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135 Years of Ornithology in Bulgaria: The Role of the National Museum of Natural History at the Bulgarian Academy of Sciences in the Development of Ornithology in Bulgaria – Representatives, Collections and Achievements

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135 Years of Ornithology in Bulgaria: The Role of the National Museum of Natural History at the Bulgarian Academy of Sciences in the Development of Ornithology in Bulgaria - Representatives, Collections and Achievements

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Abstract: For the first time, an attempt has been made to present in a systematized form chronologically the development of ornithological studies at the National Museum of Natural History in Sofia (Bulgaria) from its foundation in the last decades of the 19th century to the present day. This 135-year period (1889-2024) includes the work of 12 curators of the ornithological collections. Their major contributions and most-significant ornithological publications are also presented.

Keywords: history of ornithology; ornithological collections; natural sciences; birds studies; science in bulgaria; natural history museums

Introduction

Ornithology is the oldest and most developed zoological discipline in Bulgaria. A recent publication [1] provides a comprehensive overview of the main achievements and most prominent researchers in bird studies in Bulgaria over the past 277 years. So far, scientists in the country have worked in a total of 46 areas/aspects of bird research. Georgi Hristovich (1863-1926) was the first Bulgarian ornithologist, who published the first scientific research on Bulgarian birds in a Bulgarian scientific edition in Bulgarian language [1]. He is followed by Pavel Patev, Nikolay Boev, Stefan Donchev, Simeon Dimitrov and many others, most of them part of the staff of the National Museum of Natural History in Sofia (NMNHS-BAS). Bulgarian ornithology has data on 739 species of birds (421 recent and 318 established on the basis of their fossil/subfossil remains). Avian faunistics is the oldest and most developed field of ornithological research. The countries of the Balkan Peninsula are the most studied foreign territories by Bulgarian ornithologists. Antarctica is the most remote region where Bulgarian scientists have conducted ornithological research. They have contributed to the study of birds in 68 countries and territories around the world. A total of 40 new taxa of birds have been described from Bulgaria - 1 modern (*Streptopelia decaocto*) and 39 fossils (Miocene - early Holocene) - a valuable contribution to world bird science. The oldest and largest collection of birds is kept in the NMNHS-BAS. This institution for the past 135 years has always been and is currently the most influential research center in the field of ornithology in Bulgaria. Here we present for the first time all the twelve curators of bird collections (of stuffed skins, total mounted dry preparations, fluid preserved specimens, eggs, nests, skeleton/bone, fossil and subfossil) of the NMNHS-BAS, as well as their major and most significant scientific contributions in ornithology.

1. Tsar Ferdinand I (Ferdinand Maximilian Karl Leopold Maria von Sachsen-Coburg und Gotha) (1861-1948). Curation period of the Ornithological Collections: 1889-1892. (Figure 1).

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Figure 1. Tsar Ferdinand I. ca. 1890s. Photograph: https://www.standartnews.com/balgariya-.obshtestvo/zaradi-nezavisimostta-ferdinand-se-krie-v-toaletna-437276.html

The idea of establishing a national natural history museum originated even before the Liberation of Bulgaria by the Ottoman Empire (1878). The first natural specimens of the National Bulgarian Museum in Brăila date from 1870. They were brought from Romania to Sofia by Prof. Marin Drinov (1838-1906), whose initiative it was. According to the advisor and Minister of Education at the time, Dr. Konstantin Ireček (1854-1918), in addition to archaeological and industrial, the National Museum should also have a natural science department [2].

After the arrival of Prince Ferdinand of Saxe-Coburg in 1887 as King Ferdinand I - state head of the Bulgarian government, the idea of creating a natural history museum was successfully realized. His in-depth knowledge of natural science, acquired during his youth at the Viennese Academy "Theresianum", also gave rise to his lasting interest in living nature and especially in exotic birds. The fact that in 1862 he accompanied the famous Alfred Brehm (1829-1884) on his trip through Africa also speaks of Ferdinand I's interests and appearances in various fields of natural science. With them was the animal artist Robert Kretschmar (1818-1872), who illustrated the legendary encyclopedic edition ("Tierleben") of A. Brehm. Some of his originals are still kept in the museum. As soon as he arrived in Bulgaria, King Ferdinand I set out to get to know the nature of the country. The solid education he received as a youth, as well as his numerous travels, turned him into a passionate nature lover. On August 2, 1889, the official celebration of the 2nd anniversary of the "ascension" of His Royal Majesty Ferdinand I to the Bulgarian throne was organized in the Palace in Sofia. The king's personal collection of birds and insects was displayed at the afternoon cocktail party. Among the first collections of birds shown were preparations of South American species of hummingbirds, and the entomological collection featured the beautiful tropical butterflies of South America. The exhibition was arranged in two halls of the court building in Sofia. This was the first organized exhibition of natural objects - stuffed birds, mammals, insects and minerals from Bulgaria. In addition to the princely family, the opening was attended by government officials and distinguished Bulgarian nature lovers. The French diplomat, ornithologist and naturalist Count Amedée Alléon (1838-1904), after meeting King Ferdinand I, proposed to him to establish a natural history museum in Bulgaria based on the exhibits collected until then [2]. His collection of stuffed birds was of extremely high scientific and artistic value. A. Aléon, on his own initiative, collected birds and nests near the Black Sea in 1881-1885 and sent them to Paris for processing. This remarkable collection already served in its time to create his work on taxidermy [3]. In this book, some preparations from the ornithological collection of today's NMNHS-BAS are even photographed, which also have great historical value. Such are, for example, the preparations of Eurasian griffon vultures (*Gyps fulvus*), collected in Varna in 1884, Greater spotted eagle (*Clanga clanga*), collected in 1869 in Belgrade, etc. [2]. As the French ambassador to the Ottoman Empire, Amédée Alléon was among the most influential and high-

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ranking Western Europeans in Constantinople. He was a hunter, nature lover, collector, preparer and a talented animalist-miniaturist artist [4]. Most of the A. Alléon bird preparations in NMNHS-BAS are of diurnal birds of prey (eagles, vultures, buzzards, kestrels, falcons and hawks) and waterfowl (ducks, geese), grebes, grebes, gulls, plovers, cranes, etc.). He collected them mostly in the vicinity of Constantinople - Chekmeje, Makrikoy, San Stefano, Buyukdere, Demirji, but also near Varna, Constanța, Skoutari. There are also specimens shot from Alléon in other parts of the Ottoman Empire (in Albania) and far beyond its borders (Finland) (Boev, 2019). Throughout this initial period, the ornithological collections were completed, identified and arranged under the direct direction of King Ferdinand I. His ornithological interests have taken him more than once to interesting observational exotic places around the world. For example, in Europe he visited the island of Heligolland (Germany), where at his time the largest ornithological station for observing the flight of birds was located in Europe [5]. He was one of the first zoologists in (Eastern) Europe who realized the important role of zoos in the conservation of rare animal species. On his personal initiative, bearded vultures (*Gypaetus barbatus*) - the rarest bird species in Bulgaria and the Balkans - were successfully bred in his zoo in Sofia. Thus, the Sofia Zoo became the first in the world where bearded vultures successfully bred. In a cage measuring 7 x 8 x 9 meters a pair of these birds from 1916 to 1929 produced eleven chicks (Figure 2; [6]).

Figure 2. Bearded vulrures (*Gypaetus barbatus*) bred in the Royal Zoological Garden of Tsar Ferdinand I in Sofia (between 1894 and 1913). Unpubl. photograph.

For about 50 years, it remained the only one in this respect until the 1970s, when it began to breed in Switzerland as well [7]. His knowledge of zoology and botany has amazed even prominent world experts. "The field in which he works with the greatest pleasure is ornithology. Privy Councilor Prof. Ludwig Heck (1860-1951) called him in one of his articles "the best living connoisseur of exotic birds" [8].

2. Paul Leverkühn (Paul Georg Heinrich Martin Reinhold Leverkühn) (1867-1905). Curation period of the Ornithological Collections: 1892-1901. (Figure 3).

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Figure 3. Paul Leverkühn. After 1895. Photograph: https://en.wikipedia.org/wiki/Paul_Leverk%C3%BChn

During the first years, the collections grew rapidly with the acquisition of new incomes from abroad. This increased the care of arranging, documenting and storing them. Therefore, the first director, the German ornithologist - Dr. Paul Leverkühn, was appointed to the museum. Not only the ornithological, but also all other collections were under his expert guidance. P. Leverkühn was a corresponding member of the French Zoological Society. In 1893, Tsar Ferdinand I entrusted P. Leverkühn with the management of his zoo in Sofia (the first on the Balkan Peninsula). Later, he took the position of "Director of the Library and Scientific Institutes" that had been opened especially for him. In 1894, Leverkühn sealed the correspondence with a stamp that read: "Director der Wissenschaftlichen Institute und Bibliotek Seiner Koniglichen Hochheit der Furstenvon Bulgarien". Even before his arrival in Bulgaria, Leverkün had a good personal collection of stuffed animals, which he brought to Sofia. Birds among them predominated. The museum's natural collection was also enriched with some rare and valuable preparations donated by Ferdinand's mother, Princess Clementine [2]. The museum also received the collection of Emil Werner, a friend of P. Lewerkuhn. According to the catalog of the collections from that time [9], the collection of Emil Werner in the museum contains 695 birds. The majority of specimens had been collected by Werner himself mostly in Germany, some in Austria and few also in the countries of the Balkan Peninsula. Some additional birds from elsewhere were obtained for Werner's collection by exchange. Meanwhile, however, a quarter of them seem to be lost. This valuable historical collection was built up in the last ten years (1884-1894) of E. Werner's life [10]. It contains specimens of 27 families and almost half of them belong to the Passeriformes [11]. E. Werner published only one ornithological publication [12]. It is about the occurrence of Pallas' Sandgrouses (*Syrrhaptes paradoxus* Pall.) in the vicinity of Kiel in 1888. Some of the observed birds were shot ant three of these specimens are still kept in the NMNHS-BAS. With great enthusiasm and competence, Dr. Leverkühn arranged the existing ornithological collections, as well as those collected from different parts of Bulgaria and the Balkan Peninsula. To the ornithological collection formed in this way was added the collection of beautiful preparations of birds and bird's nests and beetles of A. Alléon, bought in 1891. The oldest preparations in this collection were collected back in the 1970s and 1980s [2]. Dr. Leverkühn fulfilled his duties perfectly as curator of the museum's collections until his last day, when he died untimely in 1905.

3. Knut Christian Andersen (1867-1818). Curation period of the Ornithological Collections: 1901-1904 (Figure 4).

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Figure 4. Knud Andersen. 03.07.1902. Photograph: After Nankinov (2002).

In 1901 he started working as an assistant to the director of the Natural History Museum in Sofia, doctor Paul Leverkühn, a later as a curator at the same museum. During that time, several large collections were already gathered in the Palace of Prince Ferdinand I: (1) of birds shot in various areas of the country; (2) magnificent ornithological collection of the French Count Amedé Alléon living in Constantinople (pr. Istanbul); (3) the collection of African birds and mammals of the Czech traveler Dr. Emil Holub and (4) collection of Indian birds of Stuart Baker, former Secretary of the British Ornithological Society. As known, Mr. Baker collected birds for his collection in 9 years in the last decade of 19th century [13]. The great majority of the stuffed skins originates from Cachar Hills in Assam (NE India). Untill 1904 Knud Andersen was in charge of arranging and cataloging these collections and the collections of mammals [14]. He also contributed a lot to the completion of the collections with preparations chiefly of birds and mammals. At the same time he carried out a unique triennial studies of the night migration of the birds in the region of Sofia [15]. The data from these observations were included half a century later in Patev's monograph [16]. In 1904, he left Bulgaria and traveled to London, where he became an eminent bat specialist at the British Museum (Natural History). bird migrations in Bulgaria. We can consider that K. Andersen is the founder of the study of bird migrations in Bulgaria. In this field, he published the first studies for the country [17,18].

4. Hermann Graetzer (187X- unknown). Curation period of the Ornithological Collections: 1905-1907. After the departure of K. Andersen and the death of P. Leverkün, in 1905 the second court physician Dr. Hermann Graetzer was appointed in place of Dr. Leverkün as head of the museum collections. He directed the museum for 8 years (until 1914). Dr. Gretzer, Dr. Ivan Buresch and the preparator Henrich Julius completed the arrangement of the collections in the halls begun by P. Leverkühn. The process of increasing collections (donations and acquisitions from the country) continues intensively [2]. Dr. H. Graetzer was the author of the foreword to the first catalog of the collections of the Royal Museum of Natural History [9] and it is believed to have been heavily involved in its preparation. Unfortunately, no data about his activities have been preserved in the museum's archives. No other publications of H. Graetzer are known.

5. Henrich Julius (1866 - unknown). Curation period of the Ornithological Collections: 1907 - unknown. In 1898, the first preparator - Henrich Julius - was appointed to the museum. In the following years, many preparations came out of his hands, distinguished by their scientific and artistic value [2]. H. Julius was not only a master preparer, but also a hunter, a nature lover and a

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good connoisseur of the Bulgarian nature. He plays an important role in arranging and curating the collections, especially those of birds and mammals.

6. Tsar Boris III (Boris Klemens Robert Maria Pius Ludwig Stanislaus Xaver) (1894-1943). Curation period of the Ornithological Collections: ca. 1919-1928 (Figure 5).

Figure 5. Tsar Boris I. May 1929. Photograph: Unknown.

Tsar Boris III, like his father, was an excellent connoisseur of the world's birds. In recognition of his ornithological competence, after his name Marquis Masauji Hachisuka (1903-1953) described [19] a genus of family Zosteropidae (*Borisia*, Hachisuka, 1936), now synonymized. It included 4 species (three of g. *Sterrhoptilus* Oberholser, 1918, and one of g. *Dasycrotapha* Tweeddale, 1878): *B. dennistouni* (now *Sterrhoptilus dennistouni* (Ogilvie-Grant, W. R., 1895) - Golden-crowned Babbler), *B. nigrocapitatus* (now *Sterrhoptilus nigrocapitatus* (Steere, 1890) - Black-crowned Babbler), *B. capitalis* (now *Sterrhoptilus capitalis* (Tweeddale, 1877) - Rusty-crowned Babbler), and *B. plateni* (now *Dasycrotapha plateni* (Blasius, 1890) - Mindanao Pygmy Babbler) [20]. Because of his colossal knowledge of zoology (and ornithology in particular), Tsar Boris III was elected a "life" member of the British Ornithological Society, a regular member of the German Ornithological Society (since 1931), an honorary member of the Union of Hungarian Ornithologists (since 1930), and an honorary member of the Bologna Academy of Sciences (since 1930, its only foreign member until then) [21]. As Nowak [22] writes “For a long time, the king not only took care of the ornithological collection of the museum in Sofia, but also personally identified the systematic affiliation of new acquisitions.”

7. Pavel Atanasov Patev (1889-1950). Curation period of the Ornithological Collections: 1928-1948. (Figure 6).

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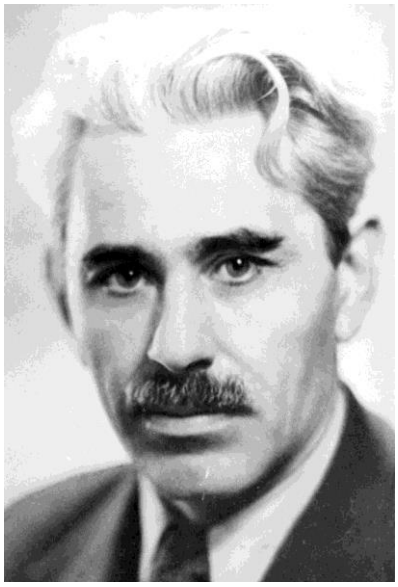

Figure 6. Assist. Prof. Pavel Patev. After 1947. Photograph: Unknown.

At first he studied lower single-celled animals, but his main scientific activity was on the fauna and flight migrations of birds in Bulgaria. Since 1930, he has been curator of the Bulgarian Ornithological Center. Under his leadership from 1928 to 1941, 22,021 birds were ringed at the Bulgarian Ornithological Center [23]. He recruited a large number of bird-ringers and compiled a special guide to facilitate their work [24]. He represented Bulgaria at the 9th International Ornithological Congress in Rouen, France, where he participated with a summary report on the distribution of birds in Bulgaria [25]. He published the first bird fauna of Bulgaria [16]. In addition to the author's personal observations of birds in nature and studies of museum and zoo materials, practically all foreign and our published information on the Bulgarian avifauna is reflected in this monograph. It was made with the competence and skill of a long-time researcher of the avifauna of Bulgaria and on the basis of rich zoological material, numbering over 11,000 bird specimens. P. Patev is rightly considered the founder of modern ornithology in Bulgaria [26]. In 1928, Patev was offered to deal with the huge library of the Natural History Museum. At the time, it numbered around 30,000 volumes of specialized natural history editions and was in fact one of the richest libraries of its kind in South-Eastern Europe. Later, Patev became curator of the ornithological department at the Natural History Museum. Despite his burden with library work, Patev took up with great enthusiasm the classification and study of the ornithological collections and their replenishment with new materials. The birds collected by Patev and his assistants were arranged in a special, scientifically valuable collection of the birds of Bulgaria, which under his editorship after 10 years of collection work reached 9000 specimens [27]. For about 15 years of collecting work practically from all over the country, Patev managed to collect for the ornithological collection of the museum no less than 5,400 specimens of birds, a significant part of which are currently kept in the scientific collection of the National Museum of Natural History at the BAS [26]. In 1930, Patev was assigned the leadership of the Bulgarian Ornithological Center. For 19 years, he has put a lot of effort into its activation. In 12 years under his leadership, almost 30,000 birds were ringed. P. Patev has established and maintained constant contacts with all ornithological centers in Europe. The data collected by him are essential for establishing the flight paths of birds [27] of migratory birds from Bulgaria. With his scientific activity in the field of ornithology, P. Patev gained international authority and popularity. He was elected a corresponding member of several foreign ornithological societies - the Union of American

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Ornithologists, the British Ornithological Society, the Bavarian Ornithological Society and the German Ornithological Society, a corresponding member of the Hungarian Ornithological Center. His reputation as an ornithologist in the Balkans, and indeed far beyond, stands high; his authority was international' [28]. During the period 1929-1950, Patev published a total of 33 scientific and popular scientific works in Bulgarian, German and English on ornithological topics.

8. Nikolay Krumov Boev (1922-1983). Curation period of the Ornithological Collections: 1948-1969. (Figure 7).

Figure 7. Assist. Prof. Nikolay Boev. 1984. Photograph: Unknown.

N. Boev, with short interruptions, was an employee of the museum from 1947 to 1969: 1947-1949 as a laboratory biologist; 1950-1951 as a Junior Research Associate; 1963-1969 against as a Junior Research Associate, and in the period 1963-1965 he was curator of the museum. In the 1950s and early 1960s, he was the only Bulgarian ornithologist. He established 36 species of birds new to the fauna of Bulgaria. Of the 315 bird species reported by [16] for the fauna of Bulgaria, N. Boev identified 36 species (11.4%) as new to the country. In 1941 he published the first publication in Bulgaria about birds that disappeared in historical times. In 1945 he sorts the vertebrate collections (under the guidance of scientists at the museum) after the destruction by the bombing of Sofia in 1944. In 1949 he creates the emblem of the Union for the Protection of Native Nature - the profile image of a bearded vulture, which later became the symbol of Bulgarian nature protection. In 1949 he enriches the Sofia Zoo, which was too depleted of species and specimens after the war. Three new bird species for Bulgarian fauna - *Rissa tridactyla* (Linnaeus, 1758), *Phalaropus lobatus* (Linnaeus, 1758), and *Chroicocephalus genei* (Breme, 1839), have been reported by him too [29]. In 1966 he actively participated in the work of the commission on drafting the text of the Nature Protection Act and the Regulations for its application. His personal field and literature reseach allower him to publish in 1962 the most complete bird fauna in Bulgaria [30] at the time (after that of [16]), containing many data from personal observations and illustrated by him with color and black-and-white line drawings. Several years he worked over an extensive study on the composition and distribution of birds in Thrace [31]. For 16 poorly studied species of birds with border (peripheral) distribution in the country, he reported the most abundant information for Bulgaria up to that time [32]. He also published (co-authored) the first textbook in Bulgaria on the conservation of nature [33]. In 1963 for the first time in Bulgaria, he gave lectures on ornithology (special course) at the Faculty of Biology at

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Sofia University „St. Kliment Ohridski“. In 1963-1965 he udertakes a "gradual modern reorganization" of the exposition of the Museum of Natural Sciences at the BAS with the introduction of a new type of exposition in biogroups and "small model dioramas". Many new localities of some of owl species in Bulgaria of boreal distribution have been published by [34]. In the period 1975-1981 N. Boev actively promoted the idea of publishing a national "Red Book" of endangered animals and plants in Bulgaria and participated in its publication [35] as co-author and co-editor. Since early 1970-s he began to popularize his idea for the establishment in Bulgaria of an Institute of Ecology and Nature Protection, which eventually became part of the BAS, but in a short time and after 2010, this institution (and its successors) lost its legal status independence. For four years (1973-1976) he he gave lectures on "Fundamentals of the Protection of the Natural Environment" for the first time in Bulgaria, at the Faculty of Biology of Sofia University. In 1976-1983 he initiated and prepared the publication of a 3-volume bird fauna in the BAS "Fauna of Bulgaria" series, which was published only in 1990-2011 in 4 volumes [36–39]. Last three years of his activelife (1979-1981) he devoted to organization and construction of he new exposition of the Natural History Museum in the town of Kotel. In 1980-1985 N. Boev popularized his his idea for the creation of a Bulgarian Society for the Protection of Birds, which was realized (1988) three years after his death [40].

9. Stefan Donchev (1931-2010). Curation period of the Ornithological Collections: 1969-1974. (Figure 8).

Figure 8. Assist. Prof. PhD Stefan Donchev. 2000. Photograph: Unknown.

In addition to the ornithological collections in the museum (which from 1947 to 1974 was merged with the Zoological Institute of the BAS), St. Donchev for 6 years (1969-1975) headed the Bulgarian Ornithological Center. In the 1950s, he studied the birds of the Vitosha mountain, which was also the subject of his PhD thesis [41]. St. Donchev is the author of about 100 scientific works and 300 popular scientific articles and 3 books in the field of ornithology [42]. Among his more significant studies are those on the systematics, ecology and biology of corvid birds [43], the bird composition of the Western Stara Planina [44], Central and Eastern Stara Planina [45] and the Rose Valley [46] in Bulgaria. Nine species of birds were reported for the first time for the avifauna of Bulgaria by St. Donchev: *Aquila fasciata* Vieillot, 1822, *Vanellus spinosus* (Linnaeus, 1758), *Hydroprogne caspia* (Pallas, 1770, *Phalaropus fulicarius* (Linnaeus, 1758), *Locustella fluviatilis* (Wolf, 1810), *Acrocephalus agricola* (Jerdon, 1845), *Curruca cantillans* (Pallas, 1764), *Monticola solitarius* (Linnaeus, 1758) and *Lanius nubicus* Lichtenstein, M.H.C., 1823. [47]. Two species of birds (*Circus cyaneus* (Linnaeus, 1766) and *Ichthyaetus relictus* (Lönnberg, 1931) were reported as new to the fauna of Vietnam [48]. He also studied birds in

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Algeria and Tunisia. As head of the Bulgarian Ornithological Center, Donchev also prepares voluntary bird ringers. He also published one of the first bulletins with data on the birds ringed in the country. [50]. In 1972, the museum conducted a complete inventory of the mounted total preparations of birds (performed by the ornithologist Bozhidar Ivanov). Most of the established species of birds, new to the fauna of Bulgaria, in the museum's collections are also presented with the first proof specimens obtained by Stefan Donchev himself.

Commented [M1]: Wrong reference number: [50], prev number is [48] , reference 49 has no citation

10. Krasimir Paskov Kumanski (1939-2006). Curation period of the Ornithological Collections: 1976-1986. (Figure 9).

Figure 9. Assist. Prof. PhD Krasimir Kumanski. 22.03.2006. Photograph: Z. Boev.

After the separation of the NMNHS-BAS from the former Zoological Institute with a Museum at the BAS, the curatorship of the ornithological collections was entrusted to the entomologist K. Kumanski. He was a specialist in caddisflies (Trichoptera) insects and is one of the world's experts on this group. He is the author of 2 volumes on the fauna of caddisflies in Bulgaria [50,51]. As a scientist with extensive zoological competence, he formally maintained these collections, but did not actually conduct research on them. During his time, Zlatozar Boev, who entered the museum in 1980 as a young specialist, began a complete inventory of the mounted total dry preparations of birds in the exhibition halls and depots, as well as the osteological collection of mammals (mainly carnivores, lagomorphs, bovids, etc.) and a conchological collection of freshwater snails. Kr. Kumanski directed most of the inquiries from abroad about the ornithological collections in the museum to Z. Boev.

11. Zlatozar Nikolaev Boev (b. 1955-). Curation period of the Ornithological Collections: 1986-2023. (Figure 10).

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Figure 10. Prof. PhD, DSc. Zlatozar Boev. 16.06.2022. Photograph: Zlatozar Z. Boev.

Z. Boev was the curator of all ornithological collections in the museum from 1986 to 2010. After 2010, he was the curator of the fossil and subfossil bird collections, the osteological and fluid-preserved (alcohol-formalin) bird collections. Z. Boev was the first PhD student in ornithology at the museum and defended the first PhD thesis on ornithological topics at the museum. In the first two years (1980-1981) he carried out the first complete inventory of the exposition fund of the ornithological collections. Next decades he published a number of publications on various parts of the ornithological collections [52–56] Z. Boev created two new collections – (1) osteological and (2) paleo- and archaeo-ornithological. As of 2024, both rank first among Southeast European collections of this type in terms of richness. In 1999 he defended the first DSc thesis in Bulgaria [57] in ornithology (and second by a Bulgarian ornithologist). Z. Boev founded three new ornithological branches in Bulgaria – (1) osteology, (2) exterior morphology and (3) paleo- and archaeo-ornithology. In addition to Bulgaria, he studied fossil birds from Azerbaijan, Greece, New Zealand, Serbia, and Vietnam. He participated in the training and evaluating of scientific personnel in paleornithology in Greece, Russia, Serbia and Ukraine. His basic scientific contributions in ornithology could be grouped as follows: **(1) Paleornithology and 4rchaeornithology:** He raises paleornithology in Bulgaria to the level of the developed countries in Europe and the world in this field. For 43 years he explored bird remains from 130 localities. Bulgaria became one of the well-studied countries in terms of its fossil and subfossil avifauna. Ca. 1% of the world's fossil birds were described by him. Het found over 410 taxa – 318 species, 120 of which are extinct from the late Tertiary and Quaternary in Bulgaria. He discovered and described 41 taxa - 5 genera, 35 species and 1 subspecies of fossil birds new to the science. All of them are widely accepted by the world scientific community. He discovered the first fossil ostriches [58], peacocks, hornbills [59], snowy owls, waldrapps and many more in Bulgaria. He also discovered remains of some exotic fossil birds – *Sruthio karatheodoris* Forsyth Major, 1888, *Pavo bravardi* (Gervais, 1849), *Apus baranensis* Janossy, 1977 [60], ptarmigan, willow grouse, Eurasian black grouse, red-billed alpine chough, etc. For the first time in Europe, he discovered the distribution of a new order of birds - the tropical hornbills (Bucerotiformes Fürbringer, 1888). For the first time in the world, he reports fossil species of *Circaetus* Vieillot, 1816, *Actitis* Illiger, 1811, *Regulus* Cuvier, 1800, *Loxia* Linnaeus, 1758, *Coccothraustes* Brisson, 1760, etc. He reports the oldest finds in Europe of 21 recent genera, among which are the most ancient goshawks, eagles, vultures [61], magpies, many genera of small passerines. In most cases, they are the first information about the fossil record of these

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genera in the world. For Greece, he reports for the first time a number of species and genera unknown in the fossil record of the country. Describes the world's first fossil goose - the Thessalian goose (*Branta thessaliensis* Boev & Koufos, 2006). In Greece, he established (co-authored) the world's westernmost distribution of the Ergilornithidae family - the crane equivalent of the ostriches. Further he develops the hypothesis of the Pliocene origin of the tetraoninae grouse birds in SE Europe. Proves that they originated in Europe (in the Balkan Peninsula) and not in the Nearctic. For the first time in the world, he established the association "*Pavo - Lagopus*" [62]. Formulates the hypothesis that tetraonine tundra/snow grouses originally were steppe (more precisely, savannah) birds that adapted to the cold climate after the end of the Pliocene [63]. He also proves the autochthonous origin of the *Phasianus colchicus colchicus* Linnaeus, 1758 in Bulgaria and rejects the neo-ornithological hypothesis of its anthropogenic migration to the Balkans from Colchis in the Hellenistic era. He proves that at the end of the Tertiary, so-called mixed avifaunas existed in the Balkans, containing representatives of different zoogeographic areas. He also proves that during the Pleistocene (Wurm) and in the avifauna of Bulgaria, almost the entire boreo-montane ("glacial") avifaunistic complex (of over 20 species) was represented. He found that over 1/10 of the bird families of the modern fauna of Bulgaria during the "Pliocene-Holocene" period significantly reduced their species diversity [57]. Based on his studies, already in the 1990s, four Bulgarian localities of fossil avifauna (Varshets, Slivnitsa, Dorkovo and Muselievo) were included in the list of the most significant ("reference sites") paleornithological localities in Europe, and the first two ranked among the most important localities of Plio-Pleistocene avifauna in the entire Palearctic [64,65]. With this, Bulgaria took its leading place among the countries with the richest and most significant paleornithological information on the continent and in the world. He finds the first evidence of the past distribution of some of the rarest and most extinct species of birds from the modern fauna of Bulgaria - eagles, vultures, falcons, owls, cranes, bustards, swans, cormorants, etc**. (2) Morphology and ecology of recent birds:** Z. Boev compiles a complete "Osteological Atlas" and and an identification guide of all elements of the skeleton of the representatives of a family of birds - herons (Ardeidae), from the European avifauna and studies their bone-morphological anomalies [66]. He proves that in 54% of cases the osteological anomalies are of traumatic origin. He established for the first time that female individuals are 4-5 times more vulnerable to bone trauma, which he explained by the decalcification of their bones due to egg laying [67]. In a comparative aspect, he studies the exterior and skeletal morphology of all species of herons in Europe and establishes the adaptation mechanisms in the directions of evolution of the subfamilies and tribes within it. For the first time in the world, for this group, he studied their adaptations in relation to their movement on the ground and obtaining food, and established correspondence of the anatomical structure with the type of habitats and the degree of adaptation to ichthyophagy [68–70]. Morphometric data (109 characters) for European herons significantly complement the characteristics of their morphological adaptations, sexual dimorphism and their individual modification variability and have been used in major national and world reference books for these birds. He establishes and determines the differences in the conservatism of their bone features. The proportions of the skull play an important role in the separation of ecological niches. The increase in the relative weight of the skeleton in connection with the progressive lengthening of the long bones of the lower limbs has an adaptive character. He found a relationship between habitat type and the proportions of the pelvis, long bones and foot skeleton. The morphology of the beak, head and neck is consistent with the narrow dietary specialization and hunting strategies of individual species. In a number of studies he examined nutritional biology of owls, falcons, eagles and vultures from the Bulgarian avifauna, and also (co-authored) in European Turkey and Kazakhstan. Z. Boev explored the nesting biology of rare and endangered species in Bulgaria. For the oystercatcher, for the first time, he establishes an intracontinental extension of the nesting area, reports an unknown new subspecies for the country – *Haematopus ostralegus longipes* Buturlin, S. A., 1910, as well as new nesting sites (the first nesting of the species along the Danube). For the first time, he investigated the distribution and numbers of a species of bird (oystercatcher) from the Bulgarian fauna over a 100-year period and established the terms and parameters of all phases of reproduction. He also made contributions in the field of phenology (nesting, flight, distribution) of birds – *Delichon urbicum, Apus apus,* etc. **(3). Faunistics and**

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zoogeography of recent birds: For the first time, the full composition of the modern avifauna of Bulgaria (419 species, 266 breeding) has been identified. He studied the distribution of several dozens of bird species in Bulgaria and summarizes and makes the first comprehensive zoogeographical analysis of the recent Bulgarian avifauna [71]. He made a first review and evaluation of bird studies over the last 262 years (1744-2006), the composition of the avifauna (96 Neogene, 160 Pleistocene and 399 recent species), its changes in the last 100 years, the importance of the Bulgarian territory for the migration and wintering of birds in Europe, migratory routes, wintering areas and the network of important bird sites, as well as modern ornithographic regionalization of the country [72]. For 20 species of birds, het summarizes the available information on the past and present distribution, numbers, threatening factors for their survival in the country and proposes measures for their protection. Most of them are for already extinct or too rare and endangered species of our fauna. [73] pblished a second "Red List" of birds 32 years after the publication of the first one for the country. It is also a reasoned justification of the categories of their conservation status and an analysis of their zoogeography, habitats, relictness, etc. Z. Boev made a number of palaeozoogeographical contributions - he proved that in the late Neogene, parts of southern Bulgaria were dominated by savannas inhabited by representatives of the Afrotropical and Afrotropical-Indo-Malayan fauna (peacocks, ostriches, hornbills) and confirmed the existence of the Balkan-Iranian palaeozoogeographic province during the late Miocene. Z. Boev was the supervisor of ten PhD students who successfully defended their PhD in ornithology. In addition to his ornithological publications, Z. Boev also published a series of articles on the history of NMNHS-BAS, which always contain a lot of information about the history of ornithology and ornithological collections in Bulgaria. A significant part of his research is also on modern, subfossil and fossil mammals, but these remain beyond the scope of the present review.

12. Petar Stanislavov Shurulinkov (1975-2023). Curation period of the Ornithological Collections: 2010-2023 (Figure 11).

Figure 11. Assist. Prof. PhD Petar Shurulinkov. 18.04.2016. Photograph: Z. Boev.

Initially, P. Shurulinkov worked in the field of blood parasites of birds. After joining NMNHS-BAS in 2010, he qualified as an Associate Professor and took over part of the museum's ornithological collections (of dry preparations of birds and that of bird nests and eggs). He is the author of over 140 scientific publications, mostly in the field of ornithology and bird parasitology, among them 8 books, and 33 articles (chapters) of scientific books, 11 essays on bird species in the second edition of the Red Book of Bulgaria. Among his popular works, the field guide birds of Vitosha Mountain [74] stands out, and among his scientific works - the summary of Biodiversity of the Lower Danube [75]. Petar's

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main scientific contributions are in the field of ornithology, parasitology and nature conservation. In ornithology he worked mainly on the distribution, migration, population dynamics, biology and ecology of birds. In the field of parasitology his achievement are on the blood unicellular parasites of birds; fauna and distribution of hemosporidians in Bulgaria; influence of various factors on the extent of infection of birds with Haemosporidia Danilewsky, 1885; impact of Haemosporidia on wild birds and on migration in migratory species [76]. His contributions in the nature conservation are in the field of protection of birds; conservation legislation, important bird areas for the protection of birds and their habitats. Peter was the supervisor of two PhD students who successfully defended their PhD thesises in 2022 and 2023. One of the last initiatives of Assoc. Prof. P. Shurulinkov was the Ornithological Camp "Durankulak" (NE Bulgaria on the Via Pontica flyway), organized by the NMNHS-BAS. In the last few years, ten or more thousands of birds of about 90-100 species have ringed there. This ranked the camp first on the Balkan Peninsula. P. Shurulinkov established the Dusky warbler (*Phylloscopus fuscatus* (Blyth, 1842)) as a new species for the Bulgarian avifauna at this camp. In his memory, the Ornithological Camp in Durankulak in 2023 was named "Peter Shurulinkov".

Conclusions

The first studies on birds in Bulgaria were carried out by foreigners. The first ornithological publications by Bulgarians appeared in 1890. As a scientific branch of zoology, ornithology arose on the basis of the first ornithological collections in Bulgaria stored in NMNHS-BAS. An extremely favorable circumstance was the fact that two of the state rulers of Bulgaria - the kings Ferdinand I and his son Boris III were professional connoisseurs and lovers of birds. The collections were enriched and arranged under their direct supervision. For the entire 135-year period of their existence (1898-2024), they have been curated by a total of 12 curators (two of whom are the two kings of Bulgaria). The longest was the curatorship of Z. Boev - 37 years (1986-2023). As of 2024, the ornithological collections number: over 19,200 units of fossil and subfossil birds, over 4,000 units in the osteological collection, over 4,300 units of mounted total dry preparations, 11,300 stuffed skins, 44 alcohol-formalin preparations, 150 nests and 420 eggs of birds. Based on materials from Bulgaria, 42 bird taxa new to science have been described so far. Ornithology in the countries of the Balkan Peninsula during the last century was most developed in Bulgaria and especially in NMNHS-BAS.

The ornithologists who worked in this museum were among the most qualified Bulgarian zoologists. Some are also the most famous and notable natural scientists in Bulgaria in general. This is not just about the two Bulgarian kings with their professional ornithological competence. Pavel Patev, Nikolay Boev, Staffan Donchev and most of the other curators are prominent names in Bulgarian science with an excellent reputation as world scientists. We can rightfully claim that such scientists can develop and perform only in such solid scientific institutions as NMNHS-BAS.

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