

Night Rest during Nestling Period in Four Passerine Species under Subarctic Summer Conditions

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Lennerstedt, I. Night Rest during Nestling Period in Four Passerine Species under Subarctic Summer Conditions. *Ornis Scand.* 4, 17–23, 1973.

Night rest during nestling period was studied by observations from a hide-out and by an automatic recorder for a total of 42 nights under subarctic summer conditions at Ammarnäs, Swedish Lapland (66° N). The female was usually sitting on the nestlings during night rest. *Phylloscopus trochilus* rested for 5–7 hours, the time being almost equally distributed around midnight; *Emberiza schoeniclus* for 3.5–5 hours, mostly before midnight; *Luscinia svecica* and *Saxicola rubetra* 3–5 hours, mainly after midnight. Time of night rest – before, around, or after midnight – seems to be species-specific. Species differences indicate that other factors than light are involved in the adaptation of diurnal activity rhythms to subarctic summer conditions.

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INTRODUCTION

Ammarnäs, Swedish Lapland (65° 58'N, 16° 13'E), has continuous daylight during the breeding season, although the sun is below the horizon for some hours around midnight. Light conditions permit the birds to be active during all the night hours; but they take a 3–5 hours rest in most activities. This period is called night rest.

The activity of Willow Warbler *Phylloscopus trochilus*, Reed Bunting *Emberiza schoeniclus*, Bluethroat *Luscinia svecica*, and Whinchat *Saxicola rubetra* was studied in the subalpine birch forest on the slopes of the Kaissats and Valle mountains in the seasons 1963–1969. This communication deals with the length of night rest and the time of its beginning and end. Observations from the first season, 1963, have been discussed elsewhere (Lennerstedt 1964).

Night rest was studied during the nestling period, because this period is often critical for the production of young. If the food supply is short, adult birds can compensate for this by extending feeding activity into the night hours.

This is crucial for the relation between feeding and clutch size. It is usually thought that clutch size is adapted to the number of nestlings that adult birds can normally rear, and to the increasing day length from south to north (Lack 1947). The clutch size and productivity of Reed Bunting in southwest Finland were thoroughly studied and discussed by Haukioja (1970).

Larvae of the moth *Oporinia autumnata* were very abundant in the seasons 1963 and 1964; nestlings of Willow Warbler and Reed Bunting were principally fed on them. In the following seasons, these larvae were scanty or absent, and the nestlings were fed on other insects.

MATERIAL AND METHODS

Field work

Activity of birds at nest was studied either by direct observations from a hide-out close to the nest or by automatic recording. The extent of this field work is shown in Fig. 1, where the number of nestlings and their age are indica-

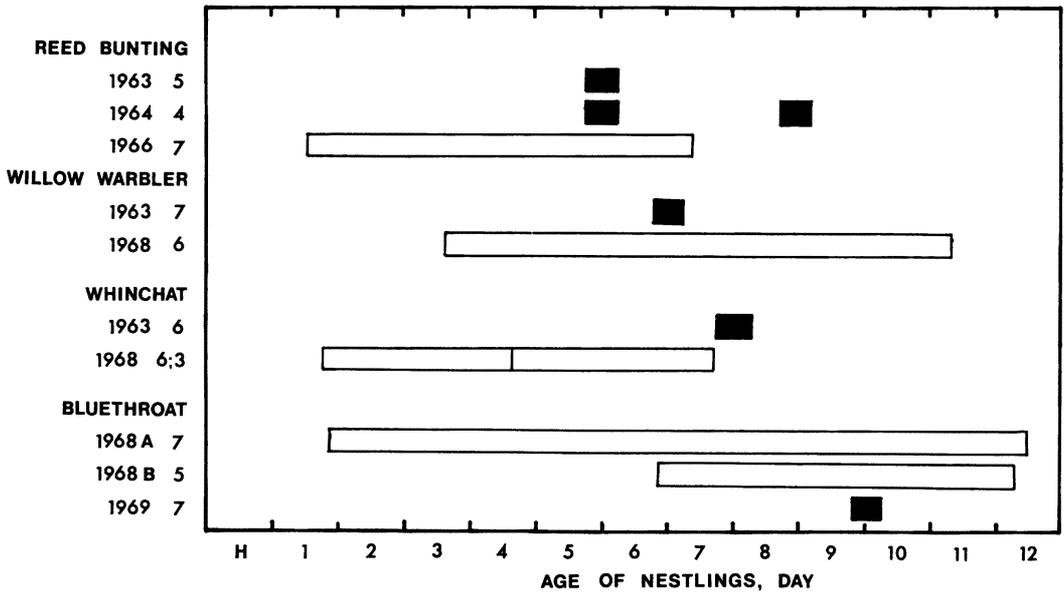


Fig. 1. Times of hide-out observations (black rectangles) and automatic records (unfilled rectangles) on the nest activities of four species. H = day of hatching. Number of nestlings is indicated. In Whinchat 1968, 3 nestlings disappeared on Day 4 and the remaining 3 on Day 7.

ted. The nests of Reed Bunting 1966, Bluethroat 1968B, Bluethroat 1969 were supplied with an extra nestling. The number of nestlings of Whinchat 1968 was reduced by plundering during the observation period.

The age of nestlings was counted from the day of hatching = Day H. The first night after hatching is Night 1. The next day = Day 1, when nestlings were about one day old. Thus Night 1 precedes Day 1. Time statements are rounded to five minutes, and since true midnight at Ammarnäs lies five minutes before the official, Central European midnight, they are approximately equal to the movement of the sun. Times for sunset and sunrise, indicated in the activity diagrams in Figs. 2–6, are those for the low alpine heath. At nests on the southern slope of the Kaissats and Valle mountains, the sun disappears about three hours before sunset and appears again about two hours after sunrise.

Recorder and interpretation of records

A photoelectric cell, containing a light-acti-

vated switch, and a lamp were mounted on a frame and placed at the nest. Every passage of a bird was registered by a counter, and by a pen on recording paper at 2.70 mm/min. The recorder was constructed especially for studies on bird-nest activities.

The four species investigated always build their nests on the ground. During the incubation period, the author successively surrounded and covered the nests with small twigs and grass. When the recording started, the adult birds could enter or leave the nest only through a 15–20 cm tunnel. The frame with photoelectric cell and lamp was placed near the entrance of the tunnel to avoid irrelevant movements in the nest being recorded.

The recorder cannot indicate why a mark on the paper occurred. It makes the same record for a bird passing with food to the nestling as, for instance, for a wag of the tail when the bird is sitting in the tunnel. In most cases, however, the records were made in such a way that one record obviously corresponded to one passage of a bird to or from the nest. Two records within a few seconds were inter-

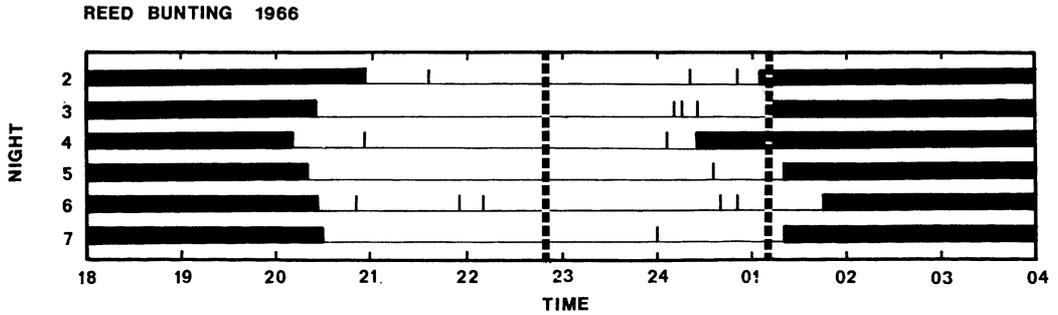


Fig. 2. Activity records of Reed Bunting 1966, nest with 7 nestlings (one extra). Black indicates normal feeding activity; vertical lines, single records during night rest. Vertical broken lines indicate sunset and sunrise.

preted as one nest visit by one bird. When four records occurred close to each other, it was assumed that the male and the female made one nest visit each. When more than four records occurred in rapid succession, the number of nest visits interpreted was reduced, as the male and female obviously had not had reasonable time to get food for the nestlings.

Most nights, there was a sharp transition from day-time feeding activity to night rest. Sometimes, however, there was a more continuous transition from day activity to night rest, the spell between the records in the late evening or early morning hours being abnormally long. Visual observations revealed that these isolated records were rarely caused by feeding visits. Consequently, they should

not be interpreted as indicating normal day-time feeding activity.

As a reasonable approximation based on direct observations, night rest was considered to occur when there were more than 15 minutes between two records. Such long intervals between nest visits did not occur when day-time feeding was going on. This was true for all species studied. Thus the automatic recordings could be used for interspecies comparisons.

LENGTH AND TIME OF NIGHT REST

The nest of Reed Bunting 1963 contained 5 nestlings, and night rest was observed to occur between 2000 and 0045 hrs. Reed Bunting

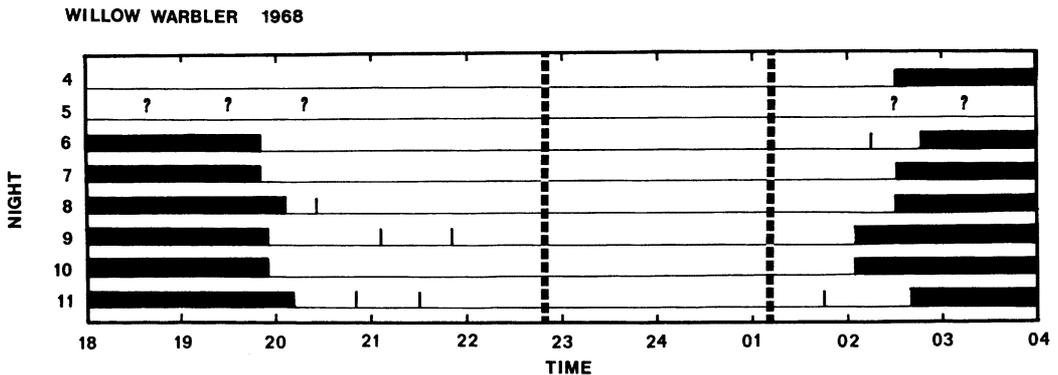


Fig. 3. Activity records of Willow Warbler 1968 with 6 nestlings. Black indicates normal feeding activity; vertical lines, single records during night rest. There was a break in recording during Night 5. Vertical broken lines indicate sunset and sunrise.

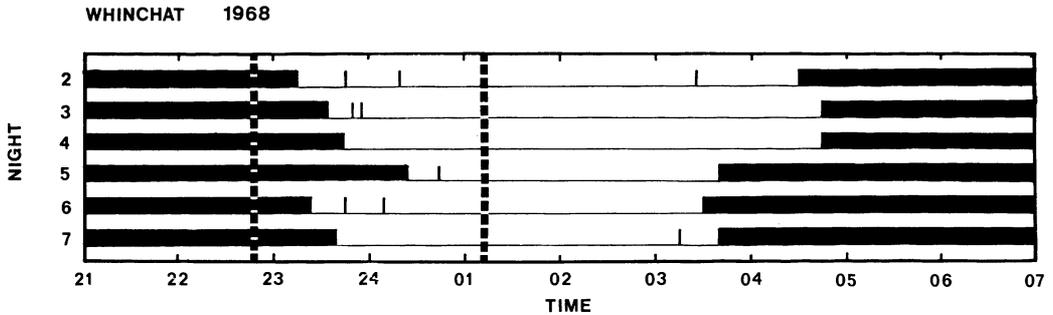


Fig. 4. Activity records of Whinchat 1968. The nest was plundered; it contained 6 nestlings during Nights 2–4 and 3 nestlings during Nights 5–7. Black indicates normal feeding activity; vertical lines, single records during night rest. Vertical broken lines indicate sunset and sunrise.

1964 had initially 5 nestlings, but one of them disappeared. Rest during Night 6 lasted from 2010 to 0055 hrs, and during Night 9 from 2005 to 0110 hrs (observations from a hide-out). Thus, the rest lasted about 5 hours, most of the period before midnight (Lennerstedt 1964).

Reed Bunting 1966 was supplied with an extra nestling from another nest; thus the brood consisted of 7 nestlings. The nest was recorded automatically (Fig. 2). Single records occurred during night rest and particularly during the latter part. Night rest started between 2000 and 2100 hrs and ended about 0030 to 0130 hrs. The time of these rests coincided with those observed in the earlier years. The presence of one extra nestling did not appreciably affect the length of night rest.

Night rest of Willow Warbler 1963 lasted for about 5 hours, 2055 to 0150 hrs (direct observations, Lennerstedt *op.cit.*). The Willow Warbler 1968 was recorded automatically (Fig. 3). Rest started about 2000 hrs and ended between 0200 and 0300 hrs. Thus, rest at the two nests lasted for more than 6 hours, the time before and after midnight being about equal length. Resting hours corresponded to those hours when the northern slopes of the mountains were shadowed from the sun.

Whinchat 1963 was observed to have a night rest of 3 hours, from 2400 to 0310 hrs (Lennerstedt *op.cit.*). Whinchat 1968 had 6 nestlings in the clutch, but three disappeared by plundering on Day 4 and the remaining three on Day 7. Fig. 4 shows the recordings at the nest. In Nights 2–4, rest lasted for about 4 hours,

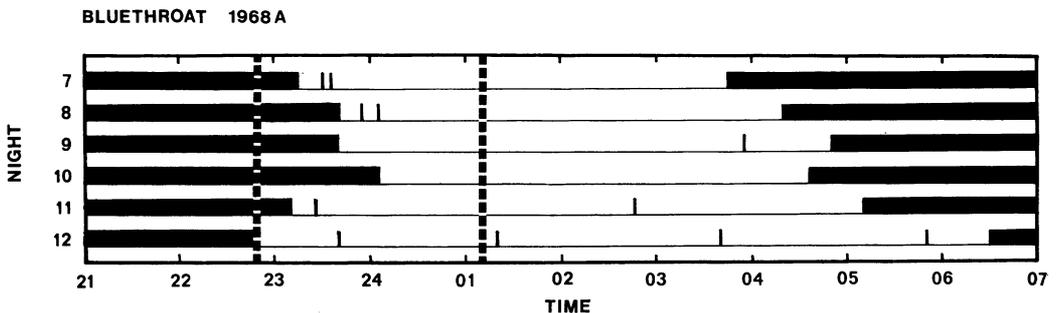


Fig. 5. Activity records of Bluethroat 1968A. The nest contained 5 nestlings; 3 fledged on Day 10, only 2 nestlings being left in the nest during Nights 11–12. Black indicates normal feeding activity; vertical lines, single records during night rest. Vertical broken lines indicate sunset and sunrise.

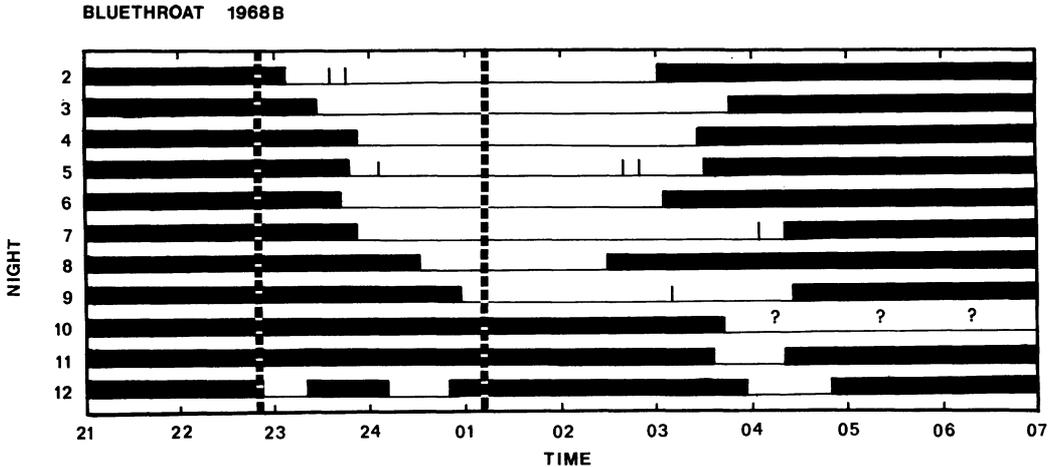


Fig. 6. Activity records of Bluethroat 1968B with 7 nestlings (one extra). Black indicates feeding activity; vertical lines, single records during night rest. There was a break in recordings during Night 10. Feeding at a reduced activity level occurred during all hours of Nights 10–12; four pauses longer than 30 minutes are indicated in the same way as for normal night rest. Vertical broken lines indicate sunset and sunrise.

from 2330 to 0430 hrs, but the period was shortened to about 3 hours during Nights 5–7 when the rest ended about 0330 hrs.

Two nests of Bluethroat were automatically recorded in 1968: Bluethroat 1968A with 5 nestlings (Fig. 5), and Bluethroat 1968B with 7 nestlings (one extra) (Fig. 6).

Night rest of Bluethroat 1968A began between 2300 and 2400 hrs and ended between 0400 and 0500 hrs, but there was a substantial variation from day to day. The rest lasted for 4–5 hours. On Day 10, three of the five nestlings left the nest, whereas the other two stayed in the nest for another two nights. During Night 12, nest activity did not begin until 0630 hrs. This does not imply that the female began day activity so late; during early morning hours, she could have fed the nestlings outside the nest without taking notice of the two in the nest.

The nest of Bluethroat 1968B was recorded for most of the nestling period. During Night 2, rest started at 2305 hrs. The following nights showed a successive displacement of the start up to 0100 hrs during Night 9. The time for the end of the rest during Nights 2–9 showed a substantial variation. Rest lasted for 3.5–4.5

hours. Behaviour at the nest during the last three nights, 10–12, differed from that in the earlier nights. There was continuous activity throughout the night, although slightly reduced. There were some pauses in activity, lasting for 10–20 minutes. Pauses of more than 30 minutes are shown in Fig. 6. During Night 12, the 30-minute pauses occurred as early as about 2300 hrs and as late as between 0400 and 0500 hrs. This suggests that the Bluethroats had no normal night rest during the last three nights, but were active at a lower level which extended over a period longer than the normal night rest. No visual observations were made during the active night hours, but the records in the night were of the same appearance as in the day; therefore it is probable that they concerned feeding.

Thus, activity at the nest of Bluethroat 1968B with seven nestlings differed from Bluethroat 1968A with five nestlings in the displacement of the beginning of night rest, in the shorter length of rest, and in the activity pattern during Nights 10–12, when the nestlings had obtained the capacity of regulating the body temperature (Dawson & Hudson 1970). More observations are necessary, how-

Table I. Length of night rest and time of its beginning and end during the nestling period at Ammarnäs

Species	No. of nests	No. of nights	Length hrs	Beginning hrs	End hrs
Willow Warbler	2	8	5-7	20-21	02-03
Reed Bunting	3	9	3.5-5	20-21	0030-0130
Bluethroat	3	18	3-5	23-01	03-05
Whinchat	2	7	3-5	23-24	0330-05

ever, to decide whether these differences should be ascribed to the differences in brood size.

The nest of Bluethroat 1969 was also supplied with an extra nestling, raising the size of the brood to 7. Rest during Night 10 lasted for 4 hours, 0015-0415.

DISCUSSION

The length of night rest, and the time of its beginning and end during the nestling period, varied with the species. Table I presents a compilation of observations and records at Ammarnäs.

Night rest of Willow Warbler was 5-7 hours, i.e. about two hours longer than that of Reed Bunting, Bluethroat, and Whinchat. The Willow Warbler in southern Finland (Kuusisto 1941) was recorded as having about the same length of night rest as at Ammarnäs, whereas the Willow Warbler in northern Finland had a shorter rest, 3-4 hours (Brown 1963, Peiponen 1970). The reasons for this difference in length of night rest between the Swedish and Finnish subarctic Willow Warblers are not known.

Night rest of Reed Bunting mainly occurs before midnight, whereas that of Bluethroat and Whinchat occurs after midnight. Similar observations on Reed Bunting and Bluethroat were made by Peiponen (1970) in northern Finland. This indicates that the time of night rest - before, around, or after midnight - is species-specific. The species differences suggest that light conditions as such are not of decisive importance for the adaptation of diurnal activity rhythms in the subarctic summer. Other factors such as temperature and food availability may also be involved.

The Reed Bunting has a night rest mainly before midnight, and it resembles the Redwing *Turdus iliacus* in this respect (Swanberg 1951, Brown 1963). It has been proposed (Brown 1963) that the time for rest in the Redwing is adapted to the behaviour rhythms of the food items, which principally consist of worms and snails and which are most active in early morning hours with high humidity. The Reed Bunting at Ammarnäs was observed to feed mainly on insects, and it thus differs from the Redwing, but the details of food choice are unknown.

ACKNOWLEDGEMENTS

The study was carried out as part of the ornithological project at Ammarnäs. I am much indebted to the leader of the project, Professor Anders Enemar, for working facilities and criticism of the manuscript. The recorder and transformer were constructed in collaboration with E. Persson and S. Å. Berglund. Christer Neideman assisted during the field work. The study was supported by a grant from the Royal Society of Sciences and by Grant 2180-19, 21 from the Swedish Natural Science Research Council.

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Received July, 1972

Published May 1973