Use of aspen *Populus tremula* by Capercaillie *Tetrao urogallus* in southeastern Norway

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The use of aspen *Populus tremula* by 27 Capercaillies *Tetrao urogallus* equipped with radio transmitters was recorded at Varaldskogen, southeastern Norway, during May–October, 1986–87. Males were observed in aspen at 23 of 301 checked locations, while females were recorded only once from 88. Males used aspen in two distinct periods, 29 May–30 June and 25 August–6 October. The frequency of male locations in aspen was four times higher in early summer than in autumn. Some males most probably actively selected aspen trees, while others did not use aspen at all. Modern forestry practice may reduce the density of aspen trees below a threshold value which prevents birds from taking advantage of this food source.

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Introduction

During the snow-free season Capercaillie *Tetrao urogallus* consume a great variety of plant species, including leaves of aspen *Populus tremula* (Semenov-Tian-Shansky 1960, Romanov 1979). In the boreal forest zone the proportion of aspen leaves in the diet increases from north to south (Seiskari & Koskimies 1955, Romanov 1979), presumably because aspen is more abundant in southern regions (e.g. Blumenthal 1942). However, while it has been shown that aspen leaves are of no importance in the diet in northern regions (Semenov-Tian-Shansky 1960, Pulliainen 1979), the seasonal occurrence and significance of this feeding habit is poorly known in southern regions.

The Capercaillie is the most sexually dimorphic grouse, and intersexual niche segregation has been indicated both in feeding habits and habitat use (e.g. Seiskari 1962, Rolstad et al. 1988). Reports on aspen feeding have not distinguished between males and females, hence, we do not know whether it applies to both sexes.

Here I report on the occurrence and the frequency of the use of aspen by Capercaillie in a boreal forest area in southeastern Norway. In particular, I focus on seasonal distribution and intersexual differences.

Material and methods

Fourteen males and 13 females >1 year old were monitored for 23 "male-years" and 16 "female-years" using radio-telemetry at Varaldskogen, southeastern Norway (60°10′N, 12°30′E) during 1986–87. The use of aspen was recorded by localizing the birds with a portable receiver, and approaching them for visual contact. Bird locations were sampled randomly with respect to the occurrence of aspen trees, which were totally mapped within a 25 km^2 area. The forest was dominated by Scots pine *Pinus sylvestris* and Norway spruce *Picea abies*. After common birch *Betula pubescens*, aspen was the most common deciduous tree. However, the density of aspen trees ≥5 m tall was only 13/km^2 (Table 1). The distribution of aspen trees was highly clustered, as shown by counting the number of trees in 500 × 500 m squares and comparing the observed distribution with a Poisson distribution (coefficient of dispersion = 8.9, $\chi^2 = 181$, df = 1, $P < 0.001$; Sokal & Rohlf 1981:87). However, aspen aggregations, defined as 500 × 500 m squares with ≥10 trees, were distributed randomly throughout the study area, with the mean distance to the nearest neighbour being 0.87 km ($R = 1.21$, $z = 1.37$, $P > 0.10$; Clark & Evans 1954). Aspen feeding implies consumption of leaves, and the use of aspen has never

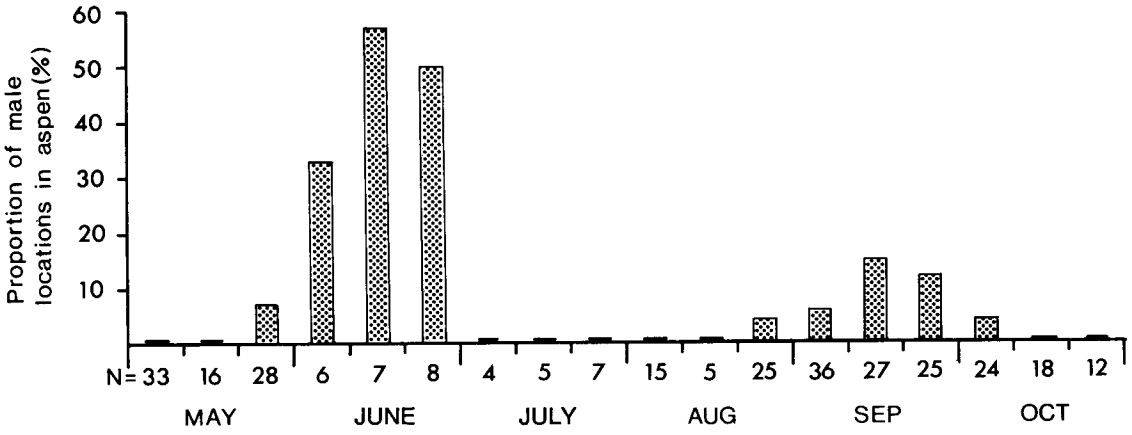

Fig. 1. Seasonal distribution of Capercaillie males equipped with radio transmitters observed in aspen at Varaldskogen, southeastern Norway, 1986–87. N = total numbers of checked locations within 10-day periods.

Table 1. Observed (O) and expected (E) locations of Capercaillie males in the four most common tree species at Varaldskogen, southeastern Norway, 1986–87. The pine, spruce and birch tree percentages were derived from Rolstad & Wegge (1987), based on the relative density of trees ≥5 m tall in old forest (≥70 years). Early summer = 29 May to 30 June, Autumn = 25 August to 6 October.

		Early summer		Autumn	
	%	O	E	O	E
Pine	56	8	11	70	45
Spruce	36	0	7	0	29
Birch	8	0	2	0	7
Aspen	0.03	12	0	11	0
Total		20		81	

been reported to occur in winter. Hence, I concentrated on the snow-free season, namely May–October. Aspen leaves opened during 25 May–5 June and fell during 20 September–15 October. A more detailed description of the study area, vegetation, and field technique is presented in Wegge & Rolstad (1986) and Rolstad et al. (1988). Statistical tests are two-tailed.

Results

During 1 May to 31 October males were recorded in aspen at 23 of 301 checked locations (8%). Females were recorded at 1 of 88 locations (1%; 21 September), which was significantly less than in males ($P < 0.05$, Fisher's exact test). The seasonal distribution of male locations in aspen was bimodal, with peaks in mid-June and mid-September (Fig. 1). Locations in aspen were recorded within two distinct periods, 29 May to 30 June (33 days) and 25 August to 6 October (43 days); they were more frequent in early summer (12 out of 30 observations; 40 %) than in autumn (11 out of 121; 9 %) ($\chi^2 = 17.8$, df = 1, $P < 0.001$). Of the total 24 bird locations in aspen, 17 were recorded during the early morning and late evening, namely within an hour after sunrise and an hour before sunset. Because most of the bird observations were made during the morning and evening this was no different from that expected by chance.

Nine of the 14 males were recorded in aspen during the two years. These birds were located more often in aspen during early summer (12 out of 17 observations) than during autumn (11 out of 56) ($\chi^2 = 15.7$, df = 1, $P < 0.001$). The remaining five males were never observed in aspen. During autumn 1986 and early summer 1987 birds were intensively monitored each day. Two of the males were never recorded in the vicinity of aspen trees and, therefore, evidently did not use aspen at all.

To indicate whether aspen was preferred, I calculated the expected locations of birds in the four most common tree species and compared them with the subset of bird observations made in trees (Table 1). Males used aspen trees more often than expected, both in early summer ($P < 0.001$, Fisher's exact test) and in autumn ($P < 0.001$). Because females were observed in aspen only once, it could not be ascer-

Table 2. Distribution of aspen trees ≥5 m tall and male Capercaillie locations in aspen according to successional stages and forest types at Varaldskogen, southeastern Norway, May–October, 1986–87.

	Aspen trees	No. of observations	
	%	Observed	Expected
Successional stages			
Clearcut 0–1 m	1.5	0	0
Plantation 1–6 m	10.4	4	2
Plantation ≥6 m	2.5	0	1
Old natural forest	85.6	19	20
Total	100	23	
Forest type			
Pine dominated forest	33.6	6	8
Spruce dominated forest	66.4	17	15
Total	100	23	

tained whether they preferred aspen. The expected proportion of locations in aspen was 1:3182.

To test whether birds preferred aspen trees associated with particular habitat types I compared the habitat at used aspen trees with that expected from a random use of aspen trees ≥5 m tall, with respect to successional stage and forest type (Table 2). The comparison revealed that males used aspen trees according to availability. Four male observations were made in aspen trees 5–10 m tall and 19 in trees ≥10 m, no different from that expected by chance.

Discussion

Seiskari & Koskimies (1955) maintained that the main period of aspen feeding in southern Finland coincides with the hunting season in September and October. This was not the case at Varaldskogen, where the frequency of male locations in aspen was four times higher in June than in September. The early summer feeding period may have been overlooked in earlier reports. The period seemed to be shorter than in autumn, and 10 out of 12 locations in aspen were recorded during early morning and late evening, namely before 04.00 and after 20.30. Few people are in forests at this time. There is little logging activity and no hunting.

My findings indicate that some males most probably actively selected aspen trees. Aspen leaves presumably are more palatable than birch leaves and conifer needles, because they are less resinous (Lindlöf et al. 1974). On the other hand, aspen leaves contain less crude protein and sugar, and more crude fat and fiber than other food plants growing on the ground, for example, the bilberry *Vaccinium myrtillus* (Lindlöf et al. 1974). Males started to utilize aspen in late May. This coincided with the opening of the leaves. Generally, newly opened leaves are more nutrient rich than older ones, and aspen leaves are relatively rich in minerals (Lindlöf et al. 1974). Birds roost in trees by night, and by selecting aspen trees they can easily supplement their diet during morning and evening feeding periods. The most intensive moult period is during July and early August (Lindén 1984). In this period flight is seriously hampered and males commonly roost on the ground at night (own obs.). The reduced flying ability may hinder the movements of the big birds in aspen crowns. Throughout the growing season the content of crude fiber in aspen leaves increases. This may explain why aspen was used less often during autumn than in early summer.

It may be that the seasonal distribution of aspen feeding reflects transitional feeding periods between the summer and winter diets, and that birds consume aspen leaves to readjust the digestive process. In autumn, the aspen feeding coincided with the transition period to pine feeding. In mid-October birds regularly fed on pine needles. However, this probably did not apply to the early summer feeding period. At Varaldskogen bare ground appeared in late April and early May, and males commonly fed on the ground from mid-May. When the first aspen leaves opened, males had already consumed plants poor in crude fiber for two weeks.

Earlier studies have not treated the sexes separately. At Varaldskogen the intersexual difference in the use of aspen was striking. While males regularly used aspen both in early summer and autumn, females were hardly ever recorded in aspen. The period when aspen leaves opened coincided with the incubation period of females. Because aspen trees were sparsely distributed, it was probably too costly for incubating females to take advantage of this food source. During mid-summer females with broods were precluded from feeding in trees, and if they lost their broods, they quickly started moulting which probably hampered arboreal movements.

However, why did not females use aspen in the same proportion as males during autumn? Due to the great sexual dimorphism the sexes probably are constrained by different ecological factors. Throughout

the year the daily energy demands of males are higher than those of females (Lindén 1984). Rolstad et al. (1988) supposed that males primarily are constrained by nutritional requirements, while females are more constrained by predation. Habitat selection studies have shown that females prefer denser habitats than males (e.g. Rolstad et al. 1988). Females seem to avoid exposing themselves in open habitat as shown, for instance, by the fact that during winter they feed in the middle crowns of pines, while males prefer the tops (Seiskari 1962:57). It may be that females renounce using aspen because this feeding habit is encumbered with a high risk of predation. In calm weather feeding birds can be localized by the noise of the trembling leaves.

Aspen leaves did not seem to be an indispensable food source at Varaldskogen; some males and most females evidently never used aspen. On the other hand, some males presumably preferred aspen. Seiskari & Koskimies (1955) and Pulliainen (1979) suggested that the availability of aspen probably must exceed a certain minimum value to warrant selective utilization. At Varaldskogen the distribution of aspen trees was highly clustered. Because males had larger home ranges than females (Rolstad et al. 1988, Rolstad in ms.), the intersexual difference in the use of aspen may partly be explained by the fact that male home ranges were more likely to encompass one or more aspen aggregations than female home ranges. In modern silvicultural practice aspen trees are removed in favour of pine and spruce trees which are economically more valuable. This may reduce the density of aspen trees below the critical threshold value which prevents birds from taking advantage of this food source.

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Selostus: **Haapa metson ravintona**

Kaakkois-Norjassa tutkittiin 27:n radiolähettimin varustetun metson ruokailua haavoissa touko–lokakuussa 1986–87. Metsokukkojen havaittiin ruokailevan haavoissa 23:ssa 301:stä tarkistetusta paikasta. Koppeloita havaittiin vain kerran 88 paikalla. Kukot käyttivät haapoja neljä kertaa useammin kesällä kuin syksyllä. Kirjoittaja arvelee, että nykyaikainen metsänhoito vähentää haapoja niin paljon, etteivät metsot enää voi hyödyntää tätä ravintovaraa.

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