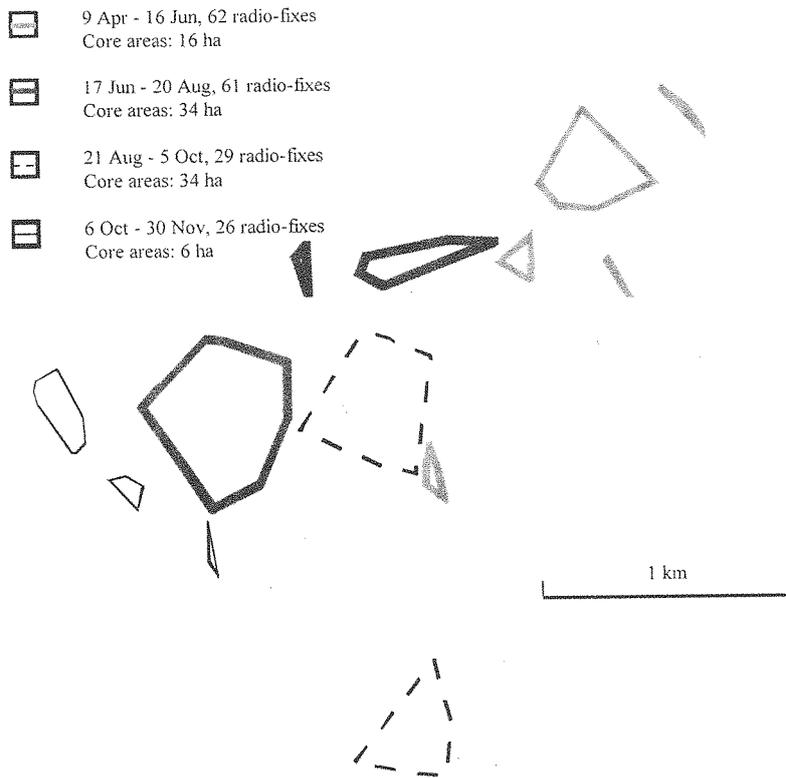


Figure 6. Core areas (90 or 95% cluster analysis) of an unpaired male over four time periods from 9 April to 30 November 1997.

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