

Territory fidelity in a Swedish pheasant *Phasianus colchicus* population

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Individually marked pheasants were used to map territories and study the selection and fidelity of these territories in South Sweden. The territories were occupied in March-May and 75 % were established within two weeks. The cocks returned year after year to the same territory areas. However, in two cases (5.6 %) it was demonstrated that cocks shifted their territories between two years. Yearlings occupied their territories later in the season than did older cocks. About 20 per cent of the yearlings did not get any territories but constituted a "floating" population of cocks during the breeding season. In a removal experiment it was demonstrated that the non-territorial yearling cocks were physiologically capable of holding territories.

The pheasant hens moved around among the territories and visited several cocks in early spring but by May they had selected a territory and settled there for the rest of the breeding season. Further, it was possible to state that the hens returned to the same territories and the same cocks even in the following year.

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1. Introduction

The Ring-necked Pheasant *Phasianus colchicus* has been demonstrated by Collias & Taber (1951) and Burger (1966) in U.S. to be territorial. In Britain, Lachlan & Bray (1973) also found territoriality and could demonstrate an almost exclusive territoriality which was opposite to the findings by Gates and Hale (1974) in U.S. These authors suggest that a crowing centre area is a more adequate description of the area than an exclusive territory. They also found that a high proportion of the hens were accompanied by different cocks during the breeding season.

These aspects: (1) The territoriality and (2) the faithfulness of the hens to different cocks were investigated in this study which was carried out between 1971-76 in South Sweden.

2. Study area and methods

The study area is situated in the Revinge area 20 km east of Lund in South Sweden. In the study area (417 hectares) which included a dense pheasant population, a 169 hectare map area was delineated (Fig. 1). This area includes bushy marshes, wet meadows and open cattle-grazed fields. The vegetation in the marshes is dominated by *Carex* spp., *Phragmites communis* and bushes of willow, birch and alder. In the wet meadows the vegetation constitutes of *Deschampsia*

caespitosa, *Epilobium hirsutum* and *Urtica dioica*. The open grazed fields are covered mostly by *Dactylis glomerata*. The pheasant population in this area had been self recruiting for at least the last 20 years before the study started and the population normally reached a spring density of around 25 pheasants per 100 hectares. During the study this population was excluded from the open season for hunting.

Pheasants were trapped during winter in traps baited with cereal grains. All trapped birds were marked with numbered metal leg-rings ($n_{1971-76} = 397$). In 1971-73 both sexes were also marked with a thin aluminium tab (25 × 25 mm) numbered in bright fluorescent colours and attached to a thin collar around the neck. The tabs were hanging down and out from the feathers just above the breast. They were easily detected within 100 metres even when the vegetation hid most of the bird's body. This marking technique had the advantage of being invisible when a pheasant in danger laid down in the vegetation cover. However, during moulting the birds sometimes got entangled in the collar with their lower mandible when preening the feathers on the neck and the breast. Therefore, from 1973 the cocks were marked with backtabs similar to those used by Blank & Ash (1956) on Grey Partridge and by Labisky & Mann (1962) on pheasant. Hens were not backtabbed owing to the risk being detected by a predator on the nest. The hens were equipped with radio transmitters according to Tester et al. (1964) which were fitted on the back of the bird and then were practically invisible among the feathers. Plastic leg-rings in different colour combinations were also used to identify the hens individually.

By continuous observations of the individually marked pheasant cocks during several hours at a time, the territories could be delineated. Sometimes only the centres of observation plot swarms could be defined, but often the border was exactly defined from territorial displays and fights between

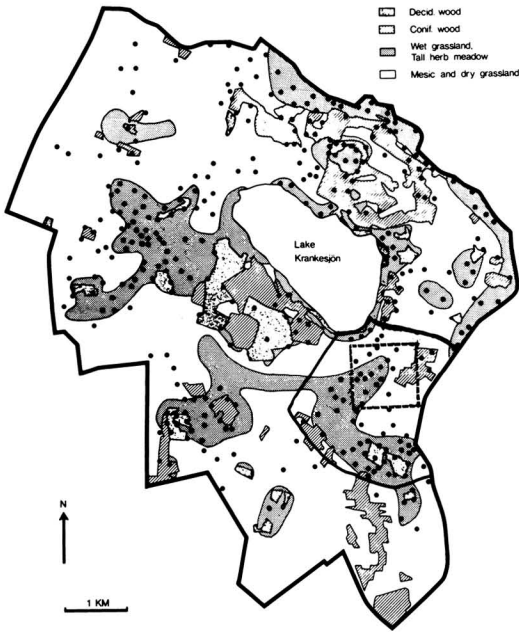


Fig. 1. Map of Revinge area with study area (broken line), map area (solid line), forests and wet meadows (shaded) indicated. Solid circles indicate location of crowing cock pheasants in early breeding season (April) completed with cocks which established territories in later (May) in 1972.

neighbouring cocks. The observations on individually marked hens were noted together with the cocks which they accompanied.

3. Results

In spring the winter flocks of pheasants break down, first those of cocks and about a month later those of hens. The cocks spread out to their

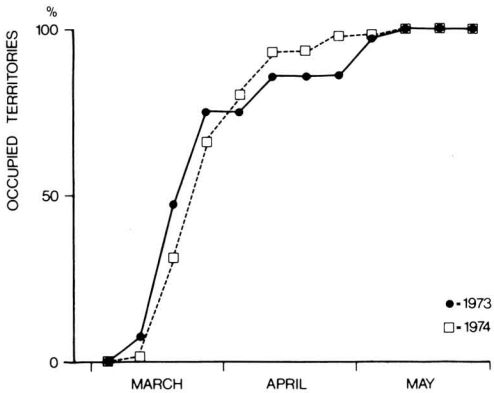


Fig. 2. The successive occupation of territories in 1973 and 1974 presented as a percentage of the total number of finally occupied territories.

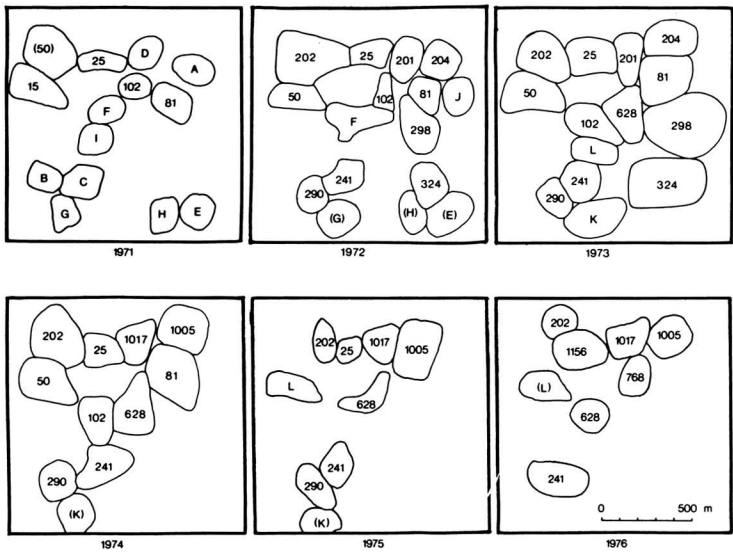


Fig. 3. Pheasant territories when well established in May in the study area during 1971-76. Numbers refer to identified (tagged) cocks, letters to unidentified (not tagged) cocks. Letters within brackets indicate cocks which probably are the same as those during the year before. However, this could not be proved as these birds were not tagged.

♂	1971	72	73	74	75	76
15	-					
50						
81						
102						
25						
201						
204						
298						
324						
241						
290						
202						
628						
1005						
1017						
1156						-
768						-
MEAN AGE	(1.0)	1.3	2.3	2.9	3.4	2.8

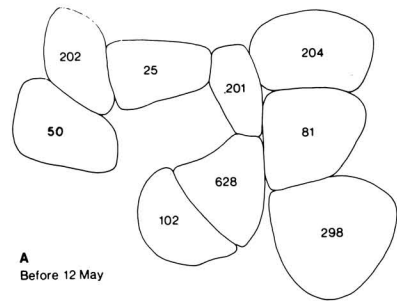
Fig. 4. Age distribution and mean age of the territorial cocks during 1971-76 in the area studied. As no. 15 was aged as "adult" when first tagged in 1971 it may be 2 years old or older in 1972, this mean is uncertain and put in brackets.

former territories used the previous year during March and April (Fig. 2) and the main part of the territories were occupied in a few weeks from late March to early April. However, it was early May before all territories were occupied. These later occupied territories were established by yearlings.

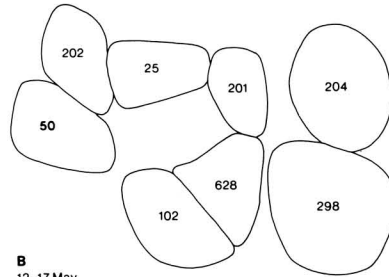
Cocks older than yearlings returned to their former territories as demonstrated in Fig. 3. There were only two occasions in six years where a cock altered his territory from one year to another: no. 50 in 1971-72 and no. 102 in 1972-73. In the other 34 cases, when birds could be appropriately identified, they were shown to return to the same territory area year after year. There was a decrease in density of territorial cocks during the last two years. It seemed to be the result of bad recruitment the year before so that missing old cocks were not replaced.

As most of the cocks in the study were aged and individually marked it was possible to establish an age table for the territorial cocks (Fig. 4). The mean age was found to increase from 1972 to 1975 (1971 was excluded as the prehistory of the cocks marked this year was unknown). This increase was simultaneous with the decrease in population size and due to the poor recruitment of young cocks.

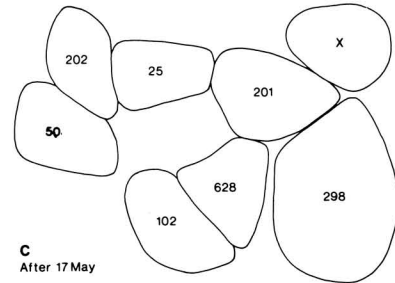
The turn-over frequency of pheasant territories during the years 1971-76 in the area shown in Fig. 3 ranged from 25-57% as a maximum estimate if all unidentified cocks were regarded as different individuals, but from 20-40% if



A
Before 12 May



B
12-17 May



C
After 17 May

Fig. 5. Distribution of pheasant territories in the study area 1973 before (A) and after removal of a first (B) and a second (C) cock. A new cock ("X") which occurred in C was a yearling bird.

regarded as the same as indicated by letters in Fig. 3.

During the period of high territorial activity, several cocks were observed to be non-territorial in April-June. In the area with individually marked territorial cocks there were at least five cocks which were "floaters". These marked cocks were all yearlings. They were observed in several (3-7) territories during May-June. The non-territoriality could be explained as a result of the occupation of all suitable areas by older cocks. However, it could also be that these cocks were too young to breed and occupy territories.

In early May at the time when the territory establishment was completed a three years old cock (no. 81 in Fig. 5) was removed. Two neighbouring cocks (no. 204 and 298) expanded or

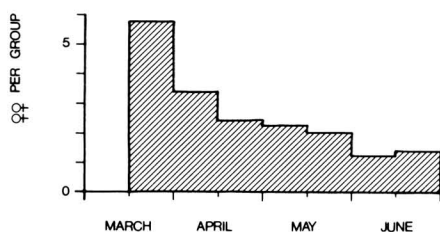


Fig. 6. Size distribution of hen groups in the Revinge area calculated every two weeks from March 15 – June 30.

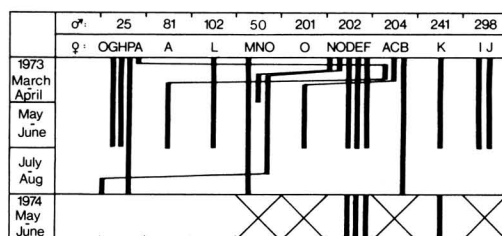


Fig. 7. Distribution of hens between different territorial cocks in 1973 and 1974. The cocks are indicated by numbers, the hens by letters. Vertical bars indicate periods of observations on the respective hens. Crosses indicate cocks which were known to be missing in 1974.

moved their territories in the next day so that empty area was filled up again. After five days one of these cocks (no. 204 in Fig. 5B) was removed. The empty area was then occupied by two expanding neighbour territories (no. 201 and 298) but a new, previously unknown cock, also occupied a territory (no. X in Fig. 5C). This cock proved to be a yearling. This result indicates that there were young cocks available to occupy empty territories and they were capable of doing so but were prevented by old and dominant cocks.

Two weeks after the last removal both the removed cocks were released in their former territory areas. The no. 81 cock was able to re-establish his territory but the younger (two years old) no. 204 cock was not, and disappeared during the summer.

In April, the hen flocks were broken into smaller groups (Fig. 6) which spread out over the area and settled in late April in territories of different cocks. The further drop in group size during May and especially in June is due to egg-laying and incubation, which cause the hens and their cocks to be less visible for certain observations.

As pointed out in Fig. 7 pheasant hens did alter their cocks between the periods March–April and May–June as a result of the dissolving winter flocks and temporal settlement before they finally decided on a cock. However, during May–June no hens were found to shift their cocks. The few data from July–August indicate that hens were still associated with the same cocks as they were earlier in the season of that year. In fact, during the next breeding season four hens were found to return to the same cock as in the previous breeding season. However, the data are few and four of the cocks were known to be lost between the two years.

4. Discussion

In this study it is shown that pheasant cocks have defined territories which they occupy in March–April when they leave their winter areas. However, the data presented here cannot exclude the possibility that the territories are more likely to be crowing centres, as proposed by Gates & Hale (1974) and further stressed by Brown (1975) as “core areas”. In Gates & Hale’s (1974) study area in Wisconsin the average density of cocks was as low as 1.0–2.7 territorial cocks per 100 hectares. In the Revinge population the average density varied between 7–13 territorial cocks per 100 hectares, and there the territories seemed to be exclusive as no overlap was recorded during the breeding season. So, the observed differences could be a matter of density. Also, Burger (1966) in the U.S. and Lachlan & Bray (1973, 1976) in Britain demonstrated exclusive territories in the pheasant. In the Revinge study the cocks were shown to return to the same territories in subsequent years with very few exceptions. Such a strong fidelity to a specific territory area has the advantage that the cock is familiar with the habitat variation and the seasonal changes and the predictability of habitat qualities within the territory and thus has a higher survival probability. It was also found in the Revinge study that territories situated peripherally, i.e. with only one neighbour, were only occupied by the same cock for one year, but the central territories, i.e. territories with more than one neighbour, were occupied by the same cocks for several years. So territory quality in terms of preferability probably affects survival of the occupant so that the occupants of less preferred and peripheral territories have a lower survival rate.

The occupation of territories in spring occurred successively with about two months

between the earliest and the latest establishment, although about 75 % of the territories were occupied during the first two weeks. There was a tendency for the most preferred territories to be established earlier in the season than the less preferred ones. The sequence of territory occupation is in accordance with predictions in the hypothesis of Fretwell & Lucas (1969). However, it was not possible in the Revinge study to measure the reproductive success of the individual cocks and this should have been the adequate measurement of territory quality. The earliest occupied territories were located close to the wintering areas and established by cocks of high social rank in consistence with findings by Collias & Taber (1951). The high ranking cocks often were the oldest cocks (Göransson, unpubl.). The conclusion is that older cocks, which also are socially high ranked individuals, will occupy territories before the younger cocks and occupy the areas of the highest quality.

The conservative territory system with long-lived cocks makes it difficult for young cocks to establish themselves in areas suitable for high quality territories and therefore the territory turn-over rate is rather low. A rigid territory system similar to that found here was also reported by Lachlan & Bray (1973, 1976) from a British pheasant population. The cause behind the rigidity and conservative traits of the territory system might be the pattern of territory occupation; older cocks initially occupy their previous territories with the same borders as in earlier years. Territories for young cocks will then be defined. However, vacant territories might sometimes be included in neighbouring territories as was found in the removal experiment.

A rigid spatial distribution pattern, as found in pheasants, is possibly due to characteristics of the habitats, as evidenced from removal experiments on the red grouse in Scotland (Watson & Jenkins 1968). Most probably there is a combination of habitat properties and territory fidelity that

makes the borders of territories fixed and conservative.

The occurrence of a floating population of non-territorial cocks further confirms the view that new cocks are prevented from occupying territories good enough to be successful for survival and breeding. Vacancies during the breeding season seem to be filled up by expanding neighbour territories rather than by non-territorial cocks. Territoriality was also demonstrated to be strong enough to allow a removed cock to reestablish himself in his former territory three weeks after the removal.

Pheasant hens did not disperse onto territories until 3–4 weeks after the first cocks, when 90–95 % of the territories were already established. This agrees with observations on pheasants in the U.S. (Gates & Hale 1974). Polygynous females might select their home ranges on the basis of territory quality which may be correlated with the quality of the male (Wittenberger 1976).

Pheasant hens were faithful to their cocks both within and between breeding seasons. This is contrary to observations in Denmark (Clausager, pers. comm.) and in the U.S. by Gates & Hale (1974). They found that at least 19 % of the hens changed cocks during the breeding season. The number of observations in the Revinge study is limited, but indicates that the hens remained with their cocks and territories from April to September. If the selected cock occupies a good territory, it should be advantageous for the hen to remain in the territory during the entire breeding period and also to return to this territory next year, as increased experience raises the probability of finding sufficient food for a good egg production or cover for the nest. These advantages also raise the probability of survival for both the hen and her offspring and thus increase the fitness of the territorial cock as well as his hens. Territory fidelity in hens thus seems to be advantageous to their reproduction.

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