Brief reports · Tiedonantoja

A case of polygyny and other breeding data on the Arctic Warbler

Erkki Pulliainen, Jyrki Mäkelä, Tiina Kukkonen, Teemu Hyvärinen & Päivi Jussila

The permanent nesting range of the Arctic Warbler *Phylloscopus borealis* extends to Forest Lapland in eastern Finland. The numbers of breeding individuals are relatively low there, however, as in many other parts of the western margin of its range, and rather little is known about the nesting biology of this species. In summer 1986 an opportunity arose to make observations on its breeding biology in the Värriö Nature Park in Finnish Forest Lapland.

The first singing male was recorded in the Nature Park on 9 June 1986, and the first observation of a female carrying nest material was made on 20 June. Later observations were concentrated on the western bank of the Hirvasjoki River, where three or four singing males had gathered (two others at a distance of 1 km). They sang most during the first week after their arrival, usually while perched in the tall spruces growing on the slope of the river valley.

Three nests of the Arctic Warbler were found. The females appeared to be very shy in the immediate vicinity of their nests, whereas the males approached the nest fairly directly. The nests were located in natural cavities (11–12 cm long) in the surface layer of the ground, the openings varying between 6.5 × 6.5 and 8 × 8 cm. The two main components of the nest walls were thin, dry grass stalks and 3–5 cm long pieces of *Hylocomium* spp. (also some dry birch leaves and decayed wood). The openings faced SE and S–SE. All the nests were located in fresh mixed forests (*Picea excelsa, Pinus sylvestris, Betula pubescens* and *Sorbus aucuparia*), with at least some *Juniperus communis* in the shrub vegetation. The distances from the nests to the open water were 10, 70 and 5 m; nest 1 lay 350 m from nest 2 and 2 200 m from nest 3; nest 2 was 550 m from nest 3.

Nest 1, with six 2-day-old young, was found on 16 July, nest 2, with seven one-week-old young, on 20 July and nest 3, with seven fledglings, on 24 July. The male from nest 2 was caught and colour-ringed on 21 July and immediately afterwards was seen feeding the young at nest 1. This was evidently a case of polygyny. Later this male visited both nests and fed their young. Its concurrent visits to the two nests were observed for a total of 9 h 50 min over 2 days. On 21 July it spent 1 h 30 min at nest 1 and 3 h 6 min at nest 2, and on the following day it spent 5 h 13 min at nest 1 and then moved to nest 2, only to find that the young had already left. After confirming this twice, the male returned to nest 1 and stayed there until the end of the observation time (4 h 30 min). Although the young from nest 2 were still close by when the male visited it, it did not feed them, but left this job to the female.

Food for the young was gathered from the branches of spruce and birch trees and from willow bushes growing in the river. About half consisted of caterpillars of Lepidoptera, the rest of adults of Diptera (especially mosquitoes and craneflies), Ephemeroptera, Trichoptera and Lepidoptera.

The young of nest 1 were so severely parasitized by blowfly larvae that only one or two of them fledged (one drowned). As many as 10 larvae were found in one bird. The larvae pupated in the bottom of the nest.

The local *Phylloscopus* community consisted of the Arctic Warbler, the Willow Warbler, *Phylloscopus trochilus,* and the Wood Warbler, *Phylloscopus sibilatrix*. Three Wood Warbler males were singing in the immediate vicinity of the Arctic Warbler nests 1 and 2, and one nest of this species was found about 100 m from nest 2. The total number of Wood Warbler males in the study area was about three (4 others at a distance of 1 km). The number of Willow Warblers was naturally great, and one of their nests was located only 15 m from nest 1 of the Arctic Warbler. All the young in this Willow Warbler nest fledged. The Arctic Warblers chased the Willow Warblers away if they came too near their nest entrance.

Reviewing the summer habitat preferences of the European *Phylloscopus* warblers, Murton & Westwood (1977) describe Arctic Warblers as birds of "tundra birch scrub" and Wood Warblers as birds of "shady broad-leaved woodland with few scrubs". The Wood Warbler appeared in the present study area in 1980 (Pulliainen & Hietajärvi 1980) and nests in the mixed forest of the Hirvasjoki river valley where the other two *Phylloscopus* species nest. It is remarkable that in this area the Arctic Warblers prefer this kind of mixed forest with conifers to the mountain birch forests which grow only a few kilometres away.

This one case of simultaneous polygyny, possibly the first of its kind, does not allow any very general discussion. Polygamy has been recorded earlier in Wood and Willow Warblers (von Haartman 1969). In this particular case it is interesting that there was an unmated male singing in the immediate vicinity of the male with two females. It is also interesting to recall the remark of von Haartman (1969) that "many polygynous species have domed nests" (as does the Arctic Warbler). He argued that the greater security of such sites from predators lessens the need for male assistance in driving off enemies. Here the male was very busy feeding the young of the two nests, which meant that it spent less time on the watch against predators than did its females.

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Selostus: **Polygamiatapaus lapinuunilinnulla ja muitakin pesimisbiologisia havaintoja**

Kesällä 1986 löydettiin Sallassa Värriön luonnonpuistossa Hirvasjokilaaksossa kolme lapinuunilinnun pesää, joista kahdella poikasia ruokki sama koiras (todettiin värirengastuksen avulla). Lähistöllä lauloi lapinuunilintukoiras, joka oli jäänyt kokonaan ilman puolisoa. Samaan *Phylloscopus*-yhteisöön kuului sirittäjiä ja pajulintuja, joilla on aikaisemmin todettu esiintyvän polygamiaa. Lapinuunilinnulla tämä lienee ensimmäinen havainto.

Kolmen *Phylloscopus*-lajin pesimäympäristö on tuore sekametsä, jossa kasvaa kuusta, mäntyä, koivua ja pihlajaa. Pensaskerroksessa on katajaa ja kenttäkerroksessa mm. melkoisesti sammalia. Jokilaaksossa veden läheisyys on merkittävä seikka.

Pesät sijaitsivat maaonkaloissa ja ne oli vuorattu lähinnä kuivilla heinänkorsilla ja seinäsammalen kappaleilla. Pesien suuaukot avautuivat kaakkoon ja eteläkaakkoon.

Lapinuunilintukoiraat aloittivat laulun kesäkuun 9. päivänä ja kesäkuun 20. päivänä nähtiin naaraan kuljettavan pesäaineksia nokassaan. Kolmessa tutkitussa pesässä oli 6, 7 ja 7 poikasta, joista yhden pesän poikaset olivat raatokärpäsen loisimia. Loisimisesta huolimatta tästäkin pesästä lähti lentoon yksi tai kaksi poikasta. Poikasia ruokittiin erikoisesti perhostoukilla ja kaksisiipiäisillä. Poikasten pesästälähtö ajoittui heinäkuun jälkipuoliskolle.

References

v. Haartman, L. 1969: Nest-site and Evolution of Polygamy in European Passerine Birds. — Ornis Fennica 46:1–12.
Murton, R. K. & Westwood, N. J. 1977: Avian breeding cycles. — 594 pp. Oxford.
Pulliainen, E. & Hietajärvi, T. 1980: Sirittäjä Phylloscopus sibilatrix pesivänä Sallan pohjoiskärjessä. — Lintumies 15:176–177.

The authors' address: Department of Zoology, University of Oulu, Linnanmaa, 90570 Oulu, Finland

Optimal foraging theory and food selection by the Grey Partridge *Perdix perdix* in captivity

Erkki Pulliainen

An often-invoked assumption in connection with the optimal foraging theory is that natural selection favours individuals that maximize their net rate of energy intake (e.g. Schoener 1971). In this sense it can be expected firstly that food species should be strictly ranked. Secondly, it can be predicted that large food would be preferred to small, and thirdly, that calorie-rich foods would be preferred to calorie-poor foods. Among a number of alternatives, these are predictions which can be tested with the Grey Partridge, *Perdix perdix*, which actively selects with its bill those food items which it wishes to accept and discards the others. The present paper is a reinvestigation of some data on food selection in this seed-eating gallinaceous bird species (Pulliainen 1965), the gut of which has evolved for the utilization of this kind of food (Pulliainen 1984b).

The first prediction appeared to be valid in a series of trials in which four kinds of grain were offered initially in addition to green leaves, and then the favourite grain was taken away, and so on. The results obtained were as follows (in ml):

No. of trials	Wheat	Rye	Barley	Oats	Green leaves
22	315.1	16.1	5.4	2.7	364.6
7	–	83.2	6.6	4.2	411.5
7	–	–	93.7	17.0	677.6
5	–	–	–	78.1	788.8

In the second series of trials both the shape (length/breadth index) and the size of the seeds (wheat and hemp) were taken into account as follows (shape indices in parentheses): Size class No. 6 (= the largest seeds; 1.55), No. 7 (1.70), No. 8 (1.85) and No. 10 (2.00). The following combinations (of wheat grains) were offered to two partridges (a male and a female): 6, 7, 8 and 10, 6 and 7, 8 and 10, and 7, 8 and 10. In all cases (as measured by weight and volume consumed) the seeds characterized by larger size and smaller length/breadth index were preferred, i.e. the preferred seeds were at the same time larger and more spherical than the less favoured ones. The next trials were carried out with spherical hemp seeds by using three size classes 6, 7 and 8. The results were as follows:

Size class	Weight (g)	Seeds taken	Volume (ml)
6	20.2	878	24.3
7	19.3	972	23.1
8	23.5	1944	40.0

Thus the highest figures by weight, number and volume were recorded in the smallest size class. The same finding was obtained with the alternatives 6 and 7.

The crude fat content of seeds can be used as a rough indicator of their calorific value. The results of the trials with seeds possessing different fat contents are shown in the following tabulation.

	Flax	*Galeopsis* spp.	Hemp	Wheat
Fat content, %	38–45	35–40	30–32	2
Consumption in 20 trials, ml	18.7	35.0	161.6	7.6

Thus the two most fatty seeds were not the most readily consumed ones, but the spherical hemp seeds were clearly preferred (72.5 %).

Using tetraonid hybrids as examples, Pulliainen (1982) showed that the basic food selection of tetraonids is genetically determined. Interspecific differences in the digestive ability indices (Pulliainen 1984b) suggest that this is relevant in the case of partridges, too, even though partridges do not eat foods typical of woodland grouse, nor are they able to digest these foods.

There is no doubt that the optimal foraging strategy works to some extent for partridges, and it is also worthwhile for them to have a strict rank order of food items, which really seems to exist on the basis of captivity studies (the present data) and studies carried out in nature (Pulliainen 1965, 1984a). The fat-rich seeds of *Galeopsis* spp. are highly preferred in nature, but took only second place to hemp seeds, which contain less fat, in the food selection trials. The most fatty seeds (flax) took only third place. These latter two food items are not available naturally in Finland, however. The spherical shape of the hemp seeds apparently explains their attraction in these trials. In fact the shape and size of the seeds appeared to affect the food selection of the Grey Partridges to such an extent that they can be said not to have acted in accordance with the optimal foraging theory. It is also worth remembering in this context that a change in the physical condition of these birds (e.g. in oedema cases) may alone totally alter their food intake (Pulliainen 1965).

Due to their sympatric existence *Galeopsis* spp. have become important food items of the Grey Partridge in the northern part of their European range. Due to their relatively high fat content, the seeds of *Galeopsis* spp. are worth eating when the Grey Partridge are living in an area with a cold climate. The present data suggest that if the availability situation in nature were different, the composition of the diet of the species might also be quite different.