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# Fauna of small mammals from Mstów (Jurajski Landscape Park) based on pellets of the barn owl, *Tyto alba* Scop. 1796

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**Abstract:** Studies of the occurrence of small mammals in the Mstów area are reported. Data were based on regurgitate material of the barn owl, *Tyto alba*. In all, 1042 samples have been analysed, yielding a total of 2150 skeletal elements. Representative material of twenty species of small mammals, assigned to three orders, four families and thirteen genera has been recognized. In comparison to literature data for the whole Poland, the present data are apparently similar, showing only small differences for a few species. These may be linked to the specific environmental character of the studied area.

**Key words:** Mstów, Jurajski Landscape Park, barn owl, *Tyto alba*, regurgitates

## *Introduction*

Analyses of food composition of birds of prey were reported as early the second half of the nineteenth century (Gromadzki 1960). This method of study is considered more effective than other ways of gathering data, for instance by trapping. In addition, it is expedient since birds of prey are utilised as 'technical assistants' in collecting research material (Nikodem 1972). Naturally, this method, like all other ways of doing research, has its weak points; for instance, food selection by the bird species considered depends, among other things, on the character of area hunted in, of its position and as well as of seasonal changes in diet composition of those species (Gromadzki 1960). An additional problem is the quality of preservation of the material studied, which often causes problems in identifying prey items.

Our studies are local, and the results are of significance for the study area and nearby surroundings. It should be noted that this kind of research has not been done

previously in this area. Our investigations therefore enabled the gathering of new data on small mammal faunas in the Mstów area, thus providing a framework for future studies.

### *General characteristic of study area*

The Jurajski Landscape Park, was founded in 1980. It occupies an area of 59,731 hectares, including parts of several geographic regions as proposed by J. Kondracki, namely the Kraków-Częstochowa Highlands and the Woźnicko-Wieluńska Highlands, plus the 'mesoregions' Częstochowa Highlands, Olkusz Highlands and Górna Warta Depression. The park includes the chain of the Częstochowa Highlands which extends from the southwest (River Warta valley near Częstochowa) to the northeast (near Olkusz) and forms a belt with a width from a few to more than 20 kilometres and a length of almost 70 km (Rąkowski et al. 2002).

The Mstów area (UTM: CB83), is situated east of Częstochowa, in the Kraków-Częstochowa Highlasnds, 'mesoregion' Częstochowa Highlands and is limited by the northern boundary of Jurajski Landscape Park. For the present study, regurgitates of the barn owl, *Tyto alba* (Scop., 1796), were used. These regurgitates were found within the cloister of the Regular Lutheran Canons at Mstów/Wancerzów, a brick building dating from the twelfth century. This site was discovered during field observations of bat and barn owl distribution within sacral buildings in the Silesian voivodeship (Dobosz et al. 2002). However, during a field trip on May 12, 2004, the authors noted that the owls had disappeared from this site; only the remains of two dead barn owls were found. Probably, restoration works carried out at the site caused the barn owls to become walled up, and thus they died of hunger.

The hunting area of the barn owl extends for 1-2 km (in winter only, nearly 4 km) from the nesting place (internet publication no. 1), which defines the extension of the studied area.

This area is one of the more interesting sites in the park with respect to both natural landscape and history, the beauty of the area is accentuated by the River Warta, which forms rapids across Upper Jurassic rock formations.

### *Methods*

The method employed, i.e. analysis of regurgitates, is widely accepted to be the best way of studying the food of birds of prey, including owls; it also usually allows easy identification of species taken and of the number of prey items (Wołk 1965).

The material analysed comprises two sets of regurgitates, collected on May 12, 2004 by T. Marszałek and June 14, 2001 by G. Kłys. Both regurgitate samples came from the cloister roof and tower.

This might provide a basis for studies of changes over time, but since both samples originated from a site no longer active, we cannot be certain about the time of origin for either sample, which is why they were 'lumped' and analysed as one.

However, some comparisons of the two sets has been done, to study changes in alimentary composition over time.

The material studied was prepared and then identified. Preparation included:

- Dipping the collected material in ethyl octane to destroy micro-organisms and limit health risks
- Dry preparation of material.
- The bony elements were isolated, such as: jaws, skulls etc, were noted as separate elements.

Diagnostic features for specific groups were selected using a key for identification of mammals (Pucek 1984).

In statistics, the number of specimens belonging to different species was distinguished. The method of maximum was used, i.e. the final number of specimens belonging to one species was accepted as the highest number of samples, provided they are not mutually exclusive. All specimens are housed in the collections of the University of Opole.

### *Results*

The total number of prepared bony elements was 2150. Of these, the material collected on June 14, 2001 comprises 999 elements (i.e., 46,5% of the whole sample) and that acquired on May 12, 2004 includes 1151 elements (i.e., 53,5%) (Tab. 1).

Table 1. **N**umber and percentage of bony elements belonging to selected orders and families.

| **Order** (Family): | **Number and % of elements** | | | | | |
|---|---|---|---|---|---|---|
| | **14.06.2001** | | **12.05.2004** | | **Total** | **%** |
| **(Insectivora)** | **370** | **37%** | **338** | **29,3%** | **708** | **33** |
| **(Rodentia)** | **627** | **62,8%** | **810** | **70,4%** | **1436** | **66,8** |
| (Muridae) | 313 | 31,4% | 514 | 44,7% | 827 | 38,5 |
| (Arvicolidae) | 314 | 31,4% | 295 | 25,6% | 609 | 28,3 |
| (Gliridae) | 0 | 0% | 1 | 0,1% | 1 | 0,04 |
| **(Chiroptera)** | **2** | **0,2%** | **3** | **0,3%** | **5** | **0,2** |
| ∑ | **999** | **100%** | **1151** | **100%** | **2150** | **100%** |

The entire material, percentage and numbers of distinguished genera are shown in Table 1. Subsequently, the number of bony elements belonging to selected groups was compared; results are shown in Table 2.

The number of identified specimens of all small mammal species is 1042, and the highest percentages are noted for:

- Common shrew (*Sorex araneus*) - 321 (30,8%)
- Common vole (*Microtus arvalis*) - 235 (22,5%)
- House mouse (*Mus musculus*) - 191 (18,3%)
- Striped Field mouse (*Apodemus agrarius*) - 90 (8,6%)

In total, these four species amount to 80,2% of the identified specimens in the material used.

Table 2. Number of elements, specimens and percentages for all species.

| Species | Number of bony elements | Estimated number of specimens | Percentage of research material |
|---|---|---|---|
| *Sorex araneus* | 606 | 321 | 28,2% |
| *Sorex minutus* | 50 | 29 | 2,3% |
| *Neomys fodiens* | 39 | 25 | 1,8% |
| *Crocidura leucodon* | 10 | 8 | 0,5% |
| *Crocidura suaveolens* | 3 | 2 | 0,1% |
| *Mus musculus* | 469 | 191 | 21,8% |
| *Micromys minutus* | 50 | 26 | 2,3% |
| *Apodemus agrarius* | 203 | 90 | 9,5% |
| *Apodemus microps* | 27 | 16 | 1,2% |
| *Apodemus sylvaticus* | 12 | 9 | 0,6% |
| *Apodemus flavicollis* | 2 | 2 | 0,1% |
| *Apodemus* sp. | 5 | 5 | 0,2% |
| *Rattus norvegicus* | 4 | 2 | 0,2% |
| Muridae indet. | 55 | 31 | 2,6% |
| *Microtus arvalis* | 520 | 235 | 24,2% |
| *Microtus oeconomus* | 67 | 29 | 3,1% |
| *Microtus agrestis* | 9 | 6 | 0,4% |
| *Pitymys subterraneus* | 4 | 4 | 0,2% |
| *Clethrionomys glareolus* | 2 | 1 | 0,1% |
| *Arvicola terrestris* | 1 | 1 | 0,05% |
| Arvicolidae indet. | 6 | 5 | 0,3% |
| *Myotis myotis* | 4 | 3 | 0,2% |
| *Nyctalus noctula* | 1 | 1 | 0.05% |
| ∑ | 2150 | 1042 | 100% |

## *Discussion*

A comparison of these results with literature data show them to be very similar. For the barn owl it is accepted that the normal percentages in Poland is for small rodents – 65%, insectivores - 27%, birds – 3% and, in addition, bats and amphibians (Gromadzki 1960). The main theme of this paper is the composition of mammal species in the owl diet. Although the authors did not study the remainder of the vertebrate assemblages collected, the number of bird and amphibian remains corresponded, in proportions, to the data mentioned above.

The selectivity and the opportunistic character of owl hunting might cause some problems in identifying faunal composition in the study area, but this method is more authentic and effective than that provided by trapping (Wołk 1965).

Similar relationships are known for various species of owl: eagle owl (*Bubo bubo*), short-eared owl (*Asio flammeus*) and tawny owl (*Strix aluco*). The dominant group amongst mammals is small rodents. For example, for an long-eared owl (*Asio otus*) rodents account for almost 90% of the prey, and during years of mass appearance of rodents, this figure is near 100% (Gromadzki 1960, Harmata 1969). It has been established that tawny owls (*S. aluco*) living in towns supplement their diet by synantropic species, while in areas far from populated regions, their food consists mainly of small rodents (Bogucki 1967).

High percentage of common shrew (*S. araneus*) in the food of barn owl should be noted. This may be explained by the fact that the river Warta turns exactly in the study area

and thus creates ideal conditions for that species, e.g. humid river banks and meadows, edge of forest and brakes. The proportion of insectivores in owl diets differs according to the species of owl. For example, when there are no other potential prey items, a long-eared owl (*A. otus*) will eat insectivores, but very reluctantly (Sałata–Piłacińska 1995).

The issue of how many bats were included in the diet of the barn owl has a double character, but it was assumed that on the scale of the whole of Poland that index is near 0,25% and in the southern regions of the country it might be higher because of higher densities of such mammals, and more frequent hunting on bats by owls. For example, in the Wieluńska Heighlands, this index reaches 0,29% (Kowalski and Lesiński 2002). Moreover, at other sites frequent hunting by owls of bats has been noted and explained by the owl settling in the same asylums as bats and by the opportunistic character of owl hunting bats, which dependent on the density of this type of prey in the hunting area of birds of prey (Kowalski and Lesiński 2002).

At the collecting site (where the barn owls are now gone), a colony of Greater Mouse-eared Bat (*M. myotis*) was established during investigation of faunal distribution within the sacral buildings in Silesia (Dobosz et al. 2002), traces of this colony (accumulation of bat guano) were found also during the collection of the present material. This fact well stressed the view mentioned that prey availability influences composition of the prey of barn owls.

Moreover, an occasional additional element in owl diets is formed by insects, but in the analysed material no characteristic elements of those organisms were found. In general, within regurgitates there are some fragments of indeterminate chitin covers, extremities and forearms (Trzeciak 2001). A real problem may then also appear in determining if the remains are from insects taken by the owl itself, or by one of its prey items, or possibly that the insects fed on the regurgitates (Wołk 1965).

A comparison of the composition by species in the material studied with literature data reveals some dependence related to the abundance of species.

Percentages for common vole (*M. arvalis*) are more or less similar in comparable materials (internet publication no 1, Nikodem 1972), and its wide occurrence is explained by the presence of numerous cultivated fields in the Mstów area. Moreover, this species is numerous and common in the entire country (Pucek 1984).

The house mouse (*M. musculus*) is less numerous in the study area, which could be explained by problems in identifying the studied material since indeterminate elements of the family Muridae amount to almost 3% of the estimated number of specimens and even to 2,5% of all elements in the material studied. Probably, a certain portion of indeterminate specimens might belong to *M. musculus* and thus have an impact on the percentages. Moreover, identification problems could also arise from the fact that *Microtus arvalis* and *Mus musculus* are very similar, which has a compensating character (dependent of population dynamics and field relationship) and cause the predominance of mice in compact buildings; however, when built-up areas contact open nature areas, such as meadows or fields, vole predominates (Nikodem 1972). Undoubtedly, this was the case in the Mstów area which represents a village type of built-up area.

The composition of barn owl food described is a result of present-day landscapes which are dominated by cultivated fields, cultivated meadows and human settlements. This also explains why the basic diet of that species comprises species living in this habitat, in particular vole (*Microtus arvalis*) – the commonest mammal in Poland – (Pucek 1984), shrew (*S. araneus*), mice (Muridae) and, especially, house mouse (*Mus musculus*).

Usually the most important component is field mouse (*Apodemus agrarius*) (Lesiński and Rusin 1996).

The rarer species identified in the material studied are the following:

- Pygmy shrew (*Sorex minutus*), amounting to 2,8%. This species was occasionally caught by barn owls during migration between forested areas and open territories (Nikodem 1972).
- Lesser white-toothed shrew (*Crocidura suaveolens*) and bicoloured white-toothed shrew (*C. leucodon*), in total 1%. These are typically synantropic species characteristic of urban and suburban territories (Nikodem 1972), which explains their rarity.
- Harvest mouse (*Micromys minutus*) (2,4%), whose preferred habitat is streams and channels. In comparison with literature data (1–3,37%; Nikodem 1972) this percentage is an average value.
- Pygmy field mouse (*A. microps*) (1,5%).
- Root vole (*Microtus oeconomus*) (2,8%), is here near the limit of its distribution (Pucek 1984) and thus the percentage is comparatively low.
- Common pine vole (*Pitymys subterraneus*) (0,4%); this low percentage may be linked to its subterranean way of life (Nikodem 1972).
- Greater mouse-eared bat (*Myotis myotis*) (0,3%) and noctule (*Nyctalus noctula*) (0,1%). The comparatively high percentage for *M. myotis* certainly is the result of the fact that at the place of collecting a large colony of that species was established (Dobosz et al. 2002). Lower values are noted for the other bat species, and this could be due to the fact that its preferred habitat is mainly forest area and human settlements (Pucek 1984).

Summarizing the studies carried out, it is possible to state that our data, when analysed and compared with literature sources, are similar to those obtained in previous studies of the prey of *Tyto alba*. Small differences noted involve percentages for the various species, and these are explained by the specificity of their habitats.

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