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**Emil Holub's Collection
in the National Museum**

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Emil Holub's collection of vertebrates in the National Museum in Prague, Czech Republic

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Introduction

Emil Holub (1847–1902), Czech physician and naturalist, spent the years 1872–1879 and 1883–1886 in southern Africa (hereafter 'First Sojourn' and 'Second Sojourn', respectively), from where he has sent or brought back a number of natural history specimens, including various vertebrates. Upon his returns to Europe, Holub donated these specimens to a large number of institutions, including museums, universities, primary and secondary schools, clubs and others (Želízko 1931). No grand lists of his collections ever existed and Holub's collecting efforts and successes thus can be evaluated only on the basis of collections accumulated in larger museums. A significant collection of vertebrates from Holub's expeditions is deposited in the National Museum in Prague. Here we present, for the first time, a list of the latter specimens and discuss Holub's contribution to vertebrateology.

Museum acronyms are as follows: MBL = Museu Bocage, Lisbon, Portugal; MEHH = Muzeum Emila Holuba (Emil Holub's Museum), Holice, Czech Republic; NHMW = Naturhistorisches Museum, Wien, Austria; NMP = Národní muzeum (National Museum), Prague, Czech Republic.

Other abbreviations are as follows: P6V = inventory number; P6p = accession number; P6d = associated number. Numbers started with an uppercase letter are from Exhibition Catalogues created in the 1890s (A – mammals, B – birds, C – reptiles, D – amphibians). Numbers started with a lowercase letter are from an obsolete card file (a – mammals, b – birds).

Holub's collection of vertebrates in the NMP

History of Holub's vertebrate collection in the NMP

First collection of Holub's vertebrates supplied to the NMP in Prague included 208 specimens and was registered in the Accession Catalogue of the Museum in 1881.

After his return from his Second Sojourn, Holub organized two large exhibitions in Vienna (1891) and Prague (1892). Subsequently, he donated to the NMP in February 1894 a collection of 139 specimens, which were registered in the Accession Catalogue of the NMP in 1894.

In addition, the NMP received at least 13 further Holub's specimens during the 20th century via various schools and other institutions which had been once set up with Holub's specimens.

Emil Holub and Antonín Frič

Since many decades it has been taken for proven that Emil Holub aimed to donate all of his collections to the NMP, where they should have been kept apart as the 'African Museum', but that this proposal was declined by Antonín Frič (1832–1913), then director of the Natural History Division of the NMP (e.g. Obenberger 1947, Baum 1955). We found no support for this affair in contemporary literature. It seems that the 'affair' is a rumour, which appeared for the first time around 1940, i.e. a quarter century after both main protagonists passed away, Holub in 1902 and Frič in 1913, and that it became almost generally accepted after Holub's glamorization on the occasion of the centenary of his birth (see Uhl 1948 for a list of relevant papers). It is noteworthy, however, that Holub's contemporaries stressed that he preferred to disperse his collections and that he rejected proposals to sell his collections as a whole (see Želízko 1931, Baum 1955). In summary, we found nothing what would support the idea that Holub planned to create an African Museum in Prague and that Frič has stopped these plans.

Holub's activities in Austria-Hungary after his returns from Africa and his interpersonal relations have not been adequately mapped yet. Similarly, the origins of the rumour on Holub's African museum and his alleged conflict with Frič need to be examined more closely.

Sources of Holub's specimens

It has been generally assumed that all specimens donated by Holub to European institutions were collected by him or his fellows in southern Africa. This is not necessarily the case; however, we found three main sources of so-called "Holub's" specimens, as follows:

Specimens collected by Holub or his fellows in the wild and fresh specimens obtained by Holub from local hunters in southern Africa. These are the authentic specimens.

Specimens obtained by Holub in southern Africa from other persons (excluding fresh specimens). Holub himself admitted that he purchased or obtained by other means (exchange/donation) specimens from a variety of persons during his Sojourns in southern Africa (see Holub 1881a, b, c, d, Holub & Pelzeln 1882). Most of these specimens will have been of local origin, but some might have been brought to southern Africa from other parts of the world. Such a possibility is generally underestimated in papers on historical collections, but the well-documented case of the Erman Collection shows that the trade with natural history specimens was more developed even in the early 19th century than expected. Georg Adolf Erman (1806–1877), German naturalist, purchased in Rio de Janeiro, Brazil, where he called during his circumnavigation of the world in 1830, well labeled and preserved specimens of West African birds (Erman 1835, Milkovský & Frahnert 2011). Similarly, some specimens albeit brought by Holub from southern Africa, need not be of local origin.

Specimens obtained by Holub outside of Africa. These specimens may be of any geographic origin. Being back in Europe Holub tried to get any natural history specimens to be able to donate them to other persons and institutions (Zelízko 1931, Baum 1955). A probable example of this origin is the pheasant *Lophophorus impeyanus* (see below).

Unfortunately, neither the label data nor entries in NMP catalogues offer clear indications as to the origin of Holub's specimens. An attempt to find relations between entries in Holub's ornithological field-books from his Second Sojourn and bird specimens deposited in the NMP failed (J. Milkovský). Our study of Holub's vertebrate collections in the NMP and relevant documents revealed only two hints: (1) specimens donated by Holub after his Second Sojourn were probably obtained by himself in southern Africa and thus belong to categories 1 or 2; (2) specimens associated with "exact" localities were probably obtained by Holub at the mentioned localities. Nevertheless, errors may occur even among these data (see below under Theriodontia for an example). Note also that broad localities, such as "Africa" or "southern Africa", were probably added by early curators, not supplied by Holub.

Considering these difficulties, Holub's specimens should always be considered with caution.

Holub's localities

We identified localities associated with NMP specimens using Holub's itineraries (Holub 1881a, b, c, d, 1890a, b, Želízko 1902). Current names follow NGA (2011) where possible. The list is arranged alphabetically according to the current names of the localities; alternative names used by Holub and in the NMP catalogues are given in parentheses. Geographic coordinates are given using the decimal system. The expression "southern Africa" is used for the whole area where Holub and his suppliers collected, which encompasses modern-day countries of South Africa, Botswana, Zimbabwe and Zambia.

Albert's Land (Albertcountry, země Albertova): Holub's name for the hill-country south of the Zambezi, approximately from the Sesheke in the west to the Victoria Falls in the east (he did not provide an exact definition). The area is now divided between Botswana and Zimbabwe.

Algoa Bay (Řasová zátoka), Eastern Cape Province, South Africa [33.85°S, 25.90°E]

Bakwenaland (Říše Bakwenú): historical region with Molepolole, Kweneng District, Botswana [24.42°S, 25.53°E] as its capital.

Bamboesspruit (Bamboe), North-West Province, South Africa [26.93°S, 25.97°E]

Bechuanaland (Bečuánsko): historical region, corresponding with the modern-day Botswana.

Boshof, Free State, South Africa [28.54°S, 25.24°E]

Cape Colony (Cap colonies, Capland, Kapsko): historical country, now approximately covering Northern Cape, Southern Cape and Eastern Cape provinces of South Africa.

Chobe River (Řeka Čobi), right affluent to Zambezi River at Kazungula, Botswana [17.78°S, 25.29°E]. Holub worked at the Chobe in the Ngamiland District of Botswana.

Colesberg, Northern Cape, South Africa [30.73°S, 25.10°E]

Cradock, Eastern Cape Province, South Africa [32.18°S, 25.62°E]

Dinokana (Linokana, Moteba, Mo-Tebe, "Mo Tebe, Linokana", Matebe River), North West Province, South Africa [25.45°S, 25.88°E]. Motebe is a river at Dinokana.

Free State (Orang, Oranje Frydstadt), South Africa. Holub visited only the westernmost parts of this province.

Graaff-Reinet (District Graforsheinet), Eastern Cape, South Africa [32.25°S, 24.55°E]

Kameelfontein, Free State, South Africa [28.38°S, 25.16°E]

Kazuma Forest (Les Gašumský): North West District, Botswana [ca. 18.40°S, 25.50°E]

Kazungula (Gajungula), Southern Province, Zambia [17.78°S, 25.29°E]

Kimberley (Dutoitspan), Northern Cape Province, South Africa [28.73°S, 24.76°E]

Kullfontein, Northern Cape Province, South Africa [30.82°S, 25.00°E]

Klamakljenana Forest (Les Klamakleuson, Les Klamaklaganský): forested area at Matlamanyane, Central District, Botswana [19.55°S, 25.95°E]

Lesuma Forest (Lesy lešumovské), Ngamiland District, Botswana [17.90°S, 25.23°E]

Limpopo River: Makes part of the border between Botswana and Zimbabwe. Holub traveled along the river on the Botswana side from its confluence with the Marico (see there) to its confluence with the Notwane (see there). Holub's locality "Limpopo" lies thus in Central District, Botswana.

Makgadikgadi Pan (solnišťata, solniště Karnové), Central District, Botswana. Holub traveled along the eastern margin of this salt pan, via Nata [20.22°S, 26.18°E].

Marutse (Marucko, Ma-Rucká říše): Corresponds approximately with the Western and Southern provinces of the modern-day Zambia. Holub used this locality only for some mammals from his Second Sojourn. Considering the fate of his travels north of the Zambezi it is probable that most Holub's "Marotse" specimens originated from Kazungula (see there) and its surroundings.

Matabeleland (Matabel, Matabele): historical country, now in western Zimbabwe. Holub touched the country from the west at ca. 21°S.

Marico River (Mor-Rica): confluence with the Limpopo River at ca. 24.19°S, 26.88°E. This river makes part of the border between Botswana and Zimbabwe. Holub traveled along the river from the Botswana side.

Ngwezi River (Inguisi): river in southern Zambia; opens into the Zambezi north-west of Kazungula (see there), Holub crossed upper reaches of this river on his round trip to south-central Zambia north of Senkobo [17.63°S, 25.95°E], but considering the circumstances of this part of his journey he more probably collected animals near the lower reaches of the Ngwezi at Kazungula (see there).

Notwane River (Notuana, ústí řeky Notuany): confluence with the Limpopo River at Pala Camp, Central District, Botswana [23.75°S, 26.95°E]

Nunga River (Deikha, Dejka, úd. ř. Dejka, Deykan), Botswana [18.85°S, 25.60°E]. Note: Geographic coordinates are given for the place where the road from Nata to Pandamatenga crosses the river valley.

Pandamatenga (Panda ma Tenka), Ngamiland District, Botswana [18.55°S, 25.63°E]

Port Elizabeth (Elisabeth-Port, Port-Elisabeth), Eastern Cape Province, South Africa [33.97°S, 25.58°E]

Shoshong (Šošong, Shoshong river), Central District, Botswana [23.03°S, 26.52°E]

Table Bay (Tabulová zátoka, záliv Capetownský, Tafel-Bucht), Western Cape Province, South Africa [33.85°S, 18.45°E]

Transvaal (Jih. Republika, Zavaal, jižní Zavaal, jihozápadní Zavaal): Historical country in north-eastern part of the modern-day South Africa. Holub visited only the western part of this country, now North West and Gauteng Provinces of South Africa.

Upper Molopo River (Mo-Lapo): Holub visited only the upper reaches of this river, particularly the area around Lotlhakane [26.02°S, 25.63°E] and Mahikeng [25.85°S, 25.63°E], North-West Province, South Africa.

Vaal River (Val, Vål): Holub visited this river several times between Delportshoop [28.42°S, 24.31°E] in the south-west and Potchefstroom [26.72°S, 27.10°E] in the north-east. Considering his itineraries he visited the Vaal in the Northern Cape and North-West provinces, South Africa.

Wonderfontein Caves (Wardosfontein-skê jeskynê), near Carletonville, Gauteng Province, South Africa [26.30°S, 27.35°E]: Holub visited the caves briefly in April 1873.

Zambezi River (Zambesi): river forming part of the southern border of the modern-day Zambia. Holub explored the river from Chiulu [17.35°S, 24.17°E] in the west to Victoria Falls [17.92°S, 25.84°E] in the east. He visited the river in the Western and Southern provinces of Zambia, the Matabeleland North Province of Zimbabwe and the Ngamiland Province of Botswana during both of his Sojourns.

Catalogue of Holub's vertebrates in the collections of the NMP

We attempted to trace current status of all specimens registered in the Museum's Accession Catalogue as a Holub's donation. We re-identified surviving specimens and tried to find the fate of those specimens which we were unable to find (hereafter 'lost'). Details are given in the following, taxonomically arranged catalogues. Taxa within families are listed alphabetically according to currently valid names.

Taxonomic status of lost specimens was estimated on the basis of originally used scientific names and probability that the taxon was correctly identified. Unmistakable species were listed under their currently valid names; those whose taxonomic identity remained uncertain were listed under the highest acceptable taxon (genus or family).

Mammalia¹

Holub donated to the NMP 28 skins, mounts and partial skeletons (mostly skulls) following his First Sojourn, and 51 skins, mounts and partial skeletons following his Second Sojourn. They are listed in the Accession Catalogue under numbers 1-28/1881, 441/1881, and 3571-3617/1894. In addition, seven Holub's specimens were obtained from secondary sources. Overall, the NMP received 86 skins, mounts and partial skeletons of mammals, of which 50 survived in the NMP and further four were donated to the MEHH.

Mammalogical results of Holub's journeys were published by von Lorenz (1894a,b, 1896) but they were based solely on specimens deposited in NHMW. The material deposited in the NMP has never been published.

Taxonomy and species arrangement of bats follow Monadjem et al. (2010), those of other mammal groups Skinner & Chimimba (2005) and Wilson & Reeder (2005). The latter compendium was used as a reference work for the taxa of other than southern African origin. Identification of bats and shrews is preliminary, because their skulls and dentitions (in situ in all specimens) were not examined yet.

Macroscelididae

Macroscelides proboscideus (Shaw, 1800)

NMP P6V-009698 (P6p-49/1894, A-66a, a-2538): Mounted skin (in unnatural position), rather well preserved (auricles partly broken, tail shortened). Locality: "Oranjefrystaates" = Free State, South Africa. Originally catalogued as *Macroscelides proboscideus*. Current status: present. Note: The identification seems to be correct, although the confusion with some species of the genus *Elephantulus* cannot be excluded due to changes of the pelage colouration caused by long-time exposition to day-light.

NMP P6V-uncatalogued (P6p-23/1881, A-66b): alcohol specimen. Locality: "Oranje llystaates" = Free State, South Africa. Originally catalogued as *Macroscelides typicus*. Current status: lost. Note: The specimen was originally placed in the museum exhibition, removed perhaps in the 1960s.

Orycteropodidae

Orycteropus afer (Pallas, 1766)

NMP P6V-010047 (P6p-12/1881, A-266a, a-3143): mounted skin (associable with the NMP P6V-010048 skull), badly preserved (areas of bare surface on several places of the skin). Locality: southern Africa = Free State, South Africa (see NMP P6V-010048). Originally catalogued as *Orycteropus* sp. Current status: present.

NMP P6V-010048 (P6p-11/1881, A-266b, a-3144): skull with mandible (associable with the NMP P6V-010047 skin). Locality: "Oranje" = Free State, South Africa. Originally catalogued as *Orycteropus* sp. Current status: lost.

Procaviidae

Procavia capensis (Pallas, 1766)

NMP P6V-009908 (P6p 3617/1894, A-209b, a-2809): skull with mandible; well preserved. Inner surface of the orbits abraded; upper molars not fully erupted, lower molars erupted, but not in occlusion. Locality: "Orang" = Free State, South Africa. Originally catalogued as *Hyrax capensis*. Current status: present. Note: Species identification uncertain due to the subadult age of the individual – possible confusion with *Dendrohyrax arboreus* (Smith, 1827).

NMP P6V-009909 (P6p-3586/1894, A-209a, a-2810): Mounted skin (in an unnatural position), well preserved. Perhaps a skull in situ, detectable by the incisors protruding from the mouth. Locality: "Orange" = Free State, South Africa. Originally catalogued as *Hyrax capensis*. Current status: present.

Bathyergidae

cf. *Georychus capensis* (Pallas, 1778)

NMP P6V-uncatalogued (P6p-19/1881, A-uncatalogued): skin. Locality: southern Africa. Originally catalogued as "Blindmaus" ("blind mole rat"). Current status: lost. Note: The species identification is well possible, because von Lorenz (1896) mentioned two Holub's specimens of this species in the NHMW.

NMP P6V-uncatalogued (P6p-25/1881, A-190): juvenile, alcoholic specimen. Locality: southern Africa. Originally catalogued as "(Blindmaus) *Georhynchus capensis*". Current status: lost. Note: See under P6p-19/1881 (above).

Pedetidae

Pedetes capensis (Forster, 1778)

NMP P6V-uncatalogued (P6p-3590/1894, A-172a, a-3063): skin. Locality: southern Africa. Originally catalogued as *Pedetes caffer*. Current status: lost.

NMP P6V-093829 (P6p-3601/1894, A-172b): skull, of which only the complete right mandible survived. Locality: "Orange" = Free State, South Africa. Originally catalogued as *Pedetes caffer*. Current status: partly present.

Sciuridae

Paraxerus cepapi (Smith, 1836)

NMP P6V-057515 (P6p-368/2004 [orig. 18/1881], A-148): Mounted skin, well preserved. Locality: "Matabel" = Matabeleland, Zimbabwe. Originally catalogued as "Baumeichhörnchen *Sciurus cepapi*". Current status: present.

Xerus sp.

NMP P6V-uncatalogued (P6p-3591/1894, A-149): most probably skin. Locality: "Orange" = Free State, South Africa. Originally catalogued as *Spermophilus leucombrinus*. Current status: lost. Note: *Spermophilus leucombrinus* [= *Xerus erythropus leucombrinus* (Rüppell, 1835)] is a Sahelian form occurring from southern Morocco and Senegal to eastern Sudan and Tanzania (Wilson & Reeder 2005). Considering Holub's travels, this specimen might have belonged to *Xerus inauris* (Zimmermann, 1780) or *X. princeps* (Thomas, 1929).

NMP P6V-uncatalogued (P6p-3600/1894, A-uncatalogued): most probably skin. Locality: southern Africa. Originally catalogued as *Spermophilus leucombrinus*. Current status: lost. Note: See under P6p-3591/1894 (above).

Muridae

cf. *Tatera leucogaster* (Peters, 1852)

NMP P6V-uncatalogued (P6p-21/1881, A-181): skin, probably mounted. Locality: southern Africa. Originally catalogued as "Erdeichhörnchen" ("ground squirrel"), later as *Gerbillus leucogaster*. Current status: lost.

Genus et species indet.

NMP P6V-uncatalogued (P6p-3592/1894, A-uncatalogued): male, probably skin. Locality: "Zambesi" = Zambezi River, Botswana/Zambia/Zimbabwe. Originally catalogued as *Mus rattus zambesiensis*. Current status: lost.

Galagonidae

Galago senegalensis Geoffroy, 1796

NMP P6V-uncatalogued (P6p-uncatalogued, A-41): mounted skin. Locality: "Senegal". Originally catalogued as *Galago senegalensis*. Current status: lost. Note: NMP received this skin from the secondary school in Jičín, Bohemia, as a Holub's specimen. Its actual geographical origin as well as its taxonomic affiliation are uncertain.

Otolemur crassicaudatus (Geoffroy, 1812)

NMP P6V-uncatalogued (P6p-15/1881, A-42, a-2521): skin. Locality: southern Africa. Originally catalogued as "lemur?". Current status: lost. Note: See under NMP P6V-009681.

NMP P6V-009681 (P6p-16/1881, A-43, a-2521): skeleton of an adult individual with completely erupted dentition. Locality: southern Africa. Originally catalogued as "lemur". Current status: present. Note: This skeleton originated from the same individual as the skin P6p-15/1881.

Cercopithecidae

Cercopithecus pygerythrus (Cuvier, 1821)

NMP P6V-024724 (P6p-3596b/1894, A-uncatalogued): skull with mandible (mounted together by wires), well preserved (four teeth missing); adult male, all teeth erupted and in occlusion. Locality: "Limpopo" = Limpopo River, Botswana. Originally catalogued as *Cercopithecus lulandi*. Current status: present.

NMP P6V-024725 (P6p-3596c/1894, A-uncatalogued): skull with mandible (mounted together by wires), well preserved; adult female, all teeth erupted and in occlusion. Locality: "Limpopo" = Limpopo River, Botswana. Originally catalogued as *Cercopithecus lulandi*. Current status: present.

NMP P6V-024726 (P6p-3596a/1894, A-uncatalogued): skull with mandible (mounted together by wires), well preserved; juvenile individual with only two molariforms erupted in each jaw. Locality: "Limpopo" = Limpopo River, Botswana. Originally catalogued as *Cercopithecus lulandi*. Current status: present.

Papio ursinus (Kerr, 1792)

NMP P6V-009585 (P6p-3571/1894, A-22a): adult male, mounted skin, well preserved, extremities dark (blackish), not greyish. Locality: "jižní Zavaal" = southern Transvaal, South Africa. Originally catalogued as *Cynocephalus ursinus (porcarius)*. Current status: present.

NMP P6V-009602 (P6p-10/1881, A-22b, a-2430): skull with mandible of an adult individual, well preserved. Locality: southern Africa = Transvaal, South Africa (according to a label attached to the specimen). Originally catalogued as *Cynocephalus babuin*. Current status: present.

Soricidae

Genus et species indet.

NMP P6d-432/2007 (P6p-24/1881, A-65): complete alcoholic specimen, well preserved, in original jar. Locality: "Oranžsko" = Free State, South Africa. Originally identified (probably by Holub himself) as a juvenile individual of *Macroselydes* [sic; = *Macroselidae* sp.], later as *Sorex* sp. or *Crocidura* sp. Current status: present. Note: Until March 1934 placed in the permanent museum exhibition, then stored in mammalogical depository. The correct identification is impossible without a destruction of the original jar cover. Considering the geographic origin, the specimen belongs to one of some 15 shrew species occurring in the region (Skinner & Chimimba 2005).

Hipposideridae

Hipposideros caffer (Sundevall, 1846)

NMP P6V-037303 (P6p 3594/1894, A-uncatalogued): male, mounted skin with a skull in situ, rather well preserved. Brownish grey pelage colour phase, forearm length ~45 mm. Locality: "Zambesi" = Zambezi River, Botswana/Zambia/Zimbabwe. Originally catalogued as "netopýr" ("bat"). Current status: present.

Rhinolophidae

Rhinolophus denti Thomas, 1904

NMP P6P-060353 (P6p-26/1881, A-uncatalogued): complete alcoholic specimen, well preserved. Adult female, forearm length 45.1 mm, ear length 22.0 mm, horseshoe width 7.8 mm. Locality: "Cap colonies (Cradock)" = Cradock, South Africa. Originally catalogued as "netopýr" ("bat"). Current status: present. Note: If the locality of origin is correct, the record represents the southernmost record of the species (Monadjem et al. 2010).

Nycteridae

Nycteris thebaica Geoffroy, 1813

NMP P6V-037302 (P6p-3593/1894, A-uncatalogued): mounted skin with a skull in situ, rather well preserved; male, forearm length ~44 mm, ear length ~31 mm. Locality: "Zambesi" = Zambezi River, Botswana/Zambia/Zimbabwe. Originally catalogued as "netopýr" ("bat"). Current status: present.

Vespertilionidae

Pipistrellus hesperidus Temminck, 1840

NMP P6P-060352 (P6p 27/1881, A-uncatalogued): complete alcoholic specimen, well preserved; adult male, forearm length 32.4 mm. Locality: "Wordosfontein-ské jeskyně, Transvaal" = Wonderfontein Caves, South Africa. Originally catalogued as "netopýr" ("bat"). Current status: present.

Scotophilus dinganii (Smith, 1833)

NMP P6P-060354 (P6p-28/1881, A-uncatalogued): complete alcoholic specimen, well preserved; adult female, forearm length 56.6 mm. Locality: "Shoshong" = Shoshong, Botswana. Originally catalogued as "netopýr" ("bat"). Current status: present.

Manidae

Manis temminckii Smuts, 1832

NMP P6V010043 (P6p-13/1881, A-257a, a-3139): female, mounted specimen, well preserved. Locality: southern Africa. Originally catalogued as "luskoun krátkoocasý" ("short-tailed pangolin"). Current status: present.

NMP P6V-010046 (P6p-14/1881, A-257b, a-3142): female, skull without mandible (possibly associable with the P6V-010043 specimen). Locality: southern Africa. Originally catalogued as "luskoun krátkoocasý" ("short-tailed pangolin"). Current status: lost.

Hyaenidae

Crocuta crocuta (Erxleben, 1777)

NMP P6V-009810 (P6p-3584/1894, A-126a, a-2683): male, mounted specimen, rather well preserved (head skin napless, pelage colouration dilute). Locality: "Marucko" = Maruts, Zambia. Originally catalogued as *Hyaena crocuta maculata*. Current status: present.

NMP P6V-uncatalogued (P6p-3599/1894, A-126b): skull. Locality: "Panda ma Tenka" = Pandamatenga, Botswana. Originally catalogued as *Crocuta maculata*. Current status: lost; destroyed in 1945 by war affairs.

Proteles cristatus (Sparrman, 1783)

NMP P6V-009795 (P6p-3583/1894, A-127, a-2636): male, mounted specimen, well preserved. Locality: "Šošang" = Shoshong, Botswana. Originally catalogued as *Proteles lulari*. Current status: present.

Felidae

Caracal caracal (Schreber, 1776)

NMP P6V-009752 (P6p-3581/1894, A-118, a-2593): male, mounted skin, well preserved (pelage colouration slightly dilute). Locality: "Limpopo" = Limpopo River, Botswana. Originally catalogued as *Felis pardus*. Current status: present.

Leptailurus serval (Schreber, 1776)

NMP P6V-009757 (P6p-3580/1894, A-117a, a-2598): mounted skin, well preserved (pelage colouration slightly dilute, left auricle harmed). Locality: "Albertcountry" = Albert's Land, Botswana/Zimbabwe. Originally catalogued as *Felis serval*. Current status: present. Note: Colouration is characterised by stripes and large spots, not the "servaline" small spots.

Viverridae

Civettictis civetta (Schreber, 1776)

NMP P6V-009776 (P6p-147/1895, A-77, a-2617): mounted skin, well preserved (pelage colouration slightly dilute); bilaterally different pelage colouration, large dark spot. Locality: southern Africa. Originally catalogued as *Viverra civetta*. Current status: present.

Genetta tigrina (Schreber, 1776)

NMP P6V-009783 (P6p 3582/1894, A-78, a-2624): female, mounted skin, rather well preserved (pelage colouration slightly dilute, left auricle harmed). Locality: "Kapsko" = Cape Colony, South Africa. Originally catalogued as *Genetta pardina*. Current status: present.

Herpestidae

Cynictis penicilata (Cuvier, 1829)

NMP P6V-057487 (P6p-327/2004 [orig. 22/1881], A-81): mounted skin with dentition (skull?) in situ, rather well preserved; in unnatural position. Locality: "Oranje Frydstadt" = Free State, South Africa. Originally catalogued as "Schnarrthier" ("Mongoose"). Current status: present.

Mungos mungo (Gmelin, 1788)

NMP P6V-057486 (P6p-335/2004 [orig. 3597/1894], A-uncatalogued): mounted skin with dentition (skull?) in situ, badly preserved with napless regions of skin; in unnatural position. Locality: "Kameelfontein" = Kameelfontein, South Africa. Originally catalogued as *Rhyzaena* sp. Current status: present.

NMP P6V-009782 (P6p-3597/1894, A-325, a-2623): skull with mandible, well preserved (three mandibular teeth missing). Locality: "Kameelfontein" = Kameelfontein, South Africa. Originally catalogued as *Rhyzaena* sp. Current status: present.

NMP P6V-uncatalogued (P6p-17/1881, A-82): mounted skin. Locality: southern Africa. Originally catalogued as "Schnarrthier" ("Mongoose"). Current status: lost.

Canidae

Canis mesomelas Schreber, 1775

NMP P6V-009830 (P6p 8/1881, A-125a, a-2704): mounted skin, well preserved; in unnatural position. Locality: southern Africa. Originally catalogued as "šakal" ("jackal"). Current status: present.

NMP P6V-009831 (P6p-3598/1894, A-125b, a-2704): skull with mandible, well preserved (five teeth missing); adult individual, all teeth erupted and in occlusion; sagittal crest weakly developed. Locality: "ústí řeky Notuany" ("Notwane River mouth") = Notwane River, Botswana. Current status: present.

Canis sp.

NMP P6V-uncatalogued (P6p-9/1881, A-uncatalogued): skin with a skull in situ. Locality: southern Africa. Originally catalogued as "šakal" ("jackal"). Current status: lost. Note: Species identity uncertain, either *Canis mesomelas* Schreber, 1775 or *C. adustus* Sundevall, 1847 (see also von Lorenz 1894, 1896).

Mustelidae

Mellivora capensis (Schreber, 1776)

NMP P6V-009813 (P6p-3585/1894, A-106, a-2686): male, mounted skin, well preserved. Locality: "Bečuánsko" = Botswana. Originally catalogued as *Mellivora capensis*. Current status: present.

NMP P6V-uncatalogued (P6p-3585b/1894, A-uncatalogued): skin. Locality: southern Africa. Originally catalogued as *Mellivora capensis*. Current status: lost.

Poecilogale albinucha (Gray, 1964)

NMP P6V-uncatalogued (P6p-20/1881, A-89): skin. Locality: southern Africa. Originally catalogued as *Mustella* [sic] *albinucha*. Current status: lost. Note: The species identity is uncertain, because of possible confusion with *Ictonyx striatus* (Perry, 1810) (see Skinner & Chimmba 2005).

Rhinocerotidae

Ceratotherium simum (Burchell, 1817)

NMP P6V-uncatalogued (P6p-6/1881, A-uncatalogued): horn. Locality: southern Africa. Originally catalogued as "nosorožec bílý" ("white rhinoceros"). Current status: lost. Note: Species identity uncertain, because of possible confusion with *Diceros bicornis* (Linnaeus, 1758).

Diceros bicornis (Linnaeus, 1758)

NMP P6V-010657 (P6p-3616/1894, A-253b): skull with mandible, well preserved. Locality: "Inguisi" = Ngwezi River, Zambia. Originally catalogued as *Rhinoceros bicornis*. Current status: present. Note: Both morphology (Robovský et al. 2010) and geographic origin (Hillman-Smith & Groves 1994) indicate that this individual belongs to *D. b. minor* (Dunham, 1876).

NMP P6V-010706 (P6p-3588/1894, A-253a): Originally complete mounted skin with horns; was placed in the permanent museum exhibition until 1987, then it was dismembered into several parts (see Robovský et al. 2010). Mounted head with horns and tail (P6d-45/2005) are preserved; the body and extremities were destroyed. Locality: southern Africa. Originally catalogued as *Rhinoceros bicornis*. Current status: partly present.

Suidae

Phacochoerus africanus (Gmelin, 1788)

NMP P6V-009903 (P6p-3587/1894, A-217, a-2804): female, mounted skin, well preserved. Locality: southern Africa. Originally catalogued as *Phacochoerus africanus*. Current status: present.

NMP P6V-092873 (P6p-131/2010 [orig. 3615/1894], A-uncatalogued): skull with mandible, well preserved; left part of the mandible partly damaged, right lower canine missing; probably adult female, third molars in all jaws are not erupted. Locality: "Dejcha" = Nunga River, Botswana. Originally catalogued as *Phacochoerus africanus*. Current status: present.

Bovidae

Aepyceros melampus (Liechtenstein, 1812)

NMP P6V-uncatalogued (P6p-3577/1894, A-229a): mounted skin of a juvenile male. Locality: "Limpopo" = Limpopo River, Botswana. Originally catalogued as *Aepyceros melampus*. Current status: lost; donated to MEHH in 2001.

NMP P6V-093834 (P6p-3607/1894, A-uncatalogued): skull of an adult female. Locality: "Limpopo" = Limpopo River, Botswana. Originally catalogued as *Aepyceros melampus*. Current status: present.

NMP P6V-uncatalogued (P6p-3608/1894, A-229b): skull with horns of an adult male. Locality: "Zambesi" = Zambezi River, Botswana/Zambia/Zimbabwe. Originally catalogued as *Aepyceros melampus*. Current status: lost.

Alcelaphus buselaphus (Pallas, 1766)

NMP P6V-050828 (P6p-7851/1958, A-uncatalogued): mounted skin from head with horns; well preserved; perhaps a subadult individual. Locality: southern Africa. Originally catalogued as "africká trofej" ("African trophy"). Current status: present. Note: This specimen was purchased by the NMP from Dr. J. Doležal (Poděbrady, Bohemia) in 1958; it remains unknown how this Holub's specimen became Doležal's property.

Antidorcas marsupialis (Zimmermann, 1780)

NMP P6V-090467 (P6p-257/2005, A-uncatalogued): frontal part of skull with horns, mounted on a wooden plate, rather well preserved. The horn shape suggests that the individual was older than 15 months (cf. Rautenbach 1971). Locality: "z planin na řece Mo-lapo" ("from plains at the Mo-lapo river") = Upper Molopo River, South Africa. Current status: present.

NMP P6V-010727 (P6p-3576/1894, A-231a): male, mounted skin with horns, well preserved (pelage colouration dilute). The horn shape suggests that the individual was older than 15 months (cf. Rautenbach 1971). Locality: "jih. Republika" = Transvaal, South Africa. Originally catalogued as *Gazella euchore*. Current status: present.

Capra hircus Linnaeus, 1758

NMP P6V-uncatalogued (P6p-3579/1894, A-224): mounted skin of a male. Locality: "Marucká říže" = Marutse, Zambia. Originally catalogued as *Capra matocensis*. Current status: lost; donated to MEHH in 2001.

NMP P6V-uncatalogued (P6p-3613/1894, A-uncatalogued): skull. Locality: "Marucko" = Marutse, Zambia. Originally catalogued as *Capra matocensis*. Current status: lost.

Connochaetes gnou (Zimmermann, 1780)

NMP P6V-090479 (P6p-257/2005 [originally 3/1881], A-uncatalogued): male, originally mounted skin of head; now dorsal part of braincase with horns, well preserved. Locality: "solnišřata" ("saltpans") = Makgadikgadi Pan, Botswana. Originally catalogued as "pakůň od solniřat" ("wildebeest from saltpans"). Current status: present.

Connochaetes taurinus (Burchell, 1823)

NMP P6V-uncatalogued (P6p-3611/1894, A-uncatalogued): skull. Locality: "Marucko" = Marutse, Zambia. Originally catalogued as *Connochaetes taurinus*. Current status: lost.

Damaliscus lunatus (Burchell, 1823)

NMP P6V-uncatalogued (P6p-7/1881, A-uncatalogued): horns. Locality: southern Africa. Originally catalogued as "Zulu Hartebeest" [= *Damaliscus lunatus*]. Current status: lost.

Hippotragus equinus (Geoffroy, 1803)

NMP P6V-093831 (P6p-3605/1894, A-uncatalogued): skull of a juvenile male with bony crooks, without horny spathes. Locality: "ůd. ř. Dejřha" ("Dejřha River valley") = Nunga River, Botswana. Originally catalogued as *Hippotragus equinus*. Current status: present.

Hippotragus niger (Harris, 1838)

NMP P6V-uncatalogued (P6p-3604/1894, A-228): female, skull with horns. Locality: "Lesy řsumovské" = Lesuma Forest, Botswana. Originally catalogued as *Hippotragus niger*. Current status: lost.

Kobus ellipsiprymnus (Ogilby, 1833)

NMP P6V-090695 (P6p-78/2006, A-uncatalogued): skull with horns, mounted on a wooden plate; skull rather badly preserved, horns in perfect condition; adult male, all teeth erupted. Locality: southern Africa. Current status: present.

Nanger granti (Brooke, 1872)

NMP P6V-090685 (P6p-78/2006 [orig. 7851/1958], A-uncatalogued): frontal parts of skull with horns. Locality: unknown. Absent from early catalogues. Current status: present. Note: This species does not occur in southern Africa, but in East Africa from southeastern Sudan and southern Somalia to northern Tanzania (Halténroth & Diller 1994). The specimen was purchased by the NMP from Dr. J. Doleřal (Poděbrady, Bohemia) in 1958 as a part of a

former Holub's collection. However, the link between the Holub's collection and Doležal's property is unknown. Either Holub obtained the specimen from a third party or Doležal misinterpreted the origin of the specimen.

Oryx gazella (Linnaeus, 1728)

NMP P6V-uncatalogued (P6p-1/1881, A-230): horns without skull. Locality: southern Africa. Originally catalogued as *Antilope oryx*. Current status: lost. Note: This specimen was placed in the permanent museum exhibition until August 1902.

Ovis aries Linnaeus, 1758

NMP P6V-uncatalogued (P6p-3578/1894, A-221): mounted skin of a male. Locality: "Sošong" = Shoshong, Botswana. Originally catalogued as *Ovis bechuanensis*. Current status: lost; donated to MEHH in 2001.

NMP P6V-093835 (P6p-3614/1894, A-uncatalogued): skull without horns. Locality "Bečuanško" = Botswana. Originally catalogued as *Ovis bechuanensis*. Current status: present.

Raphicerus campestris (Thunberg, 1811)

NMP P6V-090691 (P6p-78/2006 [orig. 3610a/1894], A-uncatalogued): skull with mandible (mounted together by wires), badly preserved (opening on the right braincase side, four teeth missing); a subadult male, third molars in each jaw not fully erupted; bony crooks of 4 cm long. Locality: "Limpopo" = Limpopo River, Botswana. Originally catalogued as *Pediotragus campestris*. Current status: present.

NMP P6V-090692 (P6p-78/2006 [orig. 3610b/1894], A-uncatalogued): skull with mandible (mounted together by wires), well preserved; a subadult female, third molars in each jaw not fully erupted. Locality: "Limpopo" = Limpopo River, Botswana. Current status: present.

NMP P6V-uncatalogued (P6p-3574/1894, A-233a): male, mounted skin. Locality: "Orang" = Free State, South Africa. Originally catalogued as *Pediotragus campestris*. Current status: lost.

NMP P6V-uncatalogued (P6p-3575/1894, A-233b): female, mounted skin. Locality: "Orang" = Free State, South Africa. Originally catalogued as *Pediotragus campestris*. Current status: lost.

Redunca arundinum (Boddaert, 1785)

NMP P6V-093832 (P6p-3606/1894, A-uncatalogued): subadult male skull without horns. Locality: "Limpopo" = Limpopo River, Botswana. Originally catalogued as *Cervicapra arundinum*. Current status: present.

Sylvicapra grimmia (Linnaeus, 1758)

NMP P6V-093833 (P6p-3609/1894, A-uncatalogued): adult skull with bony crooks, with only one horny spath, lower incisors missing. Locality: "Orang" = Free State, South Africa. Originally catalogued as *Cephalolophus grimmii*. Current status: present.

Syncerus caffer (Sparrman, 1779)

NMP P6V-009882 (P6p-3612/1894, A-219b, a-2783): female, skull. Locality: "Marucko" = Marutse, Zambia. Originally catalogued as *Bos caffer*. Current status: lost.

NMP P6V-uncatalogued (P6p-3589/1894, A-219a, a-2777): female, probably a mounted specimen. Locality: "Marucko" = Marutse, Zambia. Originally catalogued as *Bos caffer*. Current status: lost.

Tragelaphus strepsiceros (Pallas, 1766)

NMP P6V-010719 (P6p-3573/1894, A-227a): male, mounted skin, rather well preserved (bald spots on skin, pelage colouration dilute); original (?) dentition (skull?) in situ. Seven to eight side stripes detectable. Locality: "Limpopo" = Limpopo River, Botswana. Originally catalogued as *Strepsiceros capensis*. Current status: present.

NMP P6V-091091 (P6p-206/2006, A-uncatalogued): male, frontal parts of skull with bony crooks, without horny spathes; rather badly preserved. The right crook composed of one and half of screw, the left crook with one screw. Locality: "Zambesi" = Zambezi River, Botswana/Zambia/Zimbabwe. Absent from early catalogues. Current status: present.

NMP P6V-uncatalogued (P6p-4/1881, A-227b): horns. Locality: "Říše Bakwenú" = Bakwenaland, Botswana. Originally catalogued as "Antilopa "kudu"" ("kudu antelope"). Current status: lost. Note: The specimen was placed in the permanent museum exhibition until September 1901.

NMP P6V-uncatalogued (P6p-3572/1894, A-uncatalogued): mounted skin of a juvenile female. Locality: "Řeka Čobi" = Chobe River, Botswana. Originally catalogued as *Strepsiceros zambesianus*. Current status: lost; donated to MEHH in 2001.

NMP P6V-093830 (P6p-3602/1894, A-uncatalogued): skull of juvenile female; rostral region partly damaged. Locality: "Zambesi" = Zambezi River, Botswana/Zambia/Zimbabwe. Originally catalogued as *Strepsiceros zambesiensis*. Current status: present.

NMP P6V-uncatalogued (P6p-3603/1894, A-227c): skull of an adult male. Locality: "Zambesi" = Zambezi River, Botswana/Zambia/Zimbabwe. Originally catalogued as *Strepsiceros zambesiensis*. Current status: lost.

Genus et species indef.

NMP P6V-uncatalogued (P6p-5/1881, A-uncatalogued): skull with horns. Locality: southern Africa. Originally catalogued as "Antilopa" ("antelope"). Current status: lost.

NMP P6V-uncatalogued (P6p-7543/1957, A-uncatalogued): horns. Locality: southern Africa. Originally catalogued as "sourozí antilopy" ("horns of an antelope"). Current status: lost. Note: Holub's specimen; received in 1957 from "Jedenáctiletka v Třebíči" ("eleven-year school in Třebíč").

Holub's contribution to the vertebrate zoology of southern Africa

Holub as a collector of vertebrates

Holub assembled in southern Africa a large collection of vertebrates (Zelitzko 1931). He was an enthusiastic, but apparently less experienced collector. Most specimens obtained during his Sojourns lack exact localities and dates of collection, data on their age and sex, and remarks on external characters that undergo postmortem changes. In all of this, Holub was below the standards of collecting natural history specimens of his time. This might be explained by the fact that he was a complex explorer and collector, not specialized in any field of natural history and with interests extending far beyond science. Regardless of the reasons, the scientific value of Holub's vertebrate collections is distinctly lower than it could have been if Holub would work in agreement with collecting standards.

Holub as a vertebratologist

Holub published a large number of popular sketches in a variety of newspapers and magazines, but his scientific writings in vertebratology are limited to a few contributions in ornithology (Holub & Pelzeln 1882, Holub 1882a,b,c, 1895). With a single exception, these publications were based on the results of Holub's First Sojourn. As judged from notices in Holub's first travelogue (Holub 1881a,b), he was less versed in vertebrate zoology when he went to southern Africa for the first time. However, he returned to Africa much better prepared, as evidenced from his hand-written keys to various vertebrates in his field-books preserved in the Náprstek Museum (see Lífka 1947). In spite of this, Holub's only vertebratological paper resulting from his Second Sojourn was a brief note on the breeding biology of Hammerkop (Holub 1895).

Scientific legacy of Holub's vertebratological collections

Holub brought back from Africa large numbers of vertebrates, but he dispersed these collections before they could have been studied by any scientist. Only specimens donated by Holub to the Naturhistorisches Museum in Wien, Austria received immediate attention from vertebratologists. They included Ludwig Lorenz von Liburnau (1856-1943), August von Pelzeln (1825-1891) and Franz Steindachner (1834-1919), all curators at the NHMW, who published on Holub's collections of mammals (Lorenz-Liburnau 1894a,b, 1896), birds (Holub & Pelzeln 1882), reptiles and amphibians (Steindachner 1883) and fishes (Steindachner 1881a,b, 1894a,b). In addition, José Vicente Barboza du Bocage (1823-1907) published on Holub's collection of reptiles and amphibians obtained by the MBL (Bocage 1896).

All 19th-century researchers were primarily interested in taxonomic evaluation of Holub's specimens. Their studies resulted in a description of 14 new taxa (species and subspecies) of mammals (5), birds (2), reptiles (3), amphibians (1) and fishes (3). Subsequent revisions relegated most of these taxa to the rank of synonyms, but three taxa based upon Holub's collections are still recognized as valid subspecies of birds (2) and reptiles (1). The taxonomic status of both taxa described by Bocage (1896) has not been re-evaluated yet.

Holub's distributional records of vertebrates could have been of great importance considering ongoing environmental changes in southern Africa (e.g. Erasmus et al. 2002, Simmons et al. 2004, Hannah et al. 2005, Hockey & Midgley 2009). Unfortunately, his decline to list exact localities and dates of collections lowers the usefulness of his records. In spite of this, his record of Ranger's toad *Amietophrynus rangeri* from Shoshong, if genuine, seems to be the first for Botswana (see above).

Not yet exploited are Holub's notes on the behavior and ecology of vertebrates. Some of his ornithological observations were published (Holub & Pelzeln 1882, Holub 1895), but most remain hidden in his field-books. A study of his ornithological field-books from his Second Sojourn made by one of us (J. Mlíkovský) revealed that some of his notes might have been interesting in the late 19th century, but that they contain nothing new from the point of view of current ornithology.

Vertebrate zoology has a long tradition in southern Africa (Rookmaaker 1989) and Holub collected mostly in areas that were already visited by other collectors. Despite that, vertebrate zoology of southern Africa had not been perfectly known in Holub's times. Considering that interesting scientific novelties were discovered in the small portion of Holub's vertebrate collection that was available to European researchers we can only regret that Holub dispersed most of his collections before they could have been studied from the scientific point of view.

Vertebrate taxa described on the basis of Holub's specimens

Overall, 14 vertebrate taxa were named on the basis of Holub's specimens and some of them were thankfully dedicated to him. Types of most of these taxa are deposited in the NHMW; those described by Bocage (1896) were deposited in the MBL. Current taxonomic status follows standard reference books (see below).

Aepyceros [sic] *melampus holubi* Lorenz (1894a: 62) = *Aepyceros melampus melampus* (Lichtenstein, 1812) (Skinner & Chimimba 2005) or *A. m. johnstoni* Thomas, 1893 (Bastos-Silveira & Lister 2007) (Mammalia: Bovidae)

Agama holubi Bocage (1896: 115) = ? (Reptilia: Agamidae)

Agama pulchella Bocage (1896: 116) = ? (Reptilia: Agamidae)

Barbus holubi Steindachner (1894a: 138) = *Labeobarbus aeneus* (Burchell, 1822) (Osteichthyes: Cyprinidae)

Bufo tuberculatus Bocage (1896: 119) = *Vandijkophrynus gariiepensis* (Smith, 1848) (Amphibia: Bufonidae)

Canis holubi Lorenz (1896a: 111) = *Canis adustus adustus* Sundevall, 1847 (Mammalia: Canidae)

Cephalopus grimmia flavescens Lorenz (1894: 60) = *Sylicapra grimmia splendidula* (Gray, 1891) (Mammalia: Bovidae)

Drymaica holubii Pelzeln in Holub & Pelzeln (1882: 76) = *Cisticola natalensis holubii* (Pelzeln) (Aves: Cisticolidae)

Equus burchelli zambeziensis, Pražák* Trouessart (1898: 64) = *Equus quagga boehmi* Matschie, 1892 (Groves & Bell, 2004)

Eremias holubi Steindachner (1883: 83) = *Nucras taeniata holubi* (Steindachner) (Reptilia: Lacertidae)

Exocoetus holubi Steindachner (1881a: 54) = *Exocoetus obtusirostris* Günther, 1866 (Osteichthyes: Exocoetidae)

Lanius pyrrhostictus Holub & Pelzeln (1882: 97) = *Lanius collaris pyrrhostictus* Holub & Pelzeln, 1881 (Aves: Laniidae)

Sargus holubi Steindachner (1881b: 208) = *Boopsiodes inornata* Castelnau, 1861 (Osteichthyes: Sparidae)

Strepsiceros strepsiceros zambeziensis Lorenz (1894a: 63) = *Tragelaphus strepsiceros strepsiceros zambeziensis* (Lorenz 1894) (Wilson & Reeder 2005) or *T. s. strepsiceros* (Pallas, 1766) (Meester et al. 1986; Skinner & Chimimba 2005) (Mammalia: Bovidae)

Endnotes

1 Authors: Petr Benda & Jan Robovský.

2 Author: Jiří Milkovský.

3 These three specimens were mounted on a single stand, but I found only two in 2009. It remains unclear which specimen is missing.

4 Author: Jiří Moravec.

5 Author: Jiří Moravec.

6 Author: Radek Šanda.

7 Author: Radek Šanda.

8 Author: Boris Ekrt.



The historical presentation of Holub's collection.



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