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THE DIET OF NESTLING EURASIAN NUTHATCHES

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Abstract.—The diet of nestling Eurasian Nuthatches (*Sitta europaea*) was studied in the Magadan region of northeastern Siberia in 1987–1990. The number of prey items in a load and mass of a load did not vary significantly among years and broods. Mass of a load was positively related to the number of food items in a load. Plecoptera, Lepidoptera, Hymenoptera and Arachnoidea comprised the majority of nestling food both in frequency (76.6%) and in mass (83.2%). Almost all food types varied among years, but only a few prey types varied significantly. Arachnoidea were represented in nestling diet most evenly among all years of study. Individual variation in food types among broods was low with only one or two prey types varying significantly during each year. The seeds of the Japanese stone pine found in the diet of nestling nuthatches suggest that nuthatches could have been using caches made at least seven mo previously.

LA DIETA DE PICHONES DE *SITTA EUROPAEA*

Sinopsis.—De 1987–1990 se estudió la dieta de pichones de *Sitta europaea* en la región Magadan del noreste de Siberia. El número de presas en un cargamento y la masa de las presas no variaron significativamente entre las diferentes camadas y los diferentes años de estudio. La masa de alimento se relaciono positivamente con el número de artículos alimenticios en cada carga. Plecoptera, Lepidoptera, Hymenoptera y Arachnoidea representaron la mayoría del alimento a los pichones tanto en frecuencia (76.6%) como en masa (83.2%). El tipo de alimento varió a través de los años, pero tan solo algunas presas en particular variaron significativamente. Los arácnidos estuvieron uniformemente presente a través de todos los años de estudio. La variación individual en tipo de alimento entre las camadas fue poca con tan solo uno o dos tipos de presa que variaron significativamente durante cada año. Las semillas del pino japonés encontradas en la dieta de los pichones sugiere que los adultos muy bien pudieran estar utilizando el alimento obtenido meses antes.

The study of nestling diet provides information about the food that birds feed to their young and possibly about the diet of adults during reproduction. Although this type of study seems common, it is not easy to measure diet composition of passerine birds. In many instances, access to nests and to nestlings is the main obstacle. Species breeding in natural cavities are one group where access to nests is difficult. Eurasian Nuthatches (*Sitta europaea*) usually breed in natural cavities situated high above the ground (Pravosudov 1993), and often it is almost impossible to get access to the nestlings. This is probably the most important reason why almost nothing is known about nestling Eurasian Nuthatches. Nest-

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ling diet is no exception and we have not been able to locate any reference on this subject. In this paper, we present data on nestling diet of Eurasian Nuthatches in northeastern Siberia.

STUDY AREA AND METHODS

The diet of nestling Eurasian Nuthatches was studied in the Magadan region of northeastern Siberia during 1987–1990. Details of the study area are described by Pravosudov (1993). Eurasian Nuthatches bred mostly in old woodpecker holes and average brood size in the study area was 5.97 (SD = 1.69) nestlings (Pravosudov 1993). The method of opening holes and handling nestlings is described by Pravosudov (1993). We collected food brought to nestlings by tying a thread loosely around a nestling's neck. Parents resumed feeding soon after the "collared" nestlings were put back in the nest. We observed the nest from far enough away (30–35 m) that the parents did not appear to be disturbed by our presence. After the parents had made a number of feeding visits corresponding to the number of young in a nest, we collected the food loads from the nestlings' throats with forceps and stored each load in a separate vial. This method did not harm the young nuthatches, all of which later fledged. In 1987 and 1988, we determined only the frequency of different prey items in the diet. In 1989 and 1990, we weighed to the nearest mg total food loads taken from each nestling and all individual items those loads contained. Over all years, we collected 712 food items contained in 211 individual loads from 19 nests, 387 of which where weighed. The food loads were collected from nestlings 6–14 d old, with most collected from nestlings 8–12 d of age. Because the range of age when we collected nestling food samples was quite narrow we did not compare diet among nestlings of different ages.

To examine differences in each prey type among years and among broods, we used an ANOVA of average frequency in a load per nest. Thus the nest was the primary sampling unit for these analyses. To analyze variation in the diet among different broods, we used only 12 nests from which more then 8 loads were obtained. For these analyses, average frequency of each prey type per load was used; thus the load was the primary sampling unit.

RESULTS AND DISCUSSION

The number of prey items contained in each individual food load brought to nestlings did not differ significantly among years ($F_{3,15} = 1.66$, $P = 0.22$) or among broods ($F_{11,173} = 1.34$, $P = 0.21$, Table 1). Average mass of a load taken during 1989–1990 also did not differ significantly between years ($F_{1,6} = 0.09$, $P = 0.76$) or among broods ($F_{5,109} = 0.74$, $P = 0.59$, Table 1). The mass of a food load was positively and significantly related to the number of prey items in a load (Regression: mass = 114.63 + 14.53*items, $t = 5.44$, $P < 0.001$).

Plecoptera, Lepidoptera, Hymenoptera and Arachnoidea comprised the most frequently fed items (76.6%, Table 2). These groups also pre-

TABLE 1. Characteristics of food loads brought to nestling Eurasian Nuthatches in northeastern Siberia. Standard deviations are in parentheses.

Parameter	1987	1988	1989	1990	Total
# loads	48	38	87	38	211
# nests	5	6	5	3	19
Mean # food items in a load	4.97 (2.94)	3.19 (0.90)	2.76 (0.57)	3.45 (1.11)	3.59 (1.77)
Mean mass of a load (mg)	—	—	150.56 (29.29)	156.26 (11.71)	152.70 (23.19)

vailed in mass delivered (83.2%), with Lepidoptera comprising the largest component (46.4%, Table 3). The frequency of Hymenoptera and larvae of Lepidoptera and Coleoptera in food loads varied significantly among years ($F_{3,15} > 4.14$, $P < 0.02$, Table 2), probably due to natural changes in abundance of these prey items in the study area. Other prey types except Arachnoidea also showed variation among years, although the differences were not significant ($F_{3,15} < 1.80$, $P > 0.19$). Arachnoidea was the only group that was represented in the nestling diet evenly among all years (Table 2, 3), which suggests the importance of this prey type to Eurasian Nuthatches.

Variation in prey types among broods was quite small. In 1987, one of four broods received significantly fewer Plecoptera ($P = 0.05$, Tukey test of multiple comparisons). In 1988, larvae of Lepidoptera loads differed significantly between the two broods compared ($P < 0.05$). In 1989, the frequency of Coleoptera in food loads was significantly different for two of four broods compared ($P = 0.05$, Tukey test). In 1990, two broods compared differed in the frequency of Diptera in food loads ($F_{1,29} = 7.17$, $P = 0.05$). All other prey types did not differ significantly among the broods compared.

Nestling diet of North American nuthatches has received some attention (Anderson 1976, Pravosudov and Grubb 1993). The White-breasted

TABLE 2. Relative frequency (%) of food items in the diet of nestling Eurasian Nuthatches in Siberia.

Food type	1987	1988	1989	1990	Total
Arachnoidea	15.6	13.7	18.5	15.3	15.9
Plecoptera	38.7	14.4	8.2	18.8	19.3
Hymenoptera	7.5	27.3	13.6	4.2	12.4
Lepidoptera, larvae	4.3	14.4	24.3	50.7	23.4
Lepidoptera, imago	4.3	7.2	11.1	0.7	5.6
Coleoptera	12.9	14.4	4.9	3.5	8.6
Diptera	11.8	3.6	6.2	1.4	6.5
Japanese stone pine seeds	0	1.4	1.2	0	0.7
Other	9.2	3.6	12.0	5.4	7.6
# items	186	139	243	144	712

TABLE 3. Food of nestling Eurasian Nuthatches in Siberia.

Food type	Relative mass (%)		Mean prey mass (mg) and SD	
	1989	1990	1989	1990
Arachnoidea	13.6	21.4	39.6 ± 27.1	59.2 ± 42.4
Lepidoptera	46.1	37.1		
larvae	20.8	30.0	46.3 ± 33.4	25.0 ± 44.7
pupa	0	2.3		
imago	25.3	4.8	123.5 ± 41.7	242.0
Plecoptera	6.2	21.2	40.6 ± 23.6	49.1 ± 31.4
Perlodidae	0	21.4		
Nemouridae	0	0.4		
Hymenoptera	13.8	7.7	54.8 ± 35.3	76.7 ± 53.6
Formicidae	9.0	6.4		
Tenthredinidae	2.0	0		
Ichneumonidae	0.2	0		
Cephidae	0.4	0		
larvae	2.6	0		
Coleoptera	4.8	4.0	52.7 ± 34.3	37.4 ± 31.3
Diptera	5.7	3.1	49.9 ± 37.8	95.0 ± 8.5
Raphidioptera	0.1	0.4		
Gastropoda	0.3	0.3		
Fish bones	4.1	2.4	66.6 ± 74.9	35.7 ± 45.9
Japanese stone pine seeds	1.2	0	52.0 ± 8.9	—

Nuthatch (*Sitta carolinensis*) shows a similar diet during the summer, when these birds are also nearly exclusively insectivorous.

An unexpected component in the diet of Eurasian Nuthatches was seeds of the Japanese stone pine (*Pinus pumila*; Tables 1, 2). Although the numbers of seeds were quite low (two seeds [1.5%] in 1988 and three seeds [1.2%] in 1989), their presence suggests that the nuthatches could have been using their own caches made at least 7 mo previously.

There are two other possible explanations for the origin of such seeds: (1) the nuthatches found them on the ground where the fallen seeds had remained since the previous autumn, and (2) the nuthatches found some other animal's caches. There is reason to believe, however, that the nuthatches were, in fact, retrieving caches they had made the previous autumn. Japanese stone pine grows on the mountain slopes everywhere in our study area, and it produces a seed crop once a year, from late August until October. Eurasian Nuthatches cache seeds of the Japanese stone pine intensively during that time (pers. obs.). These seeds are consumed heavily by many birds and other animals, and the few seeds that might remain are soon covered by snow, which remains from November until late April–May. Even if a few fallen seeds survived until June, our observations showed that nuthatches rarely foraged on the ground at that time.

The main argument against nuthatches having found seeds on the ground is that all viable seeds would have germinated because there is abundant moisture in spring. The seeds that we collected from the collared nestlings in June had been shelled and appeared fresh and without

any signs of germination. Such seeds were not likely to have been found on the ground. The other explanation, that the nuthatches had pilfered caches made by other species, is unlikely because the other seed hoarders (Nutcracker *Nucifraga caryocatactes,* chipmunk) larder-hoard their caches under ground (Vander Wall 1990, pers. obs.) where they are not available to nuthatches.

In the Varied Tit, the seeds of *Castanopsis cuspidata* are cached as late as February and are used for nestling feeding in the end of April (Higuchi 1977). In our study area, nuthatches were the only birds caching seeds of Japanese stone pine in trees. Therefore, the seeds that we found in the nestling diets had most likely been cached in October at the latest, fully 7 mo before.

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