

A new locality of the northern birch mouse *Sicista betulina* (Pallas, 1779) and other small mammals revealed in the food of the tawny owl *Strix aluco* Linnaeus, 1758 in the Drawski Landscape Park (Western Pomerania, Poland)

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Abstract: In 2006 and 2025, pellets of the tawny owl *Strix aluco* were collected and studied at Zdroje site near Połczyn-Zdrój in the northern part of the Drawski Landscape Park (Western Pomerania, NW Poland). They contained the remains of 734 individuals of small mammals belonging to 22 species (4 Eulipotyphla, 4 Chiroptera and 14 Rodentia). The most important finding is the presence of the northern birch mouse *Sicista betulina* probably in an island population, more than 200 km west of the species' previously known continuous range. Also valuable is the occurrence of the edible dormouse *Glis glis*, which confirms the presence of this mammal in the forest complexes of Western Pomerania, as well as the parti-coloured bat *Vespertilio murinus* – a bat rarely recorded in this part of the country. The results of this study increase knowledge about small mammals of north-west Poland and their community structure.

Key words: Mammalia, owl pellets, isolated population, NW Poland

INTRODUCTION

In recent decades mammal communities are under the extinction risk or rapid decline in abundance due to anthropogenic changes or global climate change (Hoffmann et al. 2011, Pacifici et al. 2017). Therefore, the studies presenting current state of mammal faunas or community structure of even small areas are necessary. The mammal fauna of Western Pomerania in north-western Poland remains poorly known. With regard to small mammals, there are few well-documented localities for individual species, and most of them now have historical status (Pucek & Raczynski 1983), with no contemporary confirmations. Several species reach the limits of their ranges in this region. One of them is the Miller's water shrew *Neomys milleri* (Mottaz, 1907), which forms a large "island" within its otherwise discontinuous range on the Polish Pomerania (Pucek & Pucek 1983, Lesiński & Rusin 1996). In addition, the lesser white-toothed shrew *Crocidura suaveolens* (Pallas, 1811) (Cichocki et al. 2014), the Bechstein's bat *Myotis bechsteinii* (Kuhl, 1817) (Wojtaszyn et al. 2008), and the grey long-eared bat *Plecotus austriacus* (Fischer, 1829) (Ciechanowski et al. 2005, Wojtaszyn & Rutkowski 2007, Ciechanowski et al. 2011, Wojtaszyn et al. 2014) have their extreme northern localities here. Historical records also report the presence of the common dormouse *Muscardinus avellanarius* (Linnaeus, 1758) near Piła and along the Baltic coast (Fraser 1930, Pucek 1983a).

The analysis of owl pellets is an effective method to obtain abundant material on local assemblages of small mammals relatively quickly (Heisler et al. 2016). In Western Pomerania, this approach has also been used to investigate the occurrence of numerous species (Pucek & Raczynski 1983, Lesiński & Rusin 1996, Lesiński et al. 2024). The aim of this study is to determine the species composition and proportions of individual mammal species in the diet of the tawny owl *Strix aluco* Linnaeus, 1758. This owl is especially recommended for such study because it is sedentary, occupying its territory all year round (Mikkola 1983). As the material was collected in an area for which only limited data on the mammal fauna have been available, the results of the study will contribute to expanding current knowledge on the contemporary distribution of small mammals in Western Pomerania.

MATERIAL AND METHODS

The diet composition of *S. aluco* was examined at a single site – Zdroje near Połczyn-Zdrój in Western Pomerania, north-western Poland (53.70N, 16.19E). Owl pellets were collected three times (6 Jun, 2006, 29 May and 29 Sep, 2025 – the last two collections contained a mixture of fresh and older material). The site with the material for the study is located in the ruins of a residential building situated in a clearing surrounded by a mosaic of forests (primarily *Luzulo pilosae*–*Fagetum* beechwoods), lakes, meadows, and small peatlands (mostly around natural lakes and in depressions) (Figs. 1–3). The site is located between the towns of Połczyn-Zdrój, Czaplinek, and Barwice. It is situated within the Drawski Landscape Park and inside the Natura 2000 Special Bird Protection Area “Ostoja Drawska” (PLB 320019), approximately 200 m from the boundary of the Natura 2000 Special Habitat Protection Area “Jeziora Czaplineckie” (PLH 320039) and about 1500 m from the borders of the “Dolina Pięciu Jezior” nature reserve.

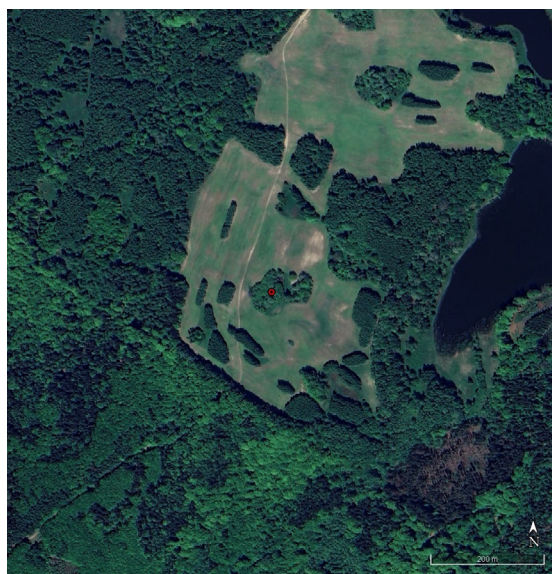


Figure 1. Aerial view of the landscape surrounding the site where pellets of *Strix aluco* were collected (marked with a red dot). The site is surrounded by cut meadows (light green), extensive mixed forests and small woodlots (green and dark green), as well as natural lakes (dark grey). The image shows a 1 × 1 km area obtained from Google Earth, centered at coordinates 53.70°N, 16.19°E.



Figure 2. Open landscape in the vicinity where the pellets of *Strix aluco* were found (Photo Andrzej Wuczyński).



Figure 3. A small forest lake in the study area (Photo Andrzej Wuczyński).

The material was analysed by using standard methods (Raczyński & Ruprecht 1974, Gryz & Krauze 2007). Mammal species were identified using a diagnostic key (Pucek 1984) and publications describing diagnostic characteristics for taxonomically groups that are difficult to identify (Ruprecht 1979, 1987). A comparative skull collection was also used.

RESULTS

In the material, 957 vertebrate prey items were identified, including 734 mammals, 22 birds, and 201 anurans. Among the mammalian owl prey, 515 individuals were identified to species (Table 1). A total of 22 mammal species were recorded: 4 Eulipotyphla, 4 Chiroptera and 14 Rodentia. Two species clearly dominated the community: the yellow-necked mouse *Apodemus flavicollis* (Melchior, 1834) and the bank vole *Clethrionomys glareolus* (Schreber, 1780), together accounting for approximately 40% of all prey. Slightly less abundant were the common shrew *Sorex araneus* Linnaeus, 1758 and the field vole *Microtus agrestis* (Linnaeus, 1761). Noteworthy is the presence of the parti-coloured bat *Vespertilio murinus* Linnaeus, 1758 among the bat remains, as well as the edible dormouse *Glis glis* (Linnaeus, 1766) and the northern birch mouse *Sicista betulina* (Pallas, 1779) (Fig. 4) among rodents. The latter species accounted for about 0.5% of all mammals caught by the owls at the study site (Table 1). The water vole *Arvicola amphibious* (Linnaeus, 1758), bats (which together represented about 0.7% of all mammals), and the European pine vole *Microtus subterraneus* (de Selys-Longchamps, 1836), the wood mouse *Apodemus sylvaticus* (Linnaeus, 1758), the house mouse *Mus musculus* Linnaeus, 1758, and the brown rat *Rattus norvegicus* (Berkenhout, 1769) were recorded only in small numbers (Table 1).

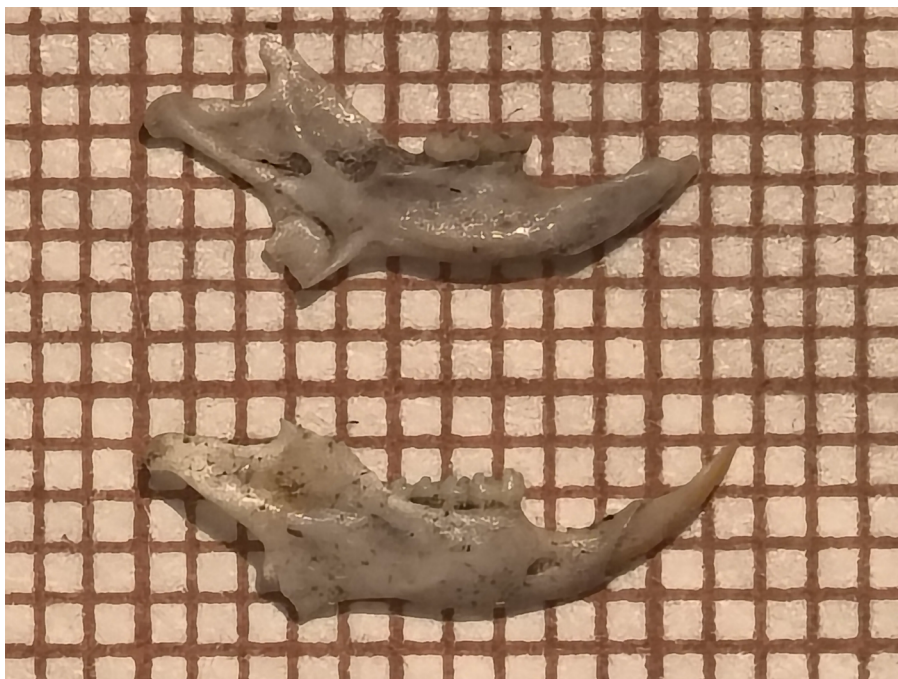


Figure 4. Mandibles of *Sicista betulina* recorded in the study material (Photo Grzegorz Lesiński).

Table 1. Mammals in the food of *Strix aluco* in Zdroje near Połczyn-Zdrój.

Species	6 Jun 2006	29 May 2025	29 Sep 2025	Total	%
<i>Talpa europaea</i> Linnaeus, 1758	3	1	9	13	1.8
<i>Sorex araneus</i> Linnaeus, 1758	27	10	35	72	9.8
<i>Sorex minutus</i> Linnaeus, 1766	2	2	4	8	1.1
<i>Neomys fodiens</i> (Pennant, 1771)	0	0	1	1	0.1
<i>Myotis nattereri</i> (Kuhl, 1817)	0	0	1	1	0.1
<i>Vespertilio murinus</i> Linnaeus, 1758	0	1	0	1	0.1
<i>Eptesicus (Cnephaeus) serotinus</i> (Schreber, 1774)	0	1	0	1	0.1
<i>Nyctalus noctula</i> (Schreber, 1774)	0	0	2	2	0.3
<i>Clethrionomys glareolus</i> (Schreber, 1780)	38	13	85	136	18.5
<i>Arvicola amphibius</i> (Linnaeus, 1758)	2	3	4	9	1.2
<i>Microtus subterraneus</i> (de Selys-Longchamps, 1836)	0	1	1	2	0.3
<i>Microtus arvalis</i> (Pallas, 1779)	7	5	26	38	5.2
<i>Microtus agrestis</i> (Linnaeus, 1761)	19	9	21	49	6.7
<i>Microtus (Alexandromys) oeconomus</i> (Pallas, 1766)	3	0	2	5	0.7
<i>Microtus</i> spp.	2	0	0	2	0.3
<i>Mus musculus</i> Linnaeus, 1758	1	0	0	1	0.1
<i>Rattus norvegicus</i> (Berkenhout, 1769)	1	0	0	1	0.1
<i>Apodemus agrarius</i> (Pallas, 1771)	3	0	4	7	1.0
<i>Apodemus sylvaticus</i> (Linnaeus, 1758)	0	0	2	2	0.3
<i>Apodemus flavicollis</i> (Melchior, 1834)	52	27	73	152	20.7
<i>Apodemus</i> spp.	65	14	138	217	29.6
<i>Micromys minutus</i> (Pallas, 1771)	3	2	4	9	1.2
<i>Glis glis</i> (Linnaeus, 1766)	0	1	0	1	0.1
<i>Sicista betulina</i> (Pallas, 1779)	1	2	1	4	0.5
Total	229	92	413	734	100.0

DISCUSSION

In the analysed sample of mammalian prey of *S. aluco*, 22 species were recorded. This is a high number, indicating considerable richness of the local small mammal community. In Poland, a greater number of mammal species (23–28) has been reported in the diet of the owl in the Białowieża Forest and the Biebrza National Park (Gryz et al. 2012, Lesiński & Błachowski 2023), but those data were not derived from single sites, as is the case for the Zdroje locality. The owls' hunting ranges in the Drawski Landscape Park include a mosaic of habitats, which explains the presence in the material of species typical of forests (*C. glareolus*, *A. flavicollis*, *G. glis*), open areas: the common vole *Microtus arvalis* (Pallas, 1779) and the striped field mouse *Apodemus agrarius* (Pallas, 1771), as well as

synanthropic environments (*M. musculus*, *R. norvegicus*). The last two species are not abundant due to scarce human settlements. A low share of *A. agrarius* in the diet of owls in the study area draws attention, but it is relatively rare in this part of Western Pomerania (Ruprecht 1983b, Lesiński et al. 2024). Moreover, in the Zdroje locality a typical agricultural area with a mosaic of arable fields does not occur.

The results provide well-documented data on small mammals, including common and widespread species in Poland. The present study confirms that *S. aluco* exhibits a wide food niche and hunts across various habitat types, although most frequently in forests. Despite the diet diversity resulting from the habitat mosaic in the area, the primary prey of this owl outside urban areas most often includes *C. glareolus* and *A. flavicollis*. Similar results were obtained for the Drawski Landscape Park and have also been reported from several other regions of Poland where the species' diet has been studied (Wiącek et al. 2009, Gryz et al. 2012, Lesiński & Błachowski 2023, Stolarz et al. 2024).

Undoubtedly, the most valuable finding is the discovery of a new locality of *S. betulina*, situated more than 200 km west of the previously known continuous range of the species. This is a boreal mammal which range covers north-east Europe and middle northern Asia (Meinig et al. 2017). In Poland it occurs mainly in the mountains of the south and in the eastern half of the country. Its presence in Pomerania had not been documented before. The nearest sites within the continuous range where the species has been recorded are located near Elbląg, in the Warmia and Masuria region (Pucek 1983b). The lack of intensive research on small mammals in Pomerania makes it difficult to assess the status of the newly discovered *S. betulina* locality, but it appears likely that it represents an isolated, insular occurrence separated from the main range. A single locality of this species has also been detected in Wielkopolska, ca. 190 km south from Zdroje (Tryjanowski 1989). Further west, it has been reported from isolated sites in Denmark (Meinig et al. 2017, Andersen et al. 2022). It cannot be excluded that the newly discovered Pomeranian locality is a similar relict of an earlier, wider range.

Among the other valuable species recorded at the Zdroje site, the bat *V. murinus* should be mentioned. This species is rarely recorded in north-western Poland (Ruprecht 1983a, Ciechanowski & Wikar 2022, Wojtaszyn et al. 2023). However, *G. glis* is a rodent with a number of localities in this part of Poland, some of which originate from reintroduction projects (Jurczyszyn 1995, 1996, 2001, 2011). No reintroduction projects have been conducted in the northern part of the Drawski Landscape Park, and mention of the existence of a poorly studied locality of this mammal in the Połczyn-Zdrój Forest District was included in the work of Jurczyszyn & Dzieciółowski (2013). Therefore, the Zdroje locality most likely represents a naturally preserved population. Since the owls caught only a single individual of *G. glis*, it may be assumed that the population of this rodent occupied the periphery of the owls' hunting territory, which was not frequently visited during foraging. It is also possible that the species is scarce within the study area.

Species of moles and shrews (e.g. the European mole *Talpa europaea* Linnaeus, 1758, the water shrew *Neomys fodiens* (Pennant, 1771), the pygmy shrew *Sorex minutus* Linnaeus, 1766, *S. araneus*) as well as most small rodents, e.g. *C. glareolus*, *M. arvalis*, *M. musculus*, *A. agrarius*, *A. sylvaticus*, *A. flavicollis*, the harvest mouse *Micromys minutus* (Pallas, 1771) belong to common and relatively abundant on almost all territory of Poland (Pucek & Raczynski 1983). The frequent occurrence of *M. agrestis* at the Zdroje site is noteworthy. This is typical of north-western Poland, where this species appears regularly and in relatively high numbers in owl dietary samples (Lesiński et al. 2024). At least two additional Eulipotyphla species may potentially be detected at the site in the future: *N. milleri*, which is known from numerous localities in this part of Poland (Pucek & Pucek 1983), and *C. suaveolens*, for which several records exist in the vicinity of the study area (Cichocki et al. 2014).

Furthermore, many more bat species are likely to occur there than those detected in the diet of *S. aluco* (15–16 species may be present in NW Poland – Sachanowicz et al. 2006). These mammals are captured by owls only very rarely, typically accounting for well below 1% of vertebrate prey (Kowalski & Lesiński 2002).

Presented material increased the number of small mammal species recorded in the Drawski Landscape Park and north-west part of Poland. The most valuable is a presence of *S. betulina*, but the status of its population (isolated) should be confirmed by further studies conducted in other areas of the Western Pomerania.

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STRESZCZENIE

Nowe stanowisko smużki leśnej *Sicista betulina* (Pallas, 1779) i innych drobnych ssaków wykryte w pokarmie puszczyka *Strix aluco* Linnaeus, 1758 w Drawskim Parku Krajobrazowym (Pomorze Zachodnie, Polska)

Na jednym stanowisku w miejscowości Zdroje koło Polczyna-Zdroju na Pomorzu Zachodnim w latach 2006 i 2025 zebrano wypluwki puszczyka *Strix aluco*. Teren badań odznaczał się mozaiką środowisk, z udziałem jezior, lasów (głównie buczyn), torfowisk i łąk (Ryc. 1–3). Analiza tego materiału wykazała 957 kręgowców jako ofiar sów, wśród których były 734 drobne ssaki. Stwierdzono 22 gatunki ssaków należących do: Eulipotyphla (4), Chiroptera (4) i Rodentia (14) (Tab. 1). Świadczy to o dużym bogactwie zgrupowań tych zwierząt na objętym badaniem stanowisku. Najczęstszymi ofiarami sów były kolejno myszarka leśna *Apodemus flavicollis*, nornica ruda *Clethrionomys glareolus*, ryjówka aksamitna *Sorex araneus* i nornik bury *Microtus agrestis* (razem ok. 55% złowionych ssaków). Wśród ofiar stwierdzono także smużkę leśną *Sicista betulina*. Jest to nowe stanowisko tego gatunku, najprawdopodobniej wyspowe, reliktowe, znajdujące się ponad 200 km na zachód od dotychczas poznanej granicy zwartego zasięgu. Wykazano też obecność mroczaka posrebrzanego *Vespertilio murinus*, nietoperza, który w tej części Polski notowany jest dość rzadko. Popielica szara *Glis glis* na Pomorzu Zachodnim znana jest z szeregu miejsc (częściowo w wyniku podjętej w ostatnich dekadach reintrodukcji). Nowo odkryte

stanowisko tego gatunku potwierdza obecność w północnej części Drawskiego Parku Krajobrazowego jego izolowanej populacji, która prawdopodobnie przetrwała tu w naturalny sposób.

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