

Late Holocene bird fauna from Duża Sowa Cave (South Poland)

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Abstract. 2658 bird bone remains identified, belonging to at least 70 species are described. They represent various habitats such as forest, open landscape, water-and-marsh and rocks. The most interesting species: *Falco naumanni*, *Tringa* cf. *glareola*, *Lymnocyrtus minimus*, *Chlidonias nigra*, *Coracias garrulus*, *Acrocephalus palustris* and *Monticola* cf. *saxatilis*. The fauna is dated back to the Middle Ages.

Key words: subfossil birds, Late Holocene, Poland.

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I. INTRODUCTION

A very rich Late Holocene fauna from Duża Sowa Cave was found in 1969 and explored in 1972 and 1979. The locality was described in a preliminary note (BOCHEŃSKI et al. 1983), which contains also full data about molluscs and bats, as well as fragmentary data about other groups of land vertebrates including birds.

Duża Sowa Cave (= Big Owl Cave) is a rock-shelter about 7 m long, situated in one of the limestone rocks on the left slope of the Kobylany Valley, ca 15 km NW of Kraków (50°9'N; 19°47'E). The bottom of the rock-shelter was covered by a several-dozen-cm-thick layer of loose limestone gravel mixed with humus and bone fragments. The sediments were homogeneous and no stratification could be distinguished. Analogous sediments were also found on a small rock shelf below the entrance to the rock-shelter. The whole material from the inside and a majority from the shelf were examined.

The bone material from Duża Sowa Cave was previously dated back to the Late Holocene, being deposited between the Atlanticum and the Middle Ages (BOCHEŃSKI et al. 1983). A few fragments of medieval pottery and iron tools were found in the upper part of the sediments. The animal remains originated, at least in their greater part, from owl pellets, most probably those of the Eagle Owl.

II. MATERIAL

4192 bird bones and their fragments were found in the material under study. We did not identify toe phalanges (634), claws (258) and vertebrae (258) - the other unidentified remains were very fragmentary, badly preserved (e.g. only shafts without epiphyses and so on). Out of the total of 2658 remains determined, a huge majority were identified to specific level. They belonged to at least 70 species and at least 284 individuals. The results are presented in Table I.

Table I.

List of identified bird remains from Duża Sowa Cave. Numbers of fragments and minimal numbers of individuals (MNI) are given.

Bird species	No of remains	MNI	Remarks
(1)	(2)	(3)	(4)
<i>Anser</i> cf. <i>anser</i> (LINNAEUS, 1758)	1	1	juv.
<i>Anas chrypeata</i> LINNAEUS, 1758	3	1	
<i>Anas platyrhynchos</i> LINNAEUS, 1758	48	6	
<i>Anas querquedula</i> LINNAEUS, 1758	33	4	
<i>Anatinae</i> indet.	1	1	juv., another than listed above
<i>Accipiter gentilis</i> (LINNAEUS, 1758)	2	1	
<i>Accipiter nisus</i> (LINNAEUS, 1758)	3	1	
<i>Buteo buteo</i> (LINNAEUS, 1758)	3	1	
<i>Falco columbarius</i> LINNAEUS, 1758	5	2	
<i>Falco naumanni</i> FLEISCHER, 1818	9	3	1 juv.
<i>Falco subbuteo</i> LINNAEUS, 1758	20	2	
<i>Falco tinnunculus</i> LINNAEUS, 1758	54	4	
<i>Falco</i> cf. <i>vespertinus</i> LINNAEUS, 1766	8	3	
<i>Bonasa bonasia</i> (LINNAEUS, 1758)	5	1	
<i>Perdix perdix</i> (LINNAEUS, 1758)	228	12	
<i>Coturnix coturnix</i> (LINNAEUS, 1758)	319	22	
<i>Gallus gallus (domesticus)</i> LINNAEUS, 1758	130	7	
<i>Galliformes</i> indet.	16	—	
<i>Rallus aquaticus</i> LINNAEUS, 1758	8	3	
<i>Crex crex</i> (LINNAEUS, 1758)	19	3	
<i>Porzana porzana</i> (LINNAEUS, 1766)	2	1	
<i>Gallinula chloropus</i> (LINNAEUS, 1758)	11	2	
<i>Fulica atra</i> LINNAEUS, 1758	11	2	
<i>Vanellus vanellus</i> (LINNAEUS, 1758)	72	7	
<i>Pluvialis apricaria</i> (LINNAEUS, 1758)	2	1	
<i>Pluvialis squatarola</i> (LINNAEUS, 1758)	14	2	
<i>Charadrius</i> cf. <i>hiaticula</i> LINNAEUS, 1758	1	1	juv.
<i>Numenius arquata</i> (LINNAEUS, 1758)	1	1	
<i>Tringa</i> cf. <i>glareola</i> LINNAEUS, 1758	1	1	
<i>Scolopax rusticola</i> LINNAEUS, 1758	151	8	
<i>Gallinago gallinago</i> (LINNAEUS, 1758)	31	3	

Table I ctd

(1)	(2)	(3)	(4)
<i>Lymnocyrtus minimus</i> (BRUNNICH, 1764)	10	2	
<i>Limicolae</i> indet.	13	—	
<i>Larus ridibundus</i> LINNAEUS, 1766	2	1	
<i>Chlidonias nigra</i> (LINNAEUS, 1758)	4	2	
<i>Sterna hirundo</i> LINNAEUS, 1758	5	1	
<i>Columba oenas</i> LINNAEUS, 1758	30	6	
<i>Columba oenas</i> / <i>livia</i>	77	10	5-6 juv.
<i>Columba palumbus</i> LINNAEUS, 1758	8	2	1 juv.
<i>Streptopelia turtur</i> (LINNAEUS, 1758)	6	2	
<i>Tyto alba</i> (SCOPOLI, 1769)	45	4	
<i>Athene noctua</i> (SCOPOLI, 1769)	29	2	
<i>Aegolius funereus</i> (LINNAEUS, 1758)	16	2	
<i>Athene noctua</i> / <i>Aegolius funereus</i>	2	—	
<i>Strix aluco</i> LINNAEUS, 1758	67	4	
<i>Asio flammeus</i> (PONTOPPIDAN, 1763)	26	4	
<i>Asio otus</i> (LINNAEUS, 1758)	73	6	
<i>Asio flammeus</i> / <i>otus</i>	2	—	
<i>Apus apus</i> (LINNAEUS, 1758)	2	1	
<i>Coracias garrulus</i> LINNAEUS, 1758	3	1	
<i>Dryocopus martius</i> (LINNAEUS, 1758)	4	3	
<i>Picus viridis</i> LINNAEUS, 1758	6	2	
<i>Lullula arborea</i> (LINNAEUS, 1758)	21	10	
<i>Alauda arvensis</i> LINNAEUS, 1758	136	15	
<i>Hirundo rustica</i> LINNAEUS, 1758	1	1	
<i>Anthus trivialis</i> (LINNAEUS, 1758)	4	3	
cf. <i>Anthus</i> sp. (<i>pratensis</i> ?)	2	1	
<i>Lanius</i> cf. <i>collurio</i> LINNAEUS, 1758	2	1	
<i>Erithacus rubecula</i> (LINNAEUS, 1758)	3	1	
cf. <i>Phoenicurus ochruros</i> (GMELIN, 1774)	1	1	
<i>Turdus merula</i> LINNAEUS, 1758	18	3	
<i>Turdus philomelos</i> BREHM, 1831	3	1	
<i>Turdus pilaris</i> LINNAEUS, 1758	2	1	
<i>Turdus viscivorus</i> LINNAEUS, 1758	1	1	
<i>Turdus</i> sp. (middle size)	1	—	
<i>Monticola</i> cf. <i>saxatilis</i> (LINNAEUS, 1766)	1	1	
<i>Acrocephalus palustris</i> (BECHSTEIN, 1798)	1	1	
<i>Sylvia communis</i> LATHAM, 1787	1	1	
<i>Emberiza citrinella</i> LINNAEUS, 1758	3	2	
<i>Acanthis cannabina</i> (LINNAEUS, 1758)	3	2	
cf. <i>Fringillidae</i> indet.	1	1	
<i>Garrulus glandarius</i> (LINNAEUS, 1758)	9	2	
<i>Corvus corax</i> LINNAEUS, 1758	5	2	
<i>Corvus corone</i> LINNAEUS, 1758	386	26	
<i>Corvus frugilegus</i> LINNAEUS, 1758	180	15	among them juv.
<i>Corvus corone</i> / <i>frugilegus</i>	123	9	among them juv.
<i>Corvus monedula</i> LINNAEUS, 1758	95	8	
<i>Corvidae</i> indet.	2	—	
<i>Passeriformes</i> indet.	11	—	

The Table needs however some explanations and comments:

In the above-mentioned preliminary note (BOCHEŃSKI et al. 1983) 23 bird species were listed. 22 of them are presented in Table I. - the 23rd one is "*Lagopus lagopus*". Two tarsometatarsi, determined previously on the basis of their total length as belonging to the Willow Grouse were re-examined. The width of their proximal articular parts, the shape of trochleas for the 3rd toe and lack of their protrusion to the front, point in both cases to *Perdix perdix*.

"*Anatinae* indet." - this bone belonged to a young bird and its size points to another species than those listed in Table I (smaller than the Mallard and larger than the Garganey and the Shoveler).

16 remains determined as "*Galliformes* indet." are very fragmentary and not characteristic (e.g. parts of shafts); their general sizes indicate that 11 of them belonged to birds resembling the Partridge (possibly also the Hazel Hen), whereas the remaining 5 to the domestic hen.

It is very hard to distinguish the bones of *Columba livia* (*domestica*) and *C. oenas* from each other on the basis of morphology and their sizes overlap (FICK 1974). The recognition of not fully ossified bones of young birds is impossible, and this is why the category "*Columba oenas/livia*" is represented most numerous among pigeons.

7 of 13 fragments of indetermined *Limicolae* represent the furculum which is hard to determine - the sizes of all remnants are typical of such birds as the Woodcock and some smaller ones. It is therefore really possible that they belonged to some of the birds listed in Table I, and so they do not lead to an increase in their minimal numbers of individuals.

A lot of measurements of *Athene noctua* and *Aegolius funereus* as well as of *Asio otus* and *A. flammeus* overlap and not all fragments are morphologically characteristic. So, for 4 remnants it was necessary to use the categories "*Asio flammeus/otus*" and "*Athene/Aegolius*". These remnants may have belonged to the birds listed in Table I and to the same individuals.

The fragment of tibiotarsus of "*Turdus* sp." belonged to a middle-sized thrush (*merula?*, *philomelos?*, both listed in Table I).

The Crow and the Rook are another pair of European species, the bone fragments of which are hardly distinguishable, especially if they are not fully ossified (TOMEK in prep.). So, it was necessary to put them in the category "*Corvus corone/frugilegus*". The specification of fragments indicates that at least part of them belonged to additional individuals of both the species listed in Table I. And this is why we take their minimal number of individuals (9) in general calculation.

"*Fringillidae* sp." - the size of fragment is similar e.g. to that in *Carduelis chloris*, so to the species larger than that given in Table I.

III. GENERAL COMMENTS

The birds identified in Duża Sowa Cave represent a mosaic of habitats. For the great part of species listed in Table I the statement of breeding habitats (nest sites) and feeding grounds is simple. Some birds however nest in various places: i.e. the Kestrel, Little Owl, Swift and Jackdaw build their nests in holes both in trees and in rocks (and also occasionally in buildings), the Swallow and House Redstart have recently been breeding most commonly in human buildings but also in rocks; to-day the majority of known Middle European breeding sites of the Barn Owl are also in buildings though their natural sites are in trees and rocks. The Quail has been traditionally connected with steppes (and cultivated fields) but it can be dominant also in marshes and wet meadows (i.e. in the Biebrza Marshes - DYRCZ et al. 1972). Birds not identified to the level of species could not always be classified from the ecological point of view. All the above-mentioned facts cause that the following environmental divisions are not well-defined and the numbers (percentages) given are only approximate.

The bird species nesting in forests or at least in groups of trees in an open landscape prevail (more than 44%) as well as in respect of MNI (about 50%). Many of these species are however represented by single individuals - the above-mentioned large number of individuals is strictly connected with the numbers of Crows and Rooks (forming together more than 19% of MNI). It should be emphasized that both these birds breed in trees but their feeding grounds are in open areas (dry or wet). Open areas are also feeding grounds of all pigeons and doves (7% of MNI), a majority of birds of prey and at least a part of owls. Such species as the Hazel Hen and the Black Woodpecker are associated with rather large areas of mixed woods; smaller wooded areas are suitable for other species.

About 20 species (28%) represented by at least 40 individuals (14%) are typical of various water habitats. The most numerous as a group are ducks (4.4% of MNI) and among them the Mallard. The presence of a young goose (most probably the Grey Lag) indicates large areas of shallow and overgrown waters needed for nesting of this species. Large reedbeds are also characteristic of the Water Rail. Wet meadows and marshes are typical biotopes of e.g. Corncrake, Spotted Crake, Great Curlew, Snipe and Short-eared Owl, whereas more or less sandy or stony banks or islets are the best breeding sites of the Common Tern and the Ringed Plover. All the other water birds nest in the above-mentioned habitats or in mixed habitats composed of them.

The Partridge is typical of steppes and, in recent Middle Europe, of meadows and cultivated fields. This is true of the Quail and the Skylark (however the last two species can be also met with on wet meadows and marshes).

Limestone rocks, the presence of which has not changed in the valley in these thousands of years, were surely inhabited by a few species. They consist, above of all, of the Kestrel, the Swift and the Jackdaw. All these birds breed also in other sites but often use for nesting the crevices and holes in rocks (BOCHEŃSKI, OLEŚ 1977). The rock-shelter was presumably also the nest site of the Eagle Owl *Bubo bubo* (LINNAEUS, 1758); the pellets of this owl deposited here for many years were most probably the main source of bone remains analysed in the present paper.

All the above-mentioned types of habitats were present within the radius of the owl's penetration, which in the case of the Eagle Owl reaches 5 km in the breeding season and 7 km in winter (MÄRZ 1940). This is connected with the relief of the surroundings of Duża Sowa Cave (Fig. 1). Their southern part includes a part of the Rudawa River Valley, which in the older part of the Subboreal period was swampy (ALEXANDROWICZ & RUTKOWSKI 1988, RUTKOWSKI 1984) with water bodies providing biotopes for water snails (ALEXANDROWICZ 1984). This state lasted at least till the forties of the 19th century (MARCZYKIEWICZ 1847) and in the Middle Ages the marshes situated along the Rudawa reached as far as the city of Kraków (TOBIASZ 1958, 1977). The spectrum of water bird species presented here suggests also the presence of large reedbeds. The northern slopes of the valley as well as the plateau of the Ojcow Upland were presumably covered by forests to a various degree (deforestation connected with human activity took place mainly after the Middle Ages).

The great majority of species listed in Table I belong to the recent breeding fauna of South Poland. There are also several species not breeding in that part of the country now, but according to the 19th century data (TOMIAŁOJC 1990) they bred there in the past. So, the probability of breeding of such birds as *Falco vespertinus*, *F. naumanni*, *Lymnocyptes minimus*, *Tringa glareola*, *Numenius arquata*, *Asio flammeus* and *Monticola saxatilis* in the surroundings of Duża Sowa Cave in the Late Holocene is very high.

The find of not fully ossified bones of *Corvus frugilegus* indicates that the Rooks bred in the vicinity of the cave. They did not breed near Kraków in the first half of the 19th century (PIETRUSKI 1840, WODZICKI 1850) and started to breed in the 2nd half (SCHAUER 1878). On the other hand, they have been breeding in Silesia since much earlier times (TOMIAŁOJC 1990 after KALUZA 1814 and after GLOGER 1833). So, it is possible that there were waves of colonisation of South Poland by the Rooks in the Late Holocene. A similar situation may have occurred in the case of the Fieldfare.

There are a few species which, most probably, did not breed in the vicinity of Krakow, when bone materials were deposited in Duża Sowa Cave. That is above all true of *Pluvialis squatarola*. The Grey Plover has been known by now from the Upper Vistulian Pleniglacial (period of the last greatest transgression of the ice-sheet), when the habitat was more convenient for breeding of that Arctic bird than in later periods and in the Late Holocene (BOCHEŃSKI 1989). So, it may be supposed that we are concerned here with remains of migrating or wintering birds; their flocks could be recently met with also throughout Poland (TOMIAŁOJC 1990). This is also true of the remains of *Pluvialis apricaria* and *Falco columbarius*, though their recent breeding areas are situated not so far from South Poland as they are in the case of the previous species.

67 of the 70 birds found in Duża Sowa Cave were identified to specific level. Most of them are known from various Polish localities, but 15 have been found for the first time in that cave. The following species seem to be the most interesting: *Tringa* cf. *glareola*, according to BRODKORB (1967) known only from Binagady, and *Lymnocyptes minimus*, *Chlidonias nigra*, *Coracias garrulus* and *Acrocephalus palustris* mentioned by BRODKORB (1967, 1971, 1978) from two localities each. The other 4 species: *Anas clypeata*, *Hirundo rustica*, *Anthus trivialis* and *Phoenicurus ochruros* have been listed by now from



Fig. 1. Location of Duża Sowa Cave against the background of the relief of its surroundings. a - Duża Sowa Cave, b - other localities of fossil birds containing Holocene remains (M - Mamutowa Cave, N - Nietoperzowa C., Ż - Żytnia Skąła), c - rivers and streams, d - contour-lines, e - settlements. The circle indicates five-kilometre range of the Eagle Owl penetration.

early stages of the Polish Holocene only and not from the later ones (BOCHEŃSKI 1989) - they breed now in suitable places of South Poland, so the finding of their remains in Duża Sowa Cave confirms only their continuous inhabiting that territory.

It was mentioned at the beginning that the fauna was previously dated back to the Late Holocene: between the Atlanticum and the Middle Ages. The lack of *Lagopus lagopus* (see comments to Table I) and, on the other hand, the presence of *Rattus norvegicus* (see BOCHEŃSKI et al. 1983), known from Central Europe not earlier than in the 9th to 10th century (HEINRICH 1976) may suggest the limitation of the deposition of bone remains to the Middle Ages.

The significance of the bird fauna from Duża Sowa Cave has several aspects. First of all, it is the richest bird fauna of the Late Holocene, so far described in Poland from a number of bone fragments and also a number of species point of view. About 20 species were not known earlier from Polish Late Holocene materials. And so this fauna distinctly adds to our knowledge of the development of bird fauna. As the great majority of the Late Holocene localities (mainly those from the Middle Ages) contain human artefacts, their species spectrum is different from that of remains obtained from owls' pellets (BOCHEŃSKI 1983). Such materials come from a few localities only, and then only those from the upper layers of Nad Mosurem Starym Duża Cave in Ojców National Park (NADACHOWSKI et al. 1989) are comparatively numerous (51 bird species in whole material). The Holocene bird remains from a few localities lying in the vicinity of Duża Sowa Cave are not so numerous (BOCHEŃSKI 1974, 1981) and besides a few fragments from Żytnia Skała they are dated to the Early Holocene (Boreal - Atlanticum). A distributional analysis of species identified from Duża Sowa Cave gives indirect evidence of bird migrations. It concerns the Grey Plover and a few other species. That phenomenon seems to be little known for past periods.

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