# Fossil birds in the National Museum of Natural History, Sofia: composition, development and scientific value

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Keywords: avian collections; fossil birds; Neogene-Quaternary birds; Balkan fossil record; Bulgaria; paleornithology.
A review of the fossil and subfossil avian record kept in Bulgaria is presented. The only collection of fossil birds in Bulgaria was established in the 1980s. 99.6% originates from 98 localities throughout Bulgaria. Foreign fossils originate from Azerbaijan, Greece, Hungary, Namibia and New Zealand. Bulgarian avian fossil and subfossil records in collections outside the country are found in museums in France, Germany, Poland and the United Kingdom. In August 2003 the collection numbered 13,848 bones, two casts and one eggshell representing 349 taxa. Taxonomic composition includes: 22 fossil species, one fossil subspecies, one subfossil species, one subfossil subspecies and at least 160 recent species. This collection became the largest avian palaeontological collection of the Balkan during the last 15 years.

## Introduction

Although several papers on the history and scientific value of the avian collections of the National Museum of Natural History (NMNHS) of the Bulgarian Academy of Sciences (BAS) in Sofia have been published during the last decade (Boev, 1991; 1993; 2003a; 2003b), the collections of fossil birds remained beyond special attention. They have not been mentioned in the first three papers, while Boev (2003b) only listed 17 species based on Bulgarian fossils. Some data on the NMNHS's collections of avian fossil and subfossil materials are summarized in Boev (1996a – a list of preliminary identified Tertiary avian discoveries until 1995), Boev (1997 – a review of the literature on the subfossil avian record until 1980) and Boev (2002 – a list of Neogene taxa, established in Bulgaria until May 2000). The present review aims to outline their acquisition and the scientific value for avian palaeontology.

## Historical review

In comparison to other avian collections in the NMNHS, the collection of palaeontology has a short history. It was not in existence until the middle of the 1980s when all bird collections were without a curator. The Bulgarian archaeologist Prof. Rafail Popov collected some avian fossils from Palaeolithic, Eneolithic and Neolithic sites during his numerous excavations between 1904 and 1933 (Boev, 1997), especially in N Bulgaria. In his papers, Popov mentioned his records but his identifications were incomplete and not very precise. After his death in 1940, a part of his collection was deposited in the Archaeological Institute and Museum of the BAS in Sofia. Other parts went to the NMNHS. In 1980, we examined Popov's samples and only 14 bones

of *Pyrrhocorax graculus* (Linnaeus, 1766) from the Morovitsa Cave were identified. They represent a small portion of the ornitho-archaeological material collected by Prof. R. Popov, which later became lost.

In the 1970s, the Bulgarian geologist Dr Ivan Nikolov from the NMNHS, received three very valuable avian samples from the Late Miocene from two coalmines (Hrabarsko and Troyanovo) and an object from the Middle Miocene from drilling operations near Kardam village (Boev, 2002). The first two samples have been examined by Georgian paleontologist Prof. Dr Nikolay Burchak-Abramovich and Dr Nikolov (Burchak-Abramovich & Nikolov, 1984), while the last sample has been studied by Boev (2002). The samples are kept in the NMNHS. In the 1960s, Dr Nikolov received, for the NMNHS, an almost complete but heavily damaged skeleton of a gull, which was included in a coal slab, from the coalmines near the village of Hrabarsko. This specimen has recently been identified as Larinae gen. indet. (Boev, 2000).

## Bulgarian fossil and subfossil records of birds in foreign collections

Several foreign ornithologists collected and examined avian fossils and subfossils from Bulgarian archaeological sites. The Polish palaeornithologist Prof. Dr Zygmunt Bochenski (Institute of Systematic & Evolution of Animals, PAS, Krakow: ISEAK) studied avian remains of the Late Palaeolithic layers of the Bacho Kiro Cave (Bochenski, 1982). Other Polish specialists from the Department of Anatomy of the Agricultural Academy in Wroclaw and Adam Mickiewicz University in Poznan respectively, examined bird remains from the Roman town "Novae" (now Swishtov) on the Danube river coast (Waluszewska-Bubien & Krupska, 1983; Makowiecki & Schramm, 1995). These collections were deposited in their institutions in Poland. The same happened with the Eneolithic and Early Bronze Age avian record from Koprivets and Durankulak (Manhart, 1998). These objects entered the collections of the Faculty of Biology of the Ludwig-Maximilians University in Munich, Germany.

A set of eight long bones of limbs of *Chauvireria balcanica* Boev, 1997, have been sent to the Earth Sciences Center of the Claude Bernard University in Lyon, France, in 1996. Three other sets of casts of holotypes described in Bulgaria have been donated to the National Museum of Natural History (Smithsonian Institution) in Washington in 1990, the ISEAK in Krakow in 1998, and the Natural History Museum in Tring in 1999.

## Foreign avian fossil and subfossil record in the NMNHS

Very few specimens have been obtained through exchange or gifts from abroad: (1) an incomplete Late Pleistocene (Late Wurmian) skeleton composed of 50 bones of several specimens of *Aegypius monachus* Linnaeus, 1766, from Binagada (near Baku City); (2) an intact tarsometatarsus of Dinornithidae gen. indet. (Holocene) from an unknown locality in New Zealand; (3) a piece of eggshell of Struthioniformes gen. indet. (Lower Miocene) from Namibia (Mourer-Chauviré et al., 1996); (4) a cast of a Late Pliocene humerus of *Tetrao conjugens* Janossy, 1974, from Csarnota, loc. 2, Hungary (Janossy, 1976); and (5) a cast of a Ruscinian tibiotarsus of *Pavo bravardi* (Gervais, 1849) from Megalo Emvolon (near Thessaloniki) (Boev & Koufos, 2000).

## Time-scale representation

The collection of fossil and subfossil birds of the NMNHS covers a time-range from the Lower Miocene (MN 2-4[1], ca. 20 mya; Mourer-Chauviré et al., 1996) to the subrecent time (Late Holocene, Late Medieval Age, 17th century; Boev, 1996b). See table 1.

Until present, the Bulgarian avian record is known from 12 Tertiary sites, five Miocene sites (one Middle Miocene and four Late Miocene), and seven Pliocene sites (four Early Pliocene and three Late Pliocene) (Boev, 2002). The Quaternary sites are much more numerous: 86 sites. The Pleistocene records originate from 18 sites (four Early Pleistocene, one Middle Pleistocene and 13 Late Pleistocene) (Boev, 2001). The Holocene record is established in 68 sites (one Ancient Holocene, five Early Holocene, 20 Middle Holocene and 42 Late Holocene) (Boev, 1999).

Table 1. Geochronological distribution of the avian fossil and subfossil records in the collections of the NMNHS (after Boev, 1999; 2002; unpubl.).

| Period | Epoch | Number of objects | Percentage |
|---|---|---|---|
| | Middle Miocene | 12 | 0.09 |
| | Late Miocene | 47 | 0.34 |
| Neogene | Early Pliocene | 24 | 0.17 |
| | Late Pliocene | 1973 | 14.24 |
| | **Subtotal** | **2056** | **14.84** |
| | Early Pleistocene | 74 | 0.53 |
| | Middle Pleistocene | 36 | 0.26 |
| | Late Pleistocene | 5820 | 42.02 |
| Quaternary | Ancient Holocene | 4 | 0.03 |
| | Early Holocene | 612 | 4.42 |
| | Middle Holocene | 688 | 4.97 |
| | Late Holocene | 4561 | 32.93 |
| | **Subtotal** | **11,795** | **85.16** |
| | **Total** | **13,851** | **100.00** |

## Taxa representation

The composition of the Neogene avian record of Bulgaria comprises of 96 taxa representing 24 families of 12 different orders (Boev, 2002). The Quaternary record is published in more details only for the Pleistocene (Early to Late) and includes 160 recent species (Boev, 2001). The subfossil record covers 125 taxa (of at least 101 species) representing 16 orders (Boev, 1996b; 1999).

A considerable sample of recently collected subfossil avian material entered the museum in 2002. Over 2000 bones from four localities, which were dated Late Wurmian to the Middle Age and originating from former feeding places of the Eagle Owl (*Bubo bubo* (L.) from NE Bulgaria, are still under examination. The preliminary data of the dipl. biol. Ivan Mitev lists at least 95 avian taxa. Our research, assisted by Vera Hristova, in the Middle Villafranchian site near the town of Varshets (NW Bulgaria), revealed over 200 avian fossils, dated ca. 2,3 mya. These new finds are still under study.

[1] MN: Mammalian Neogene zone, after Mein (1990).

The types of the following 17 taxa, described by materials collected in Bulgaria, are kept in the NMNHS: *Phalacrocorax serdicensis* Burchak-Abr. & Nikolov, 1982; *Cygnus verae* Boev, 2000; *Anser thraceiensis* Burchak-Abr. & Nikolov, 1982; *Balcanas pliocaenica* Boev, 1998; *Geronticus balcanicus* Boev, 1998; *Buteo spassovi* Boev, 1998; *Falco bakalovi* Boev, 1998; *Tetrao rhodopensis* Boev, 1998; *Lagopus balcanicus* Boev, 1995; *Chauvireria balcanica* Boev, 1997; *Gallinula balcanica* Boev, 1999; *Fulica atra pontica* Boev & Karaivanova, 1998; *Actitis balcanica* Boev, 1998; *Regulus bulgaricus* Boev, 1999; *Loxia patevi* Boev, 1999; *Coccothraustes simeonovi* Boev, 1998; and *Coccothraustes balcanicus* Boev, 1998.

As mentioned above, at least 160 recent species have been identified from Bulgarian Pleistocene deposits. Six species have disappeared from the recent avifauna of Bulgaria: *Lagopus mutus* (Montin, 1776), *Lagopus lagopus* (Linnaeus, 1758), *Tetrao tetrix* Linnaeus, 1758, *Phasianus c. colchicus* Linnaeus, 1758, *Nyctea scandiaca* (Linnaeus, 1758) and *Pyrrhocorax pyrrhocorax* (Linnaeus, 1758). Another species, *Perdix palaeoperdix* Mourer-Chauviré, 1975, found in three sites, is fossil (Boev, 2001). Their remains are kept at the NMNHS.

Part of the palaeontological material collected in Bulgaria has been referred to by foreign authors: *Perdix paleoperdix* Mourer-Chauviré, 1975; *Pavo bravardi* (Gervais, 1849); *Tetrao partium* (Kretzoi, 1962); *Otis khosatzkii* Bochenski & Kurochkin, 1987; *Apus baranensis* Janossy, 1977; *Pyrrhocorax graculus vetus* Kretzoi, 1962, and *Corvus praecorax* (Deperet, 1892). It is kept at the NMNHS.

Table 2 shows that the NMNHS holds a total of 349 fossil or subfossil taxa. Its 13,851 objects constitute 46% of the avian collection of the museum (Boev, 2003b).

## Geographical representation

The fossil and subfossil collection of the NMNHS covers Europe (Bulgaria, Greece and Hungary), Asia (Azerbaijan), Africa (Namibia) and Oceania (New Zealand). The Bulgarian fossil and subfossil records originate from 98 localities, 21 being local avifauna which provide more complete data on the palaeo-environment and 77 localities of separate avian finds, practically found all over the country. Most of the Pleistocene sites are concentrated within the Pre-Balkan Karst Area, N Bulgaria, chiefly in the NW Balkan Range. The remaining Holocene sites are scattered throughout the country, especially in lowland areas, where the prehistoric and ancient settlements were mainly spread.

## Trace analysis on the bird bones

Some fossils are of special interest because of traces which give additional information about the cause of death or usage of the bones. These traces can be of mechanical or of thermic origin, or simple bite marks of rodents or carnivores. Exceptionally, bones were used as tools, religious objects or as ornament.

*Cut marks*

Cut marks are most frequently found on bones originating from human settlements of the Early Bronze Age to the Middle Age. Most often, these cut marks are found on bones of species which were hunted or on bones of domestic birds. For example, one ulna and two radii of *Pelecanus onocrotalus* Linnaeus, 1758, from the Early Bronze Age

were cut and used as burners. Only 12 of the 2327 bones (0.51%) from the Roman town Nucopolis-ad-Istrum bear cut marks (Boev, 1999). Some were used as ornaments. A ring was made of the middle part of the diaphysis of a humerus of *Anser* sp. from Early-Iron Age of Bagachina. Distal endings of the tibiotarsi of *Perdix perdix* (Linnaeus, 1758), from the Palaeolithic cave Temnata Doupka were used for the elaboration of strings for necklaces. Bones from preys of Eagle Owls *Bubo bubo* (Linnaeus, 1758), from most Pleistocene sites bear traces of claws marks. These marks are located mainly on the epiphyses of ossa longa tubulosa, tabula sterni and synsacrum.

*Gnawing and grazing marks*

These traces are the most frequently found marks on avian fossil and subfossil bones. Gnawing leaves clear traces on the bone surface, while grazing leaves finer superficial channels that do not break the bone entirely. They were caused by mustelids, domestic cats and dogs. Bird bones with gnawing and grazing marks in Nicopolis-ad-Istrum are rare, only representing 0.47% of the collection (Boev, 1999) and represent *Gallus gallus* (Linnaeus, 1758) (f. *domestica*), *Tetrao urogallus* Linnaeus, 1758, and *Anser anser* (Linnaeus, 1758). Bones from the Paleolithic to the Middle Ages show similar traces. A tibiotarsus of *Aquila clanga* Pallas, 1811 from Karnobat (6-11 century A.D.) and an ulna of *Tachybaptus ruficollis ruficollis* (Pallas, 1764) from Rousse (Late Holocene, undated) also show strong grazing marks.

*Burning traces*

The percentage of bones which show burn marks varies between 2.9% (Roman epoch) and 20.0% (Early-Bronze Age). The bones of *Gallus g. domestica, Tetrao tetrix* Linnaeus, 1758, and *Otis tarda* Linnaeus, 1758, most frequently show burning traces. Because of the increased fragility and fragmentarity of bones which have been exposed to fire, they are rare in archaeornithological samples.

Table 2. Taxa composition of the NMNHS collection of fossil and subfossil birds (subfamilies are given only for Muscicapidae and Emberizidae). Taxonomy of recent birds follows Cramp (1985, 1988, 1992), Cramp & Perrins (1993, 1994a, 1994b) and Cramp & Simmons (1977, 1980, 1983).

| N | Taxa | Number of specimens |
|---|---|---|
| | Dinornithiformes | |
| | Dinornithidae | |
| 1. | Dinornithidae gen. indet. | 1 |
| | Struthioniformes | |
| | Struthionidae | |
| 2. | Struthionidae gen. | 1 |
| | Gaviiformes | |
| | Gaviidae | |
| 3. | *Gavia arctica* | 1 |
| | Podicipediformes | |
| | Podicipedidae | |
| 4. | *Tachybaptus ruficollis* | 1 |
| 5. | *Podiceps grisegena* | 2 |
| 6. | *Podiceps cristatus* | 4 |
| 7. | *Podiceps nigricollis* | 1 |
| | Pelecaniformes | |
| | Pelecanidae | |
| 8. | *Pelecanus onocrotalus* | 2 |
| 9. | *Pelecanus onocrotalus/crispus* | 1 |
| | Phalacrocoracidae | |
| 10. | *Phalacrocorax carbo* | 2 |
| 11. | *Phalacrocorax serdicensis* | 15 |
| | Ciconiiformes | |
| | Ardeidae | |
| 12. | *Ixobrychus minutus* | 3 |
| 13. | *Nycticorax nycticorax* | 1 |
| 14. | *Ardea purpurea* | 1 |
| 15. | *Ardea cinerea* | 1 |
| 16. | *Ardea cinerea/Egretta alba* | 1 |
| | Ciconiidae | |
| 17. | *Ciconia ciconia* | 2 |
| 18. | *Ciconia ciconia/nigra* | 1 |

19. *Ciconia* sp. 1
Threskiornithidae
20. *Geronticus balcanicus* 2
21. Threskiornitidae gen. 1
Anseriformes
Anatidae
22. *Cygnus olor* 8
23. *Cygnus cygnus* 1
24. *Cygnus verae* 1
25. *Cygnus/Anser* 1
26. *Anser fabalis* 4
27. *Anser albifrons* 6
28. *Anser albifrons/fabalis* 2
29. *Anser erythropus* 3
30. *Anser anser* 109
31. *Anser anser domestica* 83
32. *Anser* sp. 21
33. *Anser thraceiensis* 17
34. *Branta ruficollis* 2
35. Anserini gen. 5
36. *Tadorna ferruginea* 1
37. *Tadorna tadorna* 5
38. *Anas penelope* 18
39. *Anas strepera* 7
40. *Anas crecca* 81
41. *Anas crecca/querquedula* 10
42. *Anas platyrhynchos* 123
43. *Anas platyrhynchos domestica* 4
44. *Anas acuta* 3
45. *Anas querquedula* 102
46. *Anas clypeata* 1
47. *Anas* sp. 10
48. *Balcanas pliocaenica* 1
49. *Netta rufina* 6
50. *Aythya ferina* 24
51. *Aythya nyroca* 14
52. *Aythya fuligula* 18
53. *Aythya* sp. – 1 12
54. *Aythya* sp. – 2 1
55. Aythyni gen. 4
56. *Melanitta nigra* 1
57. *Bucephala clangula* 1
58. *Bucephala clangula / Melanitta nigra* 1
59. Anatinae gen. – 1 170
60. Anatinae gen. – 2 1
61. Anatini gen. – 1 9
62. Anatini gen. – 2 1
63. *Oxyura leucocephala* 2
Falconiformes
Accipitridae
64. *Pernis apivorus* 1
65. *Haliaeetus albicilla* 2
66. *Gypaetus barbatus* 4
67. *Gyps fulvus* 3
68. *Gyps* sp. 4
69. *Gyps fulvus/Aegypius monachus* 1
70. *Aegypius monachus* 51
71. *Aegypius* sp. 2
72. Gypaetinae gen. 2
73. *Circaetus gallicus* 3
74. *Circaetus* sp. 4
75. *Circus aeruginosus* 1
76. *Circus cyaneus* 2
77. *Accipiter gentilis* 17
78. *Accipiter* ex gr. *gentilis* 1
79. *Accipiter nisus* 10
80. Accipiter sp. 4
81. *Buteo spassovi* 1
82. *Buteo buteo* 6
83. *Buteo/Pernis* 1
84. *Buteo lagopus* 5
85. *Buteo lagopus/buteo* 1
86. *Buteo* sp. – 1 2
87. *Buteo* sp. – 2 1
88. Buteonini gen. 1
89. *Aquila pomarina* 4
90. *Aquila clanga* 2
91. *Aquila heliaca* 1
92. *Aquila chrysaetus* 5
93. *Aquila* sp. ex *clanga* 7
94. *Aquila nipalensis/clanga* 1
95. *Hieraaetus fasciatus* 7
96. *Hieraaetus* sp. 3
97. Aquilinae gen. – 1 1
98. Aquilinae gen. – 2 1
99. Accipitridae gen. 32
Falconidae
100. *Falco bakalovi* 1
101. *Falco tinnunculus* 79
102. *Falco* sp. ex gr. *tinnunculus* – 1 25
103. *Falco* sp. ex gr. *tinnunculus* – 2 11
104. *Falco vespertinus* 10
105. *Falco subbuteo* 3
106. *Falco cherrug* 1
107. *Falco* sp. ex gr. *cherrug* – 1 1
108. *Falco* sp. ex gr. *cherrug* – 2 6
109. *Falco* sp. *cherrug* 3
110. *Falco peregrinus* 1
111. *Falco* sp. 21
112. Falconidae gen. 6
113. Falconiformes fam. 3
Galliformes
Phasianidae
114. *Meleagris gallopavo* 1
115. *Meleagris gallopavo domestica* 1
116. *Lagopus balcanicus* 57

117. *Lagopus lagopus* 36
118. *Lagopus mutus/ lagopus* 6
119. *Lagopus* sp. 1
120. *Lagopus / Bonasa* 1
121. *Bonasa bonasia* 19
122. *Tetrao/Lagopus* 19
123. *Tetrao partium* 20
124. *Tetrao rhodopensis* 1
125. *Tetrao tetrix* 313
126. *Tetrao tetrix/urogallus* 2
127. *Tetrao urogallus* 30
128. *Tetrao* sp. – 1 1
129. *Tetrao* sp. – 2 13
130. Tetraoninae gen. 10
131. Tetraoninae/Phasianinae 12
132. *Alectoris graeca* 8
133. *Alectoris* sp. 4
134. *Alectoris/Perdix* 8
135. *Perdix perdix* 287
136. *Perdix perdix/palaeoperdix* 14
137. *Perdix palaeoperdix* 209
138. *Perdix* sp. 28
139. *Perdix/Coturnix* 2
140. *Coturnix coturnix* 206
141. *Chauvireria balcanica* 1160
142. *Chauvireria* sp. 56
143. Perdicinae gen. 2
144. *Gallus gallus domestica* 2844
145. *Gallus/Phasianus* 71
146. *Phasianus colchicus* 79
147. *Phasianus* sp. 1
148. *Pavo bravardi* 4
149. *Pavo cristatus* 1
150. Phasianidae gen. 25

Gruiformes

Gruidae

151. *Grus grus* 4

Rallidae

152. *Rallus aquaticus* 31
153. *Crex crex* 54
154. *Porzana parva* 1
155. *Porzana pusilla* 3
156. *Porzana porzana* 5
157. *Porzana porzana/pusilla* 1
158. *Porzana* sp. 1
159. *Gallinula balcanica* 1
160. *Gallinula chloropus* 26
161. cf. *Gallinula* sp. 1
162. *Fulica atra* 165
163. Rallidae gen. 4

Otididae

164. *Tetrax tetrax* 14
165. *Otis khosatzskii* 5
166. *Otis tarda* 14
167. *Otis/Tetrax* 1
168. Otididae gen. 1

Charadriiformes

Recurvirostridae

169. *Himantopus himantopus* 1
170. *Recurvirostra avosetta* 4

Charadriidae

171. *Vanellus vanellus* 7
172. *Pluvialis squatarola* 1
173. *Charadrius* sp. 1
174. Charadrii fam. 5
175. Charadriidae gen. 21

Scolopacidae

176. *Limosa limosa* 4
177. *Numenius phaeopus/ tenuirostris* 5
178. *Tringa totanus* 10
179. *Tringa stagnatilis* 4
180. *Tringa nebularia* 5
181. *Tringa ochropus* 1
182. *Tringa glareola* 3
183. *Tringa* sp. 5
184. *Actitis balcanica* 1
185. *Actitis hypoleucos* 1
186. Tringinae gen. 1
187. *Scolopax rusticola* 1
188. *Gallinago media* 2
189. *Gallinago gallinago* 1
190. *Philomachus pugnax* 5
191. Scolopacidae gen. 8

Laridae

192. *Larus canus* 4
193. *Larus ridibundus* 3
194. *Larus* sp. 7
195. *Larus/Sterna* 4
196. Larinae gen. 1
197. *Chlidonias* sp. 1
198. *Gelochelidon nilotica* 1
199. *Sterna hirundo* 6
200. *Sterna* sp. 5

Columbiformes

Pteroclididae

201. aff. Pteroclididae gen. 1

Columbidae

202. *Columba livia* (incl. *domestica*) 103
203. *Columba oenas* 8
204. *Columba livia/oenas* 2
205. *Columba palumbus* 12
206. *Columba* sp. – 1 1
207. *Columba* sp. – 2 5
208. *Streptopelia turtur* 24
209. *Streptopelia decaocto* 5
210. *Streptopelia* sp. – 1 2

211. *Streptopelia* sp. – 2 1
212. Columbiformes fam. 2
Cuculiformes
Cuculidae
213. *Cuculus canorus* 1
Strigiformes
Strigidae
214. *Otus scops* 4
215. *Bubo bubo* 3
216. *Nyctea scandiaca* 2
217. *Surnia ulula* 1
218. *Glaucidium passerinum* 1
219. *Athene noctua* 34
220. *Athene/Aegolius* 1
221. *Strix aluco* 37
222. *Strix* aff. *nebulosa* 1
223. *Asio otus* 21
224. *Asio otus/flammeus* 20
225. *Asio flammeus* 63
226. *Aegolius funereus* 6
227. *Aegolius* sp. 2
228. *Aegolius / Athene* 1
229. Strigiformes fam. 1
Caprimulgiformes
Caprimulgidae
230. *Caprimulgus europaeus* 2
Apodiformes
Apodidae
231. *Apus baranensis* 9
232. *Apus melba* 104
233. *Apus apus* 14
Coraciiformes
Meropidae
234. *Merops apiaster* 1
Coraciidae
235. *Coracias garrulus* 1
Piciformes
Picidae
236. *Picoides minor* 4
237. *Picoides major* 2
238. *Dryocopus martius* 1
239. Non-Passeriformes indet. 1
Passeriformes
Alaudidae
240. *Melanocorypha* sp. – 1 2
241. *Melanocorypha* sp. – 2 2
242. *Galerida* sp. – 1 1
243. *Galerida* sp. – 2 3
244. *Galerida* sp. – 3 2
245. *Lullula arborea* 9
246. *Lullula* sp. 5
247. *Alauda arvensis* 14
248. *Alauda* sp. 4
249. *Eremophila alpestris* **4**
250. Alaudidae gen. – 1 1
251. Alaudidae gen. – 2 8
Hirundinidae
252. *Delichon urbica* 5
253. *Hirundo daurica* 14
254. *Hirundo rustica* 5
255. *Riparia riparia* 2
256. *Ptyonoprogne rupestris* 2
257. *Ptyonoprogne rupestris/Riparia riparia* 14
Motacillidae
258. *Anthus* sp. – 1 2
259. *Anthus* sp. – 2 3
260. *Anthus trivialis* 7
261. *Motacilla flava* 1
262. *Motacilla* sp. 1
Laniidae
263. *Lanius collurio* 9
Bombycillidae
264. *Bombycilla garrulus* 2
Cinclidae
265. *Cinclus cinclus* 1
Prunellidae
266. *Prunella modularis* 1
Muscicapidae
Turdinae
267. *Erithacus megarhynchos* 1
268. *Erithacus rubecula* 4
269. *Erithacus* sp. 2
270. *Oenanthe oenanthe* 2
271. *Monticola saxatilis* 4
272. *Turdus torquatus* 1
273. *Turdus merula* 31
274. *Turdus* sp. ex gr. *merula* 2
275. *Turdus pilaris* 1
276. *Turdus iliacus* 4
277. *Turdus philomelos* 16
278. *Turdus* sp. ex gr. *philomelos* 3
279. *Turdus viscivorus* 6
280. *Turdus* sp. – 1 5
281. *Turdus* sp. – 2 2
282. Turdinae gen. 2
Sylvinae
283. *Cettia cetti* 1
284. *Sylvia atricapilla* 1
285. *Sylvia communis* 1
286. *Sylvia* sp. 1
287. *Phylloscopus sibilatrix* 1
288. *Regulus bulgaricus* 1
289. Sylviinae gen. 1
Muscicapinae
290. *Ficedula albicollis* 1
291. Muscicapinae gen. 3

| | |
|---|---|
| Paridae | |
| 292. *Parus major* | 3 |
| 293. *Parus* ex gr. *major* | 2 |
| 294. *Parus* sp. – 1 | 1 |
| 295. *Parus* sp. – 2 | 2 |
| 296. *Parus* sp. – 3 | 2 |
| Sittidae | |
| 297. *Sitta europaea* | 2 |
| 298. Sitta sp. | 1 |
| Emberizidae | |
| Emberizinae | |
| 299. *Emberiza* sp. – 1 | 5 |
| 300. *Emberiza* sp. – 2 | 1 |
| Fringillidae | |
| 301. *Fringilla coelebs* | 8 |
| 302. *Fringilla montifringilla* | 1 |
| 303. *Fringilla* sp. | 11 |
| 304. *Carduelis carduelis* | 1 |
| 305. *Carduelis chloris* | 1 |
| 306. *Carduelis* sp. – 1 | 1 |
| 307. *Carduelis* sp. – 2 | 12 |
| 308. *Acanthis cannabina* | 6 |
| 309. *Loxia curvirostra* | 9 |
| 310. *Loxia patevi* | 5 |
| 311. *Pyrrhula pyrrhula* | 9 |
| 312. *Pyrrhula* sp. | 3 |
| 313. Carduelinae gen. | 5 |
| 314. *Coccothraustes balcanicus* | 1 |
| 315. *Coccothraustes coccothraustes* | 4 |
| 316. *Coccothraustes simeonovi* | 6 |
| 317. Fringillidae gen. | 9 |
| Ploceidae | |
| 318. *Passer domesticus* | 4 |
| 319. *Passer montanus* | 1 |
| 320. *Passer* sp. | 1 |
| 321. *Passer/Fringilla* | 1 |
| 322. *Petronia petronia* | 1 |
| Sturnidae | |
| 323. *Sturnus roseus* | 1 |
| 324. *Sturnus* sp. | 3 |
| 325. *Sturnus vulgaris* | 11 |
| 326. Sturnidae gen. | 1 |
| Oriolidae | |
| 327. *Oriolus oriolus* | 1 |
| Corvidae | |
| 328. *Garrulus glandarius* | 43 |
| 329. *Pica pica* | 65 |
| 330. *Pica* sp. | 7 |
| 331. *Nucifraga caryocatactes* | 7 |
| 332. *Nucifraga* sp. | 1 |
| 333. *Pyrrhocorax graculus* | 717 |
| 334. *Pyrrhocorax graculus/pyrrhocorax* | 1 |
| 335. *Pyrrhocorax graculus/Corvus monedula* | 4 |
| 336. *Pyrrhocorax pyrrhocorax* | 19 |
| 337. *Pyrrhocorax* sp. – 1 | 5 |
| 338. *Pyrrhocorax* sp. – 2 | 3 |
| 339. *Corvus corax* | 40 |
| 340. *Corvus corone* | 46 |
| 341. *Corvus frugilegus* | 39 |
| 342. *Corvus frugilegus/corone* | 23 |
| 343. *Corvus monedula* | 360 |
| 344. *Corvus monedula / Pyrrhocorax graculus* | 32 |
| 345. *Corvus* cf. *praecorax* | 1 |
| 346. *Corvus* sp. – 1 | 9 |
| 347. *Corvus* sp. – 2 | 7 |
| 348. Corvidae gen. | 477 |
| 349. Passeres fam. | 367 |
| Aves indet. | **3400** |
| Total | **13851** |

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