

On the activity and food of the Pygmy Owl *Glaucidium passerinum* during breeding

HEIMO MIKKOLA

Department of Zoology, University of Oulu

Since 1965 I have studied the occurrence, food and activity of owls found in Finland. In the summer of 1969 the Pygmy Owl was the object of intensive study. The Pygmy Owl has been considered a rare owl in Finland because only a few nests have been found. In reality this species particularly in the minimum years of voles is one of our most common owls. In Oulu in the summer of 1969 in an area of 100 km² there were at least four pairs. Observations of concentrations like this have been made also, for instance, in Hyrynsalmi in 1968.

Observations on activity

Materials and methods. — On 3rd May 1969 a nest was found with the female brooding in Oulu Sanginjoki, 3 meters up in an aspen-tree. The hole was originally made by a Great Spotted Woodpecker *Dendrocopos major*. The biotope was an old spruce wood by a stream; besides the spruces there were some deciduous trees (alder, birch, aspen).

The activity of the owl was studied by an automatic registering apparatus. The apparatus was designed and built by taxidermist Allan Haimakainen. The mechanism of the recorder was simply an alarm clock running a paper strip at 50 mm per hour. On the opening of the nest hole there was an iron wire treadle. When the owl came to the nest it moved the wire operating a switch (Kissling Suiz, Calw, PJXStLi 01) to a 6 V electric current. The current moved the numbers of a telephone calculator one point forwards. The telephone calculator was connected to a soft pencil which drew a line across the paper strip when the current was on. The recorder proved to be

very practical in the field and above all very economical. The alarm clock had to be wound up almost every day.

Comparison to other investigations. — Observations on the activity of the Pygmy Owl during the breeding season have been published earlier in Sweden (BERGMAN 1939, JANSSON 1964), in Norway (SEIERSTAD *et al.* 1960) and in Austria (BERGMANN & GANSO 1965). They are summarized here.

In Austria the Pygmy Owl was most active between 3 and 4 o'clock in the morning and 12—13 and 19—20. The activity began 54.5 min before sunrise and ended 12 min before sunset. The length of a day's activity was for instance on 18th June only 17.5 hours.

About 1300 km to the north in Southern Norway and Central Sweden the length of activity per day of the Pygmy Owl was already more than 22 hours. The owl rested only during the darkest hours of the night between 23 and 1 o'clock. The most active time was on both sides of the resting hours. A busy time was also before noon between 9 and 11 o'clock.

BERGMAN (1939) studied the activity of the Pygmy Owl one night on 2nd June in Central Sweden (ca. 63°N) and noted that the owl was most active from 20 to 1.50. Between 1.50 and 7.15 the parents were silent but at 7.15 the male brought prey to the nest again.

In Central Finland the owl was clearly most active from 22 to 1 and from 9 to 10 (Fig. 1). During 15 days there were 43 nest visits between 22

and 1 o'clock and from 9 to 10 o'clock 12 visits. On the average there were 10.9 (max 17, min 7) nest visits in twenty-four hours. Generally, prey is brought on half these visits. Also in S-Norway and C-Sweden they noticed that this species visits its nest ca. 11 times in twenty-four hours. In Austria the corresponding number was 10. In Finland and Austria there were three young; in C-Sweden 5 and in S-Norway 7. The number of nest visits seem not to have been influenced by the number of young.

Discussion. — In Austria and Southern Norway there were two clear peaks of activity late in the evening and early in the morning and some kind of lesser peak around midday. In Central Finland the peaks of morning and evening have combined during the short twilight 'night'. During the day between 9 and 10 o'clock there is a lesser peak as in Austria and S-Norway.

The activity of the Pygmy Owl in Austria at noon has been explained by the fact that the young become hungry at that time (BERGMANN & GANSO 1965), and the midmorning peak in the fennoscandian owls, which cease nocturnal hunting earlier than in Austria, is most likely due to this factor.

	Morning peak	Middle peak	Evening peak
Austria (49°N)	3—4	12—13	19—20
S-Norway (60°N)	1—3	9—11	21—23
C-Finland (65°N)	—01	9—10	22—

The changes in the activity of the Pygmy Owl fit also to the principle outlined by ASCHOFF & WEVER (1962): "The beginning and end of activity is dependent on both season and latitude".

The circadian rhythm of the Pygmy Owl is directly influenced by the light. In Sweden and America they have studied how much light different owl species need to find their prey by sight (DICE 1945, LINDBLAD 1967). The

sight of the Pygmy Owl in darkness is the worst of the owls', even two times worse than in man. Tawny, Ural and Long-eared Owls can see their prey very well in dark forest where the light is 0.000 000 4 foot candle (foot candle = 2 lux). Man, Tengmalm's Owl *Aegolius funereus* and the Pygmy Owl can see nothing in that light. This explains why. Pygmy Owls are inactive in Austria and S-Norway around midnight. Though Oulu is situated 172 km south of the Arctic circle, the light intensity, on the bright nights at the beginning of June, is at midnight 50 lux and in midsummer 100 lux (ERKINARO 1969a). In that light the Pygmy Owl can see its prey well.

Food during the breeding period

Material and methods. — The Pygmy Owl differs from all the other owls which nest in holes by keeping its nest-hole clean from all prey remains. For instance in the bottom of the nest in Oulu there were some remains of only six preys after the birds had left. The female threw all the other prey remains every day under the nest tree, making collection easy.

During the time 29.5.—22.6.1969 ca. 80 pellets were found in all which averages 3.2 per day. There were three young in the nest. The male often sat in a big spruce about 30 m from the nest and under this tree there were 1.5.—4.6.1969 ca. 27 pellets. In these pellets there were the remains of 38 prey animals, which is 1.4 per pellet. The length, and height were measured, and the width always measured at the highest point. The mean size of pellets was as follows:

Young and female	26 × 10 × 9 mm (N 56)
Male	30 × 13 × 11 mm (N 26)

The pellets of the male were clearly larger than those of the young and

female, but the difference in size between male and female pellets presumably depends simply on the amount of food she shares herself out of the food the male brings. In summer 1969 a nest of Pygmy Owls was found also in Jämsä and Kuusamo and from the remains collected from these nests I determined 101 more preys.

The male himself often eats the fore part of the body of a small mammal, taking the posterior part to the nest. For this reason in the pellets of the young and female there are commonly few skull remains of small mammals. In older investigations the numbers of mammals have been calculated from the numbers of skulls (e.g. UTTENDÖRFER 1952, MÄRZ 1964, BERGMANN & GANSO 1965) and this makes the number of mammals taken 4—5 times too small for the breeding period. In my materials the number of the small mammals has been calculated from the bones of the legs and the voles have usually been determined from the colour of the hair which is round the bones in the pellets (brown is Bank Vole *Clethrionomys glareolus* and black is Field Vole *Microtus agrestis*). Birds have been determined from the feathers and the numbers have been calculated from ulna, humerus and tarsus.

Results. — At the nest in Oulu the female and the young ate, calculated from the pellets, on average 4.6 (max 11, min 2) preys in twenty-four hours. Most of the prey animals were Bank Voles and Field Voles 57 % in all, and birds 38 % (Table 1). There were four insects, big coleopters which were certainly eaten by the owl. Twice they ate a Lizard *Lacerta vivipara*, which is a diurnal animal and therefore usually absent from the food of the owls.

The hunting-range of the Pygmy Owl is probably rather large. There were the remains of four House Martins *Delichon urbica* at the nest (2 ad and 2 pull),

TABLE 1. Food of the Pygmy Owl in summer 1969 at the nests in Oulu, Kuusamo and Jämsä. (*Varpuspöllön ravinto kesällä 1969 Oulun, Kuusamon ja Jämsän pesillä.*)

Prey species <i>Saaliislaji</i>	Oulu %	Kuusamo %	Jämsä %
<i>Sorex araneus</i>	—	—	6.4
<i>S. minutissimus</i>	—	1.8	—
Shrews total/ <i>Päästäiset yht.</i>	—	1.8	6.4
<i>Microtus agrestis</i>	17.5	—	29.8
<i>Clethrionomys glareolus</i>	29.2	74.2	23.4
<i>Clethrionomys vel</i> <i>Microtus</i>	9.8	—	8.5
<i>Micromys minutus</i>	1.3	—	—
Small rodents total/ <i>Pikkujysijät yht.</i>	57.8	74.2	61.7
<i>Apus apus</i>	—	—	4.3
<i>Delichon urbica</i>	2.6	—	—
<i>Parus major</i>	1.3	3.7	6.4
<i>P. montanus</i>	4.6	—	—
<i>Phoenicurus phoenicurus</i>	2.6	3.7	—
<i>Erithacus rubecula</i>	1.9	—	—
<i>Phylloscopus trochilus</i>	9.7	7.5	8.5
<i>Muscicapa striata</i>	—	—	4.3
<i>Ficedula hypoleuca</i>	4.6	1.8	—
<i>Anthus trivialis</i>	2.6	—	—
<i>Carduelis spinus</i>	4.6	—	2.1
<i>Loxia curvirostra</i>	0.6	1.8	—
<i>Fringilla coelebs</i>	2.6	3.7	—
<i>Emberiza schoeniclus</i>	0.6	—	—
Birds total/ <i>Linnut yht.</i>	38.3	22.2	25.6
<i>Lacerta vivipara</i>	1.3	—	2.1
<i>Perca fluviatilis</i>	—	—	2.1
Insecta coll./ <i>Hyönteiset coll.</i>	2.6	1.8	2.1
Total number of prey/ <i>Saaliita yht.</i>	154	54	47

though the nearest nest of House Martins was at least 1 km away.

There are small variations in the types of food at nests in different parts of the country during the same year, depending

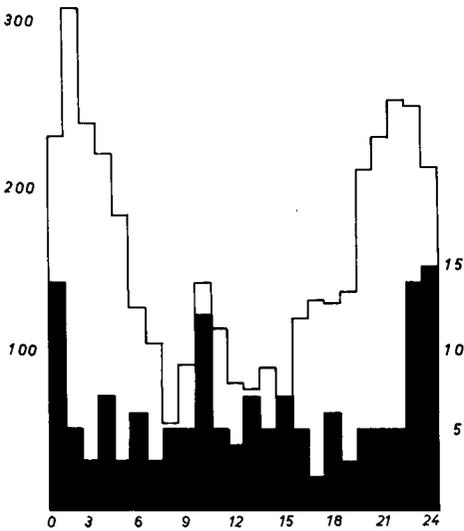


FIG. 1. Black columns: Activity (= number of nest visits) of the Pygmy Owl in Oulu during 15 days in June 1969. Sunrise ca. 1.40 o'clock and sunset ca. 23 o'clock. White columns: Activity of a female Bank Vole kept in natural conditions in Valtimo (ca. $63^{\circ}45'$) 21.—27.7. and 1.—6.8.1969. Results are total numbers of signals which are recorded from five different places (Heikura, unpublished material). Sunrise ca. 3 o'clock and sunset ca. 21 o'clock. — (Mustat pylväät: Varpuspöllön aktiivisuus (= pesällä käyntien summa) Oulussa 15 päivän aikana kesäkuussa 1969. Aurin-gonnousu n. klo 1.40 ja lasku n. klo 23. Valkoiset pylväät: Metsämyyränaaraan aktiivisuus luonnonolosuhteissa Valtimolla (n. $63^{\circ}45'$) 21.—27.7. ja 1.—6.8.1969. Tulokset ovat viiden rekisteröintikohteen aktiivisuusmerkintöjen summa (Heikura, julkaisematon aineisto). Aurin-gonnousu n. klo 3 ja lasku n. klo 21.)

on the prey species available. In Oulu no shrews were taken; in Kuusamo no Field Voles. In Jämsä shrews made up 6 %, Bank Voles 23 %, and Field Voles 30 % of the food (Table 1). In the prey of the Oulu Pygmy Owls there were 12 species of bird, in Kuusamo 6 and in Jämsä 5; in all these cases the Willow Warbler *Phylloscopus trochilus* was the commonest victim. Unusual species preyed on include a Least Shrew *Sorex minutissimus* in Kuusamo, and

a Perch *Perca fluviatilis*, a Lizard, a Dorbeetle *Geotrupes* sp. and 2 ad Swifts *Apus apus* in Jämsä.

The food of the Pygmy Owl fluctuates in different years also depending on the variations in small mammal populations (KELLOMÄKI 1969).

It is interesting to compare the activity of the Pygmy Owl with the activity of its prey animals. The peaks in the activity of the Bank Vole in Valtimo (HEIKURA, unpublished material) coincided with those of the Pygmy Owls in Oulu (Fig. 1). Both were mainly nocturnal and both had a clear peak also before noon at 9—10 o'clock.

BERGSTEDT (1965) has studied the activity of the Bank Vole in Southern Sweden. The results show that the peaks in the circadian rhythms of Bank Vole and Pygmy Owl are the same also in the south.

Also the Field Vole are in summer most active in the night when the Pygmy Owl is hunting. In winter the Field Voles are diurnal; the change-over occurs in spring and autumn (ERKINARO 1969b).

Small birds preyed on by the Pygmy Owl are mostly diurnal species. The peaks in their activity don't match the Pygmy Owl's.

Acknowledgements

I should like to express my grateful thanks to my wife, Mrs. Kyllikki Mikkola, who has done a great part of the field work, Taxidermist A. Haimakainen, Mr. K. Heikura, M. A., Biol. stud. T. Helle, Mr. K. Uino, M. A., and Biol. stud. V. Vasama, who have all given me valuable assistance in field studies, and Mr. N. Collar, B. A., who has critically read the manuscript and revised the text.

Summary

The activity of the Pygmy Owl has been studied with automatic registering apparatus in Oulu ($65^{\circ}N$) in June 1969. The Owl was most active between 22—01 and 9—10 o'clock. The circadian rhythm of the Pygmy Owl is directly influenced by the light. Influenced

by the differences in light intensity the activity of the Pygmy Owl differs in Austria, S-Norway and C-Sweden from its activity in Finland.

The food of the Pygmy Owl during breeding period has been investigated in 1969 in Oulu. Kuusamo and Jämsä. In Oulu observations of the food biology were made almost every day. Under the nest tree 80 pellets were found and under the male's resting place 27. In the pellets of the male there were 1.4 preys per pellet. The pellets of the young and female were clearly smaller than those of the male.

The female and three young ate at the nest on average 4.6 preys in twenty-four hours. From 154 preys 57 % were Bank Voles and Field Voles and 38 % birds. In the types of food there are small variations at nests in different parts of Finland during the same year (Table 1). This depends on the differences in the prey species available.

The activity of the Pygmy Owl have been compared e.g. with the activity of the Bank Vole, in which the same peaks can be seen (Fig. 1).

Selostus: Varpuspöllön aktiivisuudesta ja ravinnosta pesintäaikaan.

Varpuspöllön aktiivisuutta tutkittiin automaattisella rekisteröintilaitteella Oulussa kesäkuussa 1969. Pöllö oli aktiivisin klo 9—10 ja 22—01 välisinä aikoina. Varpuspöllön vuorokausirytmikan tärkein säätelijä on valo. Valaistuksen eroista johtuen varpuspöllön aktiivisuus on Itä-vallassa, Etelä-Norjassa ja Keski-Ruotsissa erilainen kuin Suomessa.

Varpuspöllön pesintäaikaista ravintoa on tutkittu 1969 Oulussa, Kuusamossa ja Jämsässä. Oulussa havaintoja on tehty päivittäin. Pesäpuun alta löytyi 80 ja koiraan lepopaikan alta 27 oksennuspalloa. Koiraan palloissa oli 1.4 saalista/pallo. Poikasten ja naaraan pallot olivat selvästi pienempiä kuin koiraan pallot. Naaras ja kolme poikasta söivät keskimäärin 4.6 saalista vuorokaudessa; 154 saaliista oli 57 % metsä- ja peltomyyriä ja 38 % lintuja. Ravinnossa on pientä vaihtelua samana vuonna

eri puolilla Suomea (taulukko 1). Tämä johtuu tarjolla olevan saalislajiston eroista. Lopuksi varpuspöllön aktiivisuutta on verrattu mm. metsämyyrän aktiivisuuteen, jossa on havaittavissa samat huiput (kuva 1).

References

- ASCHOFF, J. & R. WEVER 1962. Beginn und Ende der täglichen Aktivität freilebender Vögel. *Journ. f. Ornithol.* 103:2—27.
- BERGMAN, S. 1939. Brutbiologische Beobachtungen beim Sperlingskauz (*Glaucidium passerinum*). *Beitr. Fortpfl. Vögel* 15:45—51.
- BERGMANN, H.-H. & M. GANSO 1965. Zur Biologie des Sperlingskauzes (*Glaucidium passerinum* L.). *Journ. f. Ornithol.* 106: 255—284.
- BERGSTEDT, B. 1965. Distribution, reproduction, growth and dynamics of the rodent species *Clethrionomys glareolus* (Schreber), *Apodemus flavicollis* (Melchior) and *Apodemus sylvaticus* (Linné) in southern Sweden. *Oikos* 16:132—160.
- DICE, L. R. 1945. Minimum intensities of illumination under which owls can find dead prey by sight. *Amer. Naturalist* 79: 385—416.
- ERKINARO, E. 1969a. Free-Running Circadian Rhythm in Wood Mouse (*Apodemus flavicollis* Melch.) under Natural Light-Dark-Cycle. *Experientia* 25:649.
- 1969b. Der Phasenwechsel der lokomotorischen Aktivität bei *Microtus agrestis* (L.), *M. arvalis* (Pall.) und *M. oeconomus* (Pall.). *Aquilo, Ser. Zool.* 8:1—31.
- JANSSON, E. 1964. Anteckningar rörande häckande sparvuggla (*Glaucidium passerinum*). *Vår Fågelvärld* 23:209—222.
- KELLOMÄKI, E. 1969. Varpuspöllön ravintobiologiasta Etelä- ja Keski-Suomessa 1960-luvulla. *Suomenselan Linnut* 4:54—55.
- LINDBLAD, J. 1967. I ugglemarker. — Stockholm.
- MÄRZ, R. 1964. Zur Ernährung des Sperlingskauzes. *Vogelwelt* 85:33—38.
- SEIERSTAD, A., E. SEIERSTAD & I. MYSTERUD 1960. Et lite bidrag til kjennskapet til spurveugle, *Glaucidium passerinum* (L.). *Sterna* 4:153—168.
- UTTENDORFER, O. 1952. Neue Ergebnisse über die Ernährung der Greifvögel und Eulen. Stuttgart.
- Address of the author: Dept. of Zoology, Univ. of Oulu, Oulu.*