

Breeding Biology of the Little Owl

Athene noctua in France

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INTRODUCTION

Much work has been devoted to the breeding biology of the Little Owl *Athene noctua* in Europe: Juillard (1984) in Switzerland, Schönn (1986), Exo (1983), Knötzsch (1978) and Ullrich (1973) in Germany and Glue and Scott (1980) in Great Britain. In France, with the exception of a few notes collected by Labitte (1951), no study has yet taken stock of this subject. This communication will present data relating to the Little Owl's nesting sites and breeding in France, collected by inquiry and analysis of the bibliography, from 1895 to 1990 for nesting sites and from 1957 to 1990 for breeding (Hamonville 1895; Pardieu 1927; Pecheyrand 1961; Baudvin 1974; Sardenne 1976; Bergier 1980; Boutinot 1980; Bavoux & Burneleau 1983; Melliger 1987; Pepin 1989; Mandrillon & Renaudier 1989; Aleman & Dalmau 1990 and Joveniaux 1991), as well as the results of a study made by the author from 1984 onwards in the Northern Vosges, a region situated in eastern France, within the framework of the Ecology Laboratory of Dijon University and the Regional Natural Park of the Northern Vosges, with financial aid from the Ministry of Environment.

RESULTS AND DISCUSSION

Nesting sites

In France, the Little Owl lives in extremely varied habitats: traditional orchards, pasture and meadow with pollard willows, cultivated areas, parks, gardens, cliffs, quarries, villages, marshes or the banks of rivers, such as the Loire for example (Pailley *et al.* 1991).

All these habitats frequented by the species nevertheless have points in common:

- the presence of cavities for nesting,
- the existence of roosts for hunting,
- areas of short grass for feeding

The diversity of its habitat explains the great variety of the Little Owl's nesting sites (Table 1).

Trees represent the majority of nesting sites (41.9%), coming before buildings (32.1%) and the other sites (26%). In the Northern Vosges, 25 nests in trees counted by the author are in apple trees (Génot 1990). In the eastern Pyrenees, out of 27 nests in trees, 13 are in willows (Aleman & Dalmau 1990).

Fruit trees, above all apple, and pollarded trees, more particularly willow, offer the most cavities to the Little Owl. This due to the distribution of these two species over the entire French territory but above all to the fact that they offer the Little Owl roomy cavities. The nature of the trees chosen for nesting emphasises the species' anthropophilic character: pruned trees and fruit-producing trees. In spite of the tranquillity it needs in order to breed, the Little Owl willingly nests in inhabited houses (n=34). It installs itself usually under the roof, using a displaced tile or an opening in fibreglass. It can also nest in a hole in a facade or ventilation hole.

Table 1: Nesting sites of the Little Owl in France

NESTING SITES	n	%	NESTING SITES	n	%
TREES	222	41.9	BUILDINGS	170	32.2
FRUIT TREES	99	18.7	Inhabited house	34	
Apple <i>Malus domestica</i>	73		Farm	29	
Pear <i>Pyrus pyraister</i>	9		Barn	19	
Walnut <i>Juglans regia</i>	7		Hut, shed	15	
Cherry <i>Prunus avium</i>	6		Church	9	
Undetermined	3		Ruin	8	
Apricot <i>Prunus armeniaca</i>	1		Sheep-fold	8	
OTHER	67	12.6	Loft	7	
Undetermined	13		Electric transformer	2	
Mulberry <i>Morus alba</i>	9		Blockhouse	2	
Willow <i>Salix</i>	9		Football changing-room	1	
Poplar <i>Populus</i>	8		Garage	1	
Plane <i>Platanus acerifolia</i>	8		Chicken-house	1	
Ash <i>Fraxinus excelsior</i>	5		Other	34	
Oak <i>Quercus</i>	2		OTHER SITES	138	26.00
Maple <i>Acer</i>	2		Nestbox	61	
Sweet chestnut			Piles of stones	19	
<i>Castanea sativa</i>	2		Wall	17	
Conifer	2		Rockface	16	
Tamarisk <i>Tamarix gallica</i>	2		Quarry	14	
Weeping willow			Burrow	4	
<i>Salix babylonica</i>	1		Cliff	2	
Horse chestnut			Haystack	1	
<i>Aesculus hippocastanum</i>	1		Bale of straw	1	
Linden <i>Tilia</i>	1		Woodpile	1	
Palm	1		Fallen tree	1	
Elm <i>Ulmus</i>	1		TOTAL	530	100
POLLARD TREES	56	10.6			
Willow <i>Salix</i>	38				
Oak <i>Quercus</i>	6				
Ash <i>Fraxinus excelsior</i>	5				
Poplar <i>Populus</i>	3				
Undetermined	3				
Mulberry <i>Morus alba</i>	1				

Currently modern houses do not offer as many cavities and openings as traditional houses in mud and wattle, half-timbered, with thatched roof or a tile with an opening into the loft. Certain owners who cohabit with the Little Owl have confirmed its presence in their house for several decades.

The Little Owl lives essentially in rural areas, which leads to occupation of agricultural buildings: farms, barns, sheds, sheep-folds, chicken-houses (n=72). The species may also inhabit churches (n=9), quiet places but often monopolised by the Barn Owl *Tyto alba*.

For the other sites, nestboxes are relatively important (n=62). If the diameter of the entry is 7 cm and the position is suitable, the model is of little significance.

The choice of sites such as piles of stones, walls and rockfaces (n=52) justifies the species' German name: Steinkauz or Stone Owl. The cases of nesting in rabbit burrows or foxholes are exceptional. Unlike trees, buildings and other sites of human origin, rockfaces, cliffs, stony areas or burrows form natural nesting sites. These are principally found in the south of France and correspond to the only cavities available in its original habitats: open country from the Mediterranean basin to central Asia (Mikkola 1983).

Comparison of the type of nesting sites with other authors

TYPE OF NESTING SITES

The Little Owl clearly prefers hollow trees in western Europe (Table 2). But the species does adapt to local conditions for nesting and settles for buildings where there are no hollow trees. The proportion of trees is lower in France, as many regions do not have the pollarded trees or the fruit trees necessary for nesting. Moreover, "stone" sites, such as piles of stones, rockfaces, walls, ruins, are more frequent in the Mediterranean part of the country (Juillard 1985). Finally, the survey takes into account data from ornithologists who have installed Little Owl nestboxes.

Table 2: Comparison of nesting sites in different European countries

Country	Total number of nests	% Trees	% Buildings	% Other	Author
France	530	41.9	32.1	26	Génot present study
Great Britain	526	91.6	6.6	1.8	Glue & Scott (1980)
West Germany	319	66.5	26.6	6.9	Richter (1973) Hegger (1977) Exo (1981) Mildenberger (1984)
East Germany	316	54.4	27.5	18.1	Schönn (1986)
Switzerland	33	78.8	21.2		Juillard (1980)

HEIGHT OF NESTING CAVITIES FROM THE GROUND

The greatest average height, noted by Juillard (1984), is explained by the taking into account of nestboxes fixed quite high with the help of a ladder. The other average values are between 2.4 and 3 m (Table 3) and correspond to cavities in trees. In the Northern Vosges the average height of 26 cavities situated in fruit trees is 2.62 m. When the Little Owl nests in buildings, cavities are generally higher and may be over 10 m.

Table 3: Comparison of average heights of nesting cavities in different countries

Country	Author	Number of nests studied	Average height in metre
Great Britain	Glue & Scott (1980)	482	3.00
France	Genot	74	2.93
East Germany	Schönn (1986)	62	2.50
Switzerland	Juillard (1984)	59	3.90
West Germany	Exo (1981)	28	2.40

Breeding

MATING

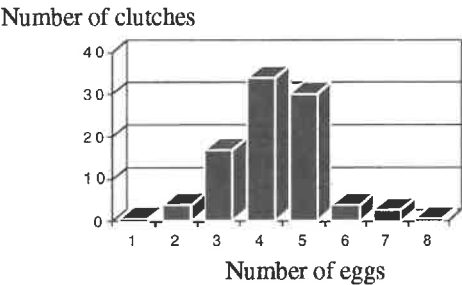
In particular regions, mating can take place from February to May but it is more frequent in March and April. Some dates are known: 07.02.87, 04.03.80, 15.03.80, 20.03.82, 13.05.87, 15.03.88, 19.04.88 and 02.05.89. Mating was observed on 04.07.88 in eastern France: did this precede replacement egg-laying or was it mating in vain (Hainard 1955)?

EGG-LAYING DATE

In the Northern Vosges, the author notes egg-laying frequency of 58% (n=24) between the third decade of April and the first decade of May. Labitte (1951) states that 60% of egg-laying dates (n=23) are in the second decade of April. Egg-laying appears to be later in the south, where the feeding of young in July coincides with the abundance of insects and in particular of orthoptera. In France, the earliest laying of eggs was recorded on 18.01.27 in the department of Allier (Pardieu 1927).

Figure 1: Number and size of 94 clutches in France

CLUTCH SIZE



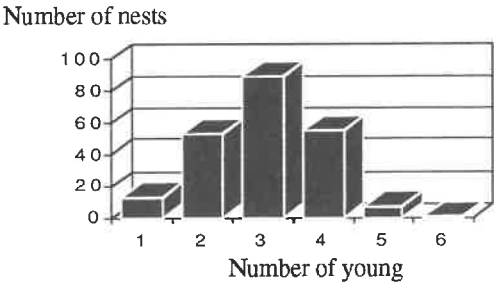
The average is 4.24 eggs per breeding pair (n=94) (Figure 1). It is interesting to compare this result with that of Labitte (1951) which indicates an average clutch size of 3.91 (n=80) for the period 1918-1950. This value, less than that recorded between 1957 and 1990, appears to eliminate contamination by biocides, of less importance before 1950, as the cause of a drop in fertility.

In the Northern Vosges, the average clutch size is 3.96 (n=33) and 3 replacement clutches were recorded out of the total of 33. Replacement clutches are rare and never exceed 10% (Knötzsch 1978 and Furrington 1987).

NUMBER OF FLEDGED YOUNG

The average productivity is 2.96 fledged young per successful breeding pair (n=218) (Figure 2), which places France among the average of European results (Table 6). In the Northern Vosges, the number of fledged young per successful breeding pair is 2.91 (n=22).

Figure 2: Number of fledged young per successful breeding pair (n=218) in France



GEOGRAPHICAL AND SEASONAL VARIATIONS IN THE BREEDING RESULTS IN FRANCE

The values of clutch size and number of fledged young per successful breeding pair have been classified according to geographical region (Table 4); those of clutch size, number of hatched young per breeding pair and per successful breeding pair, as well as number of fledged young per successful breeding pair according to climatic region: oceanic, semi-continental and Mediterranean (Table 5).

Table 4: Average and standard deviation of breeding results in France according to geographical region

BP = breeding pair SBP = successful BP	North	South	East	West
Number of eggs/BP sample	35	22	26	9
average	4.2	4.7	4.5	3.8
standard deviation	1.0	0.9	1.1	0.7
Number of fledged young /SBP sample	119	81	77	32
average	2.8	3.0	3.1	2.6
standard deviation	0.9	0.8	0.9	0.7

The results in Table 4 reveal a significant difference between clutch size in the south and west ($p<0.02$) and between the number of fledged young per successful breeding pair in the east and west ($p<0.02$) and in the south and west ($p<0.03$).

Table 5: Average and standard deviation of breeding results in France according to climatic region.

BP = breeding pair SBP = successful BP	Mediterranean climate	Oceanic climate	Semi-continental climate
Number of eggs/BP			
sample	8	19	34
average	4.7	4.0	4.5
standard deviation	1.1	0.8	1.0
Number of hatched young/BP			
sample	3	19	31
average	3.0	3.3	3.8
standard deviation	1.0	0.8	1.0
Number of hatched young/SBP			
sample	3	6	21
average	3	3	4
standard deviation	1.0	0.8	0.8
Number of fledged young/SBP			
sample	41	61	82
average	3.1	2.5	3.1
standard deviation	0.8	0.9	0.9

The results in Table 5 show a significant difference ($p<0.03$) between the number of hatched young per successful breeding pair in oceanic and semi-continental climates.

As regards the number of fledged young per successful breeding pair, a highly significant difference exists between oceanic and semi-continental climates ($p<0.001$) and between oceanic and Mediterranean climates ($p<0.002$). The synthesis of these comparisons shows better overall productivity (number of fledged young per successful breeding pair) in the east and in the south than in the west, and higher fertility (clutch size) in the south than in the west.

COMPARISON OF BREEDING RESULTS IN FRANCE WITH OTHER COUNTRIES

Table 6 shows that the average clutch size in France (4.24) is between the value indicated in Great Britain (3.59) by Glue and Scott (1980) and those established in Germany by Schönn (1986) (4.11) and Furrington (1987) (4.43), in Hungary (5.00) by Nemeth *in* Schönn (1986) and in Rumania (5.24) by Kohl *in* Schönn *et al.* (1991), confirming the relationship pointed out by Exo (1983) concerning the increase in clutch size from west to east. In the east, this fertility appears to increase with the aridity as in the desert of Turkmenistan (Sopyiev 1982). Table 6 also underlines the difference in average productivity between the Northern Vosges and the rest of France. The value of 1.45 fledged young per breeding pair ($n=40$) represents the lowest average productivity in Europe. It is lower than values recorded in Switzerland (Juillard 1984 and Baur *in* Krischer 1990) and in Germany (Schönn 1986 and Kaus 1981), already considered as insufficient for the maintenance of the species by Exo and Hennes (1980). In the rest of France, the average number of fledged young per breeding pair is 2.84 ($n=237$), one of the best values in Europe.

Table 6: Comparison of breeding results in France with other countries.

Country	E/BP		HY/BP		HY/SBP		FY/BP		FY/SBP		Author
	x	n	x	n	x	n	x	n	x	n	
EAST GERMANY	4.11	126	2.35	111	3.48	75	1.871	67	2.84	10	Schönn (1986) 1960 - 1985
WEST GERMANY											
Franconia							1.961	21	2.93	81	Kaus (1981) 1975 - 1981
North Rhineland, Coesfeld							3.122	94			Rusch (1989) 1982 - 1988
North Rhineland, Kleve	3.61	96	2.52	81	3.24	63	1.89	89	2.75	61	Exo (1987) 1974 - 1984
North Rhineland, Weil	3.87	154					2.041	86			Illner <i>in</i> Schönn <i>et al.</i> (1991) 1974 - 1982
North Württemberg, Heilbronn	4.43	112	2.74	120	5.21	74	2.831	70	3.18	98	Furrington (1987) 1973 - 1987
Lake of Constance	4.42	265	3.49	265			2.662	65			Knötzsch <i>in</i> Schönn <i>et al.</i> (1991) 1973 - 1988
Württemberg, Göppingen	4.12	141	2.78	203	3.78	149	2.352	03	3.341	43	Ullrich <i>in</i> Schönn <i>et al.</i> (1991) 1969 - 1986
Sarr			3.15	99							Schwarzenberg <i>in</i> Hahn (1984) 1980 - 1983
SWITZERLAND											
Ajoie	3.12	153	2.22	153	2.78	122	1.821	53			Juillard (1984) 1973 - 1980
Basle	3.78	76	2.98	76	4.72	48	1.78	76	2.83	48	Baur <i>in</i> Krischer (1990) 1981 - 1990
GREAT BRITAIN	3.59	268					2.402	41			Glue & Scott (1980) 1939 - 1975
CZECHOSLOVAKIA	3.90	12			2.84	39					Danko (1985a and b, 1986 and 1989) 1982, 1983, 1986 and 1989
HUNGARY	5.00	89									Nemeth <i>in</i> Schönn (1986) 1910 - 1976
RUMANIA	5.24	21									Kohl <i>in</i> Schönn <i>et al.</i> (1991) 1902 - 1975
FRANCE	4.24	94	3.62	53	3.70	30	2.842	37	2.962	18	Génot survey 1957 - 1990
Eure-et-Loir	3.91	80									Labitte (1951) 1918 - 1950
Northern Vosges	3.96	33	3.50	6			1.45	40	2.90	22	Génot study 1984 - 1991

E/BP: number of eggs per breeding pair

HY/BP: number of hatched young per breeding pair

HY/SBP: number of hatched young per successful breeding pair

FY/BP: number of fledged young per breeding pair

FY/SBP: number of fledged young per successful breeding pair

Losses during breeding

The main cause of clutch losses is predation (Table 7). This percentage (65.2%, n=69) is due to taking into account the Northern Vosges study results, which highlight important predation by the Stone Marten *Martes foina* with 19 out of 40 clutches destroyed.

Table 7: Losses of clutches and young in nests in France

Cause-Clutch	n	%	Cause-young in nest	n	%
Predation	45	65.2	Undetermined	8	40
Disturbance	10	14.5	Flooding	5	25
Sterility	9	13.0	Cannibalism	3	15
Human destruction	2	2.9	Taking from nest	2	10
Bad weather	2	2.9	Predation	2	10
Undetermined	1	1.5			
TOTAL	69	100	TOTAL	20	100

The predation rate is the highest in Europe, as Juillard (1984) notes only 25.8% (n=31), Glue and Scott (1980) 10.8% (n=37) and Schönn (1986) 31.2% (n=48). Sterility, which represents 13% of egg loss in France, is higher than in Great Britain, with 5.4% (n=37) (Glue & Scott 1980) and in East Germany with 8.3% (n=48) (Schönn 1986) but less than in Switzerland where Juillard (1984) notes 51.6% loss (n=31).

As far as loss of young in the nest is concerned, predation only covers 10% of cases (n=20) whereas it is 15% in Switzerland (n=60), 23.5% in East Germany (n=51) and 33.4% in Great Britain (n=15). Cases of syngenophagy (cannibalism) are rare (15%, n=20) compared with Switzerland where Juillard (1984) records 33.3% (n=60). Exo (1983) reports about ten cases where the youngest chick has disappeared, probably eaten by its elders, whereas Schönn (1986) considered cannibalism as a cause of loss secondary to victims succumbing to illness, lack of food or to the development of cloaca in the nest.

CONCLUSION

In France the Little Owl mainly adopts fruit trees for its nest but may choose buildings when trees are rare. The average productivity, 2.84 fledged young per breeding pair (n=237) is one of the best in Europe. But in the Northern Vosges, this productivity, 1.45 fledged young per breeding pair (n=40), can drop well below the level needed to maintain populations, for reasons which do not appear to be linked only to trophic resources (Génot 1992). The number of fledged young per successful breeding pair increases from west to east and south and clutch size from west to south. The very low productivity in the Northern Vosges is probably linked to the lack of food, to the isolation of pairs and perhaps to a lack of social stimulation by singing birds, as is the case with the quail *Coturnix coturnix* (Guyomarc'h 1991).

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