

Reproductive Output of the Tawny Owl *Strix aluco* in relation to Small Mammal Dynamics in intensively cultivated Farmland

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ABSTRACT

Preliminary data are presented from a population study of the Tawny Owl in lowland farmland (536km²) near Hradec Králové, east Bohemia. In 1986-1989, a total of 183 pairs of Tawny Owls nested largely in plastic nest-boxes. Although the Common Vole was the most important item in the diet and its proportion increased with increased abundance in the field (for all seasons 70.6% by numbers and 43.1% by weight), no significant differences both in clutch size and production of young were found between good and poor vole years, because when voles became scarce, Tawny Owls switched to other food (*Apodemus* mice, bank voles, birds, less shrews). Thus, the relatively high proportion of the Common Vole in the diet is considered to be a result of its availability rather than of a high degree of food specialisation (resident generalist). In view of material sample size and continuation of the research this contribution is considered to be a preliminary report.

INTRODUCTION

According to a relatively broad trophic niche, the Tawny Owl *Strix aluco* is considered to be a catholic predator (food generalist), without close specialisation for catching certain prey (Goszczynski 1977; Melde 1989). Nevertheless it has been shown that fluctuations in the density of small mammals, especially rodents, influence the reproduction of this territorial species, which is further modified by weather. These studies concentrated either on lowland broadleaved woodland (Southern 1970; Hiron 1976) or sub-urban areas such as parks (Wendland 1980, 1984), where *Apodemus* mice or bank voles were the most important prey. Tawny Owls on British farmland fed mainly on field voles (*Microtus agrestis*, Hardy 1977). The same pattern was confirmed for Tawny Owls inhabiting an upland spruce forest in Northumberland, where newly stocked sites with their grassy vegetation provided a major vole habitat (Petty 1987, 1989).

Although the composition of the Tawny Owl's diet formed part of an extensive study on predation in farmland in Poland (Ryszkowski *et al.* 1971, 1973; Goszczynski *et al.* 1981), little is known of how population fluctuations in small mammals affect reproduction output in Tawny Owls nesting or foraging in farmland. Because we have investigated predation on small mammals

by aerial predators in lowland farmland since 1986, a population study on Tawny Owls has been included.

MATERIAL AND METHODS

The study was carried out between 1986-1989 in east Bohemia.

The study area covers 536km². The district of Hradec Králové, where our material was collected, is a region of intensively cultivated farmland, comprising largely arable land (65.0%) and meadows or pastures (3.4%). Especially in the south-east of the area, there are woodlands (21.3%). Water (0.9%) and built-up areas (9.4%) are dispersed throughout the farmland. Our study area lies at the confluence of two rivers, the Labe and the Orlice, at an altitude ranging between 325 and 287m.a.s.l. The crops are mainly wheat, sugar beet and barley.

To increase the population density of Tawny Owls, modified plastic 40-60 litre barrels have been used since 1984 as nest-boxes for these owls, spaced out on woodland edges or clearings, in larger islands of trees and bush in arable land or in tree-lines along streams. The numbers of nest-boxes erected are given in Table 3 (see Dusík *et al.* 1986 for additional details on nest-box production and maintenance). Data on the food of Tawny Owls, nesting in the intensively cultivated farmland were obtained by three methods:

- (a) pellet analysis
- (b) findings in nest-boxes
- (c) analysis of nesting material after fledging of young (total 2,320 prey items). (See Plesník & Dusík 1988 for additional details on methods).

Most of the owls bred in nest-boxes. Territories were mapped by listening for hooting, using playback techniques from early February to late April. All nest sites were visited every week from the last week in February to the last in May each spring. At occupied nest sites visits were timed to obtain data on time of laying the first egg, clutch size and brood size at fledging.

We estimated the abundances of small mammals available by snap-trapping in early June (spring trapping) and in late September and early October (autumn trapping). Two sample quadrats (an alfalfa field, a mown meadow) were trapped each season and year. In each quadrat, 242 snap-traps were set over a trapping grid (10 x 10m) using two traps for each trapping point for six nights. Population densities were calculated using standard methods. Because the population dynamics of small mammals is influenced by numerous refuges in farmland, 200 traps were set in road ditches, railway cuttings, windbreaks, tree or bush islands, on waste land or on woodland edges for a 3-5 days period since 1987. The relative abundance was calculated as captured individuals/100 trap nights. A total of 1,724 specimens of 13 small mammal species were caught, of which 1,447 were Common Vole (*Microtus arvalis*). The material was treated by standard methods.

RESULTS

Common Vole density was highest in 1988 (good vole year) and lowest in 1987 (poor vole year). From the viewpoint of vole abundance, 1986 and 1989 are intermediate vole years (see Plesník and Dusík, this volume).

Microtus voles were the most important prey group by both number and mass in the diet of the Tawny Owl (Tables 1 and 2). The proportion of Common Vole in the diet increased as its abundance increased in the landscape and ranged between 59.6% and 82.8% by numbers and 31.2% and 64.2% by weight. When Common Voles became scarce, Tawny Owls turned to other food (especially *Apodemus* mice, Bank Vole *Clethrionomys glareolus* and birds, mainly Black-birds). Reptiles or amphibians were eaten only rarely. In a low *Microtus* vole year, insects were most numerous in the owl's diet.

Nevertheless, no significant differences both in clutch size ($t=1.233$, $df=80$, n.s.) and production of young ($t=0.934$, $df=80$, n.s., Student's *t*-test, two-tailed) were found between poor and good vole years. The lowest values both of clutch size and number of young fledged were found

Table 1. Proportions (%) of the most important prey species and groups by number in the diet of the Tawny Owl in 1986-1989

Prey species or groups	1986	1987	1988	1989	1986-1989
<i>Microtus arvalis</i>	70.1	59.6	82.8	69.2	70.6
Microtidae, tot.	74.1	66.7	83.7	80.8	76.7
Mammalia, tot.	84.9	72.5	88.7	89.4	84.1
Aves	11.9	20.6	9.9	8.3	12.5
Reptilia	0.2	0.2			0.1
Amphibia		0.2	0.7		0.2
Insecta	2.8	6.0	1.4	2.3	3.1
Nests	21	29	32	37	119
Prey animals	471	579	620	650	2320

Table 2. Proportions (%) of the most important prey species and groups by weight in the diet of the Tawny Owl in 1986-1989.

Prey species or groups	1986	1987	1988	1989	1986-1989
<i>Microtus arvalis</i>	44.6	31.2	64.2	41.6	43.1
Microtidae, tot.	49.5	37.2	67.2	59.2	47.8
Mammalia, tot.	73.6	60.5	89.4	85.6	68.8
Aves	25.8	38.0	10.5	14.3	28.6
Reptilia	0.3	0.3			1.5
Amphibia	0.3	1.2			1.0
Insecta	< 0.1	< 0.1	0.1	0.1	0.1

Table 3. Some features of Tawny Owl's bionomics in farmland, east Bohemia, 1986-1989.

	1986	1987	1988	1989	1986-1989
Number of breeding pairs	37	42	45	59	183
Number of nest-boxes installed (wooden/plastic)	45/95	42/113	38/133	36/132	161/473
% of nest-boxes occupied	26.4	27.1	23.4	33.9	28.9
Clutch size (number of clutches)	2.35 (37)	3.38 (42)	3.05 (40)	2.51 (57)	2.81 (176)
Number of young fledged per laying pair	1.62	2.74	2.40	1.98	2.18
Number of fledged young per successful pairs (number of nests)	2.50 (24)	3.19 (36)	2.53 (38)	2.26 (50)	2.59 (148)
Breeding success (young fledged/eggs laid) (in %)	69.0	81.1	78.7	78.4	77.6

in 1986 (an intermediate year for Common Vole density). Thus reproductive output in the Tawny Owl population seemed to be affected by other prey groups than Common Vole. Some environmental factors may affect the breeding performance.

DISCUSSION

Data collected in the east Bohemia lowland farmland on the variation in the diet of the Tawny Owl in relation to the density of the Common Vole are in agreement with those of Ryszkowski *et al.* (1973), who found that despite further increase in the numbers of *M. arvalis* the weight percentage of voles in the diet of *Strix aluco* remained constant, and even showed a slight drop in winter (in 1989, density of *M. arvalis* increased in cultivated fields in our study). Compared with Kestrels inhabiting the same area, Tawny Owls switched to the most abundant prey more extensively. Of the owl species examined in agrocoenoses by Goszczynski (1981), i.e. *Strix aluco*, *Tyto alba* and *Asio otus*, the Tawny Owl reacts the strongest to changes in the Common Vole density. During mass appearances of Common Vole, the Tawny Owl hunts primarily for this rodent. Thus the relatively high proportion of Common Vole in the Tawny Owl's diet may be considered a result of its availability rather than of a high degree of specialisation.

No differences in both clutch size and number of young produced per pair to fledging would result from the catholic nature of the Tawny Owl's diet. Its opportunistic character is connected with strong territoriality (Southern 1970). In addition, a poor vole year was not so sharply pronounced as extended low densities in some other microtine cycles, in contrast to the *Microtus agrestis* population cycle studied by Petty (1987, 1989). Population fluctuations in *Microtus* voles in field and meadow were not precisely synchronized in our study area. As shown from results of snap-trapping in 1991, no Common Voles were captured in the alfalfa quadrat in spring as well as on meadowland in autumn. For this year, the reproductive output was measured as follows: total 15 breeding pairs, mean brood size 3.08, mean number of young fledged per pair 2.15, mean number of fledged young per successful pair 2.33, breeding success 70.0% (Plesník & Dušek unpubl.). In addition, the density of *Apodemus* mice was high in the alfalfa field in 1987. Two years later, the Bank Vole population reached its peak density in refuges (see Plesník & Dušek, this volume).

In 1978-1989, the numbers of Tawny Owl breeding pairs increased almost exponentially in the study area. The owls have preferred the plastic nest-boxes to "classic" wooden ones or natural cavities or holes. Results of ringing show that the same plastic nest-box is used for several years (Plesník & Dušek unpubl.). Due to greater experience, these owls may be advantaged in foraging (see Jedrzejewska & Jedrzejewski 1989 for references). Martin (1986) showed that Tawny Owls' vision was similar to that of humans and their foraging success is related to knowledge of own home-range. In addition, reproductive output is affected by weather. For example, heavy rainfall caused damping of nests in 1986. In our study, there is some variation between territories in the number of chicks produced, as pointed out by Petty (*loc. cit.*).

To examine breeding of Tawny Owls in relation to their food supply or habitats, more extensive material is needed. Nevertheless the species' bionomics in east Bohemia intensively used farmland display features that are typical of the resident generalists (Andersson & Erlinge 1977). The importance of generalist predators in the microtine rodent cycle has been emphasised in recent years (Erlinge *et al.* 1983; Hanski *et al.* 1991).

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Tawny Owl *Strix aluco* - fledgling