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CLUTCH SIZE AND FLEDGING RATE IN THE EURASIAN NUTHATCH BREEDING IN NATURAL CAVITIES IS UNRELATED TO NEST CAVITY SIZE

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Abstract.—Clutch size and fledging rate of the Eurasian Nuthatch (*Sitta europaea*) breeding in natural cavities and their relation to nest cavity parameters were studied in northeastern Siberia. The size of 25 natural cavities measured bore no relationship with either clutch size or fledging rate.

SIN RELACIÓN EL TAMAÑO DE LA CAVIDAD Y EL TAMAÑO DE LA CAMADA Y LA TASA DE PICHONES QUE DEJAN EL NIDO DE *SITTA EUROPEA*

Sinopsis.—Se estudiaron en la parte noreste de Siberia, la relación entre el tamaño de la cavidad utilizada para anidar por individuos de *Sitta europea*, y el tamaño de la camada de éstos y el número de pichones que dejaban el nido. No se encontró relación entre el tamaño de 25 cavidades naturales y el tamaño de la camada o número de pichones que dejaron dichos nidos.

For some hole breeding birds it has been suggested that clutch size could be affected by nest cavity size (Karlsson and Nilsson 1977, Löhrl 1973). To date, however, the evidence has been quite controversial. The relation between clutch size and the area of the cavity floor was positive and significant in Marsh Tits (*Parus palustris*, Ludescher 1973). For Pied Flycatchers (*Ficedula hypoleuca*) breeding in nest boxes, a reduction in the nest box size correlated with a decrease in clutch size, but conspecifics breeding in natural holes did not show any relationship between cavity size and clutch size (Alatalo et al. 1988, Gustafson and Nilsson 1985, Slagsvold 1987). No significant relationship between clutch size and cavity size existed in European Starlings (*Sturnus vuilgaris*) breeding in nest boxes (Karlsson 1983), but Löhrl (1987a,b) found that both larger floor areas and deeper cavities caused larger clutches in box-nesting Eurasian Nuthatches (*Sitta europaea*). In open-nesters, birds with larger nestcups had larger clutches and greater breeding success (Slagsvold 1989a,b, Slagsvold and Amundsen 1992).

It is still unclear why cavity size should be a determinant of clutch size in hole nesting birds. Löhrl (1973) suggested that better insulation of the clutch within larger cavities due to a thicker layer of nest material allows a female to decrease her energy expenditure for thermoregulation. She somehow anticipates such savings and, therefore, increases her clutch size (Löhrl 1973). Another possible explanation is that nestlings in larger cavities have more space to avoid energetically-wasteful overheating during

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TABLE 1. Characteristics of natural cavities occupied by the Eurasian Nuthatch.

Characteristic	Mean	SD	Min	Max
Floor area (cm^2)	153.6	45.1	86.6	280.4
Depth (cm)	16.5	3.2	11.0	22.0
Entrance (cm)	3.7	1.0	2.5	7.0
Volume (cm^3)	3006	711	1759	4775

hot days (Alatalo et al. 1988, Karlsson 1983) or that sibling competition for space and favorable feeding positions is reduced (Slagsvold 1989a).

Here, I report findings from the Eurasian Nuthatch (*Sitta europaea asiatica*) breeding in natural cavities that bear on the issue of whether clutch size depends on chamber size.

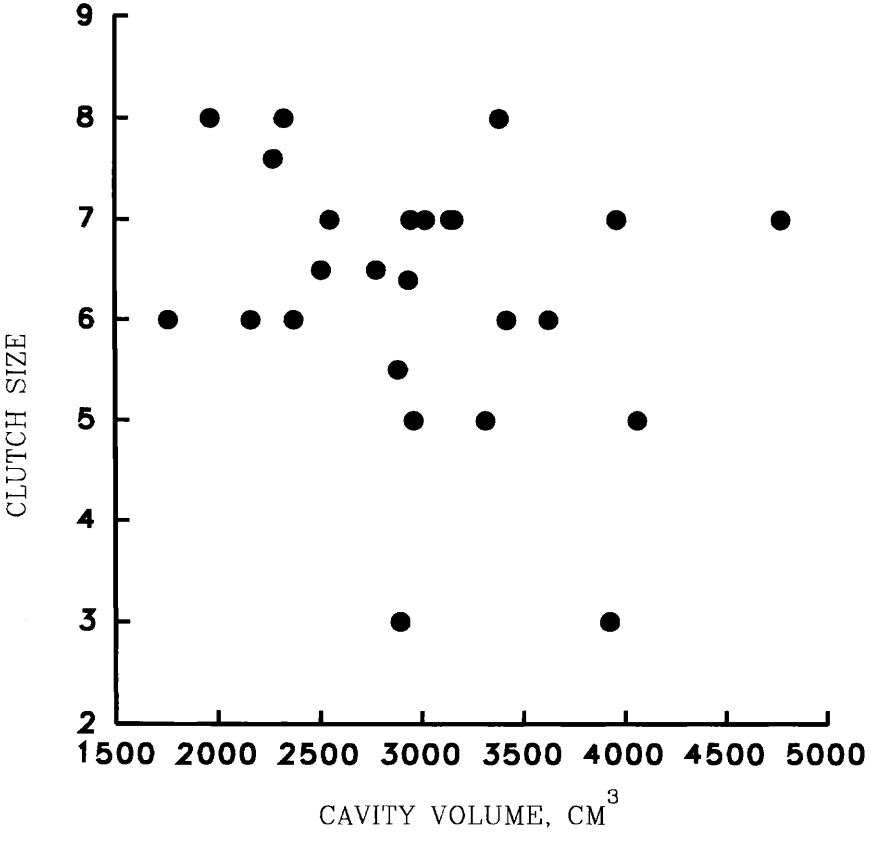

FIGURE 1. Scatterplot of clutch size and volume of natural cavities in Eurasian Nuthatches.

TABLE 2. Correlation coefficients between clutch size, number of fledglings and nesting cavity dimensions. *P*-value is in brackets.

	Clutch size	# fledglings
Floor area	−0.283 (0.17)	−0.025 (0.90)
Depth	−0.066 (0.75)	0.239 (0.25)
Entrance	0.325 (0.12)	−0.021 (0.92)
Volume	−0.239 (0.25)	0.121 (0.57)

METHODS

A detailed description of the study area in the Magadan region of northeastern Siberia has been published previously (Pravosudov 1993). Every cavity studied during 1986–1990 breeding seasons was used only once for analysis. If the same cavity was used more than once, the average

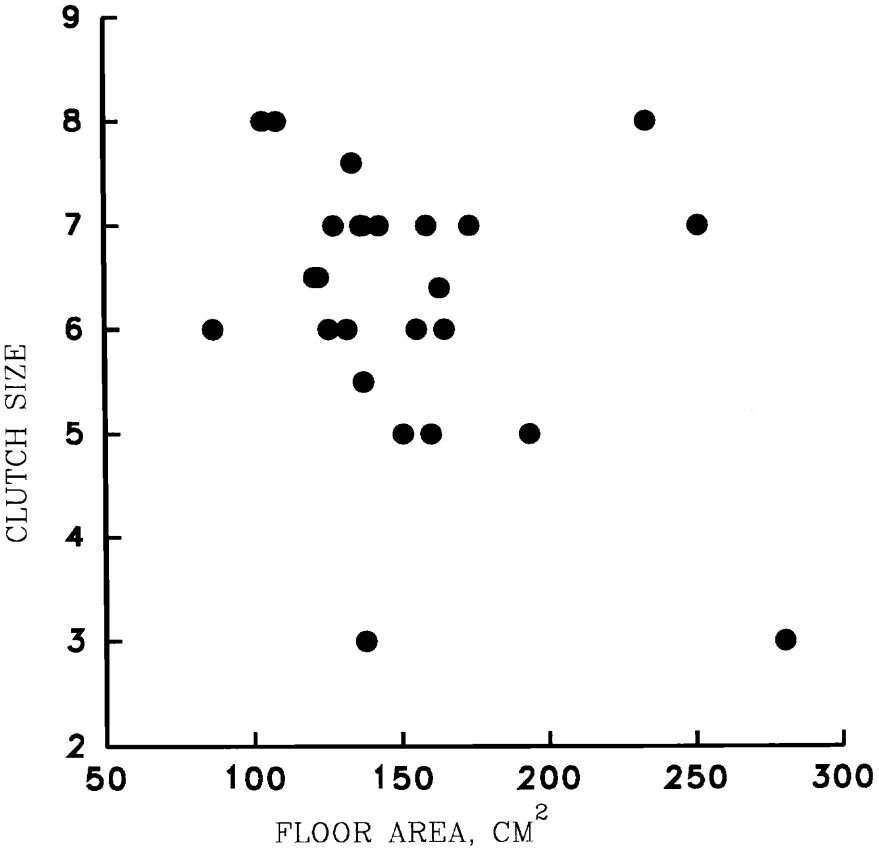

FIGURE 2. Scatterplot of clutch size and floor area of natural cavities in Eurasian Nuthatches.

values of clutch size and number of fledglings were used. Entrance size and cavity depth (from the bottom of the entrance to the bottom of the nest) was measured with a ruler. After gaining access to the nest chamber by cutting a replaceable door in a tree trunk, I measured the distance from the front to the rear wall of the cavity (X) and the width of the cavity (Y) at the bottom level. The area of the cavity floor was estimated as an ellipse ($3.142 \times X/2 \times Y/2$), and the volume of the cavity was calculated by multiplying the floor area times the cavity depth including the entrance height (Alatalo et al. 1988, van Balen 1984). I measured 25 nest cavities, and employed simple regression and correlation to check possible relations between breeding parameters and cavity size.

RESULTS AND DISCUSSION

Most of the nuthatch cavities were old woodpecker holes (Pravosudov 1993). No significant relationship was found between either clutch size or number of fledglings and any cavity dimension I measured (Tables 1–2; Figs. 1–2, $r < 0.32$, $P > 0.12$ for all comparisons).

Thus, these nuthatches as well as the Pied Flycatchers breeding in natural cavities (Alatalo et al. 1988) failed to show any relationship between cavity size and either clutch size or number of fledglings. The ranges of cavity size in this study were quite similar to those of nest-boxes used for experiments (bottom area from approx. 103 cm^3 in small boxes to 314 cm^3 in large ones, Löhrl 1987a,b). It is puzzling that most nestbox manipulation studies have shown such a trend whereas some studies of natural cavities have not. Perhaps the inconsistency arises because natural holes differ in some way other than cavity size. Different tree species, different extent of heart rot or some other factor could well affect the thermal climate inside a cavity and, therefore, be a confounding factor that prevents detection of relationships between breeding parameters and nest hole size in natural cavities.

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