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The conundrum of an overlooked skeleton referable to Imperial Woodpecker *Campephilus imperialis* in the collection of the Natural History Museum at Tring

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SUMMARY.—The discovery of an overlooked skeleton of Imperial Woodpecker *Campephilus imperialis* in the bird collection of the Natural History Museum at Tring (NHMUK) is documented, one of very few known to exist worldwide of this almost certainly extinct species. We present evidence that, on balance of probabilities, it is one of two collected by Alphonse Forrer in 1882 near the settlement of La Ciudad in the Sierra Madre Occidental, Durango, western Mexico; the whereabouts of the other, which did not come to NHMUK, appears currently unknown. During research into the NHMUK specimen, we demonstrated that the supposed Imperial Woodpecker skull held in the collection of the Russian Academy of Sciences, St. Petersburg, must in fact be that of an Ivory-billed Woodpecker *C. principalis*.

The recent discovery in the bird research collections of the Natural History Museum (NHMUK) at Tring of a very large woodpecker skeleton identified in its box merely as a '*Picus* sp.' appeared potentially noteworthy. In fact, it is clearly not a *Picus* sp., instead appearing comparable to the largest and probably extinct species, the Imperial Woodpecker *Campephilus imperialis*. Below, prior to reaching a definitive identification, we refer to it as the unidentified NHMUK skeleton.

The unidentified NHMUK skeleton exhibits several morphological characters diagnostic of the closely related (e.g. Fuchs *et al.* 2013) woodpecker genera *Campephilus*, *Chrysocolaptes* and *Reinwardtipicus*. Following the terminology of Baumel & Witmer (1993), these include an elongated proc. postorbitalis, which almost reaches the lateromedially broad and rostrally bifurcated proc. zygomaticus (pers. obs.; compare Donatelli 1996, fig. 13, and Donatelli 2014, figs. 7–8), medially converging cristae iliacae dorsales delimiting deep fossae iliacae dorsales (see Webb 2002, character 48), and a proximodistally elongated trochlea metatarsi IV (Webb 2002, character 55). However, the specimen in question is far larger than any species of *Chrysocolaptes* or *Reinwardtipicus*. Another large woodpecker, Great Slaty Woodpecker *Mulleripicus pulverulentus*, is also eliminated as it lacks the morphological characters of the new specimen described above and the craniofacial flexion zone (Donatelli 2012); moreover whilst the premaxilla is similar in length it is significantly narrower. Therefore we initially compared measurements of the length and width of the skull of the unidentified NHMUK skeleton with analogous measurements derived from NHMUK skins of the largest potentially relevant species, i.e. Imperial Woodpecker, Ivory-billed Woodpecker *Campephilus principalis* and Magellanic Woodpecker *C. magellanicus*.

In making this comparison, it is important to bear in mind that, besides the skin specimen measurements including skin / feather thickness, the skull of the unidentified NHMUK skeleton not only has a slightly damaged bill tip but, more importantly, lacks a rhamphotheca (Fig. 1). Therefore, we first took X-rays of a male and a female skin in the NHMUK collection of both *C. imperialis* and *C. principalis*, enabling us to derive estimates of their skull length both with and without the rhamphotheca. This revealed that the



Figure 1. Skull of the unidentified NHMUK skeleton in dorsal and lateral views. ZFC: craniofacial flexion zone; PrPO: proc. postorbitalis; PrZ: proc. zygomaticus (Harry Taylor, © Natural History Museum, London)

presence of a rhamphotheca increases skull length by on average 17.28% (range 16.2–18.0%, $n = 4$). As the skull without rhamphotheca of the unidentified NHMUK skeleton measured 105.3 mm, this indicated that with its rhamphotheca it would have had a total skull length of c.123.5 mm. Using these results, a plot of maximum skull width against skull length with rhamphotheca clearly indicated that the unidentified NHMUK skeleton must be either a small individual of *C. imperialis* or a large *C. principalis* (Fig. 2).

Skeletons of Imperial and Ivory-billed Woodpeckers are very rare in natural history collections. According to the *World inventory of avian skeletal specimens* (Wood *et al.* 1982, Wood & Schnell 1986) only three complete skeletons of *C. imperialis* and five of *C. principalis* were potentially available, all at institutions in the USA other than one supposed *C. imperialis* at the Russian Academy of Sciences, Institute of Zoology, St. Petersburg (ZISP). We therefore requested and received a standard set of measurements for each complete skeleton of *C. imperialis* and *C. principalis* from curators in the relevant museums: the

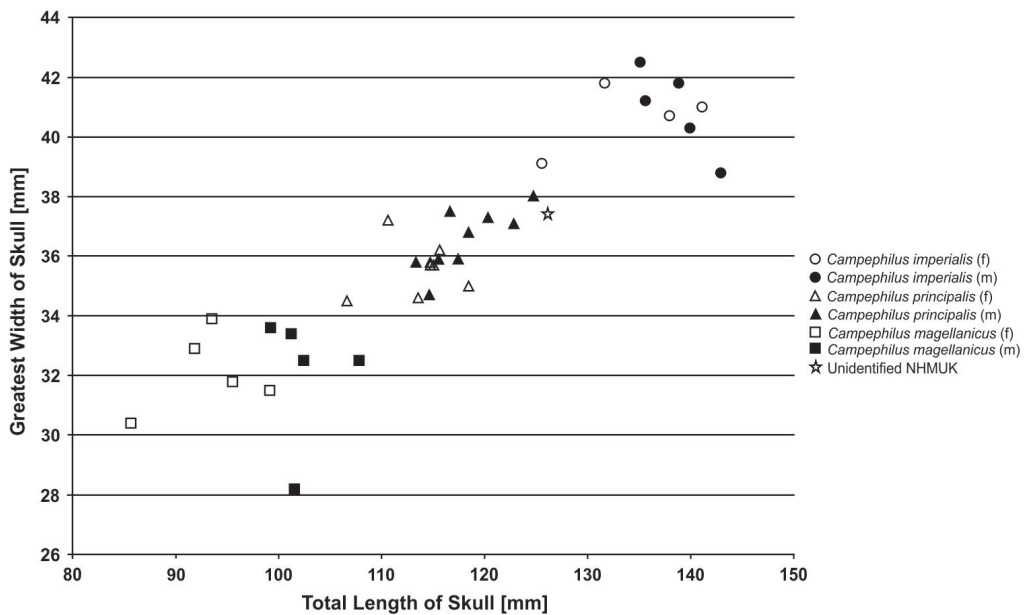


Figure 2. Graph plotting skull max. width against total length (bill tip to rear of skull) for skins of three species of *Campephilus* woodpecker in the NHMUK collection. Also shown are analogous measurements from the unidentified NHMUK skeleton, for which a correction factor upwards of 17.28% has been made to total skull length, to account for its missing rhamphotheca (see text for explanation), thereby making its measurements directly comparable with the others.



Figure 3. The ZISP skull (ZISP 1791), supposedly of Imperial Woodpecker *Campephilus imperialis* but actually Ivory-billed Woodpecker *C. principalis*, in dorsal view (Judith White, courtesy of Russian Academy of Sciences, St. Petersburg)

American Museum of Natural History, New York (AMNH), United States National Museum, Smithsonian Institution, Washington DC (USNM), Museum of Comparative Zoology, Harvard University, Cambridge, MA (MCZ), and ZISP. All responded, and MCZ

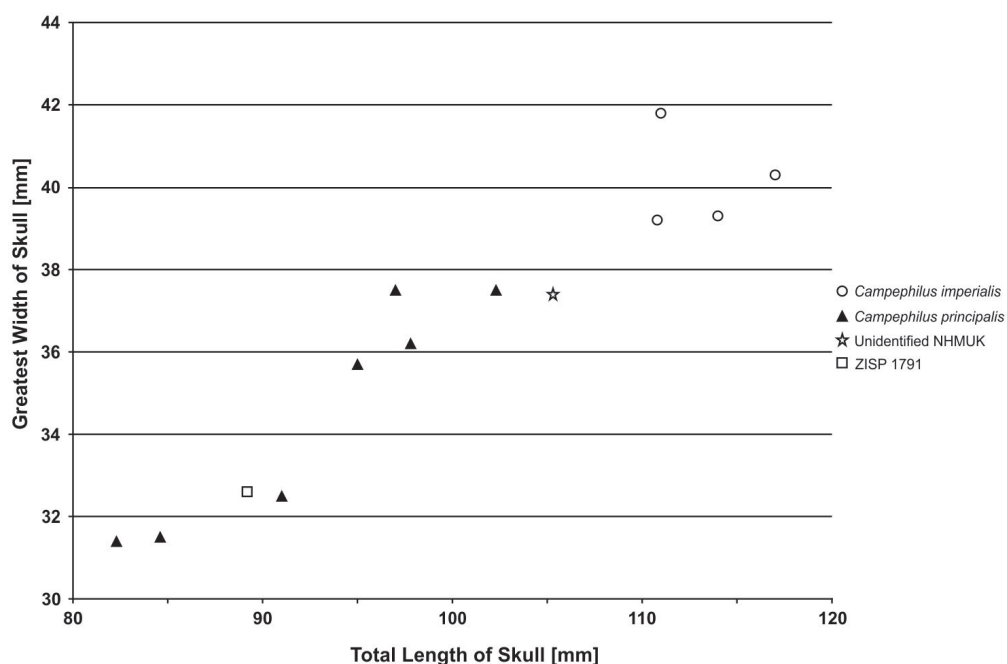


Figure 4. Graph plotting skull max. width against skull total length without rhamphotheca for Imperial Woodpecker *Campephilus imperialis* and Ivory-billed Woodpecker *C. principalis*, using data from Table 1.

kindly also supplied length and width measurements for an additional *C. principalis* skull in their collection.

During this process we learned that the ZISP specimen comprises only a skull, including a detachable rhamphotheca (Fig. 3), and subsequently JW & RPP-J were able to visit ZISP to study it further. The skull length of this specimen with its rhamphotheca was 17.7% longer than when measured without, adding confidence to the correction factor derived from X-raying NHMUK skins. The skull length measurements provided for the two AMNH skeletons alone included the rhamphotheca, so a correction based on the NHMUK skin X-ray results outlined above was made to these to derive estimates for skull length without rhamphotheca, comparable to the rest. Finally, in order to enhance the still limited sample for skull measurements, we further made use of the X-ray results from the four NHMUK skins.

Table 1 compares an array of cranial and post-cranial skeletal measurements derived from the unidentified NHMUK skeleton, from the available identified skeletons and skulls, and from X-rays of the four NHMUK skins. The post-cranial elements from the unidentified NHMUK skeleton are uniformly comparable in size to those of *C. imperialis* and unambiguously larger than those of *C. principalis*. The skull measurements are less clear-cut (Table 1, Fig. 4), with skull width approximating that of the largest *C. principalis* and total skull length falling between the ranges of the two species. Overall, given the post-cranial findings, the evidence strongly supports identification of the unidentified NHMUK skeleton as a relatively small, possibly female, *C. imperialis*. Henceforth, we therefore refer to it as the NHMUK *C. imperialis* skeleton.

A further striking conclusion from Fig. 4 is that both the length and width of the skull ZISP 1791, which lacks any associated data, are firmly embedded with those of our skeletal sample of *C. principalis* and indicate that it must be this species and not *C. imperialis*.

TABLE 1

Measurements (in mm) of specimens of Imperial Woodpecker *Campephilus imperialis* and Ivory-billed Woodpecker *C. principalis* in the collections of NHMUK, AMNH, MCZ, USNM and ZISP, compared to the unidentified NHMUK skeleton. Abbreviations: Cmc, carpometacarpus; Fe, femur; GW, max. width; Hu, humerus; Sk, skull; Skr, skull with ramphotheca; Tbt, tibiotarsus; TL, total length; Tmt, tarsometatarsus; Ul, ulna. Bracketed measurements were derived measurements using a conversion factor obtained from X-rays (see text for details).

	Unidentified	<i>C. imperialis</i>					<i>C. principalis</i>					
Registration	NHMUK	NHMUK 1898.3.10.2487	NHMUK 1898.3.10.2486	USNM 344441	AMNH 1081	ZISP 1791	NHMUK 1898.3.14.875	USNM 291358	AMNH 4708	MCZ 342302	MCZ 347308	MCZ 342397
Sex	unsexed	female	male	male	unsexed	unsexed	female	male	male	unsexed	unsexed	unsexed
Preparation	skeleton	skin ^a	skin ^a	skeleton	skeleton	skull	skin ^a	skeleton	skeleton	skeleton	skeleton	skull
Skr TL	[123.5]	129	137.3	–	130 ^b	105	112.1	–	120	–	–	–
Sk TL	105.3 ^b	111	117	114	[110.8]	89.2 ^b	95	97.8	[102.3]	91	84.6	82.3 ^b
Sk GW	37.4	41.8	40.3	39.3	39.2	32.6	35.7	36.2	37.5	32.5	31.5	31.4
Hu TL	69.4	–	–	72.5	72.9	–	–	60.1	58	56.7	56.3	–
Ul TL	85.7	–	90	88.3	88.1	–	75	71.9	70.9	68.5	69.6	–
Cmc TL	42.6	44	45	42.6	43.2	–	36	36.1	34.3	35.2	33.8	–
Fe TL	55.3	–	–	56.3	57.2	–	–	47.4	47	46.3	44.4	–
Tbt TL	71.5	–	76	74.6	74.8	–	65	63.2	60.8	60.4	60.4	–
Tmt TL	48.4	50	50	50.8	50.7	–	46	45.7	43.5	42.7	41.3	–

^ameasurements taken from X-ray of study skin.
^bslight damage to bill tip.



Figure 5. Pelvis of the unidentified NHMUK skeleton, illustrating the two different registration numbers inscribed on the same part (Harry Taylor, © Natural History Museum, London)

Although it was noted during examination of the specimen that its bill tip had some minor damage, even with the rhamphotheca in place its total skull length (105 mm) indicates it cannot be a *C. imperialis* (Table 1).

Labelling, not original, in the box of the NHMUK *C. imperialis* skeleton states that receipt was from Henry Seebohm but, most unusually, two different NHMUK registration numbers are inked on an overlapping selection of the skeleton's elements. Whereas the skull is labelled as 1896.2.16.12, the mandible is inscribed 1888.2.20.1 (Fig. 1), and the pelvis has both of these numbers written on different parts of it (Fig. 5)! The skull and mandible, despite bearing different numbers, clearly belong to the same specimen, as is the rest of the skeleton, of which parts remain articulated. This apparent double registration of one specimen clearly required further investigation.

The relevant register reveals that specimen 1896.2.16.12 is indeed recorded as a skeleton of *Picus* sp., contained in a batch of avian osteological specimens (1896.2.16.1–230) bequeathed to NHMUK¹ by Henry Seebohm (1832–95) and received following his death in November 1895 (Sharpe 1906: 472). By contrast, 1888.2.20.1 is a number whose use was

¹ NHMUK has changed its name and acronym several times over its history, but for convenience is referred to by its current official acronym throughout this paper. A synopsis of the relevant name and acronym changes was presented by Prŷs-Jones *et al.* (2014).

erroneously duplicated in different NHMUK registers for two specimens: one is a skin specimen of '*Sylvia cinerea*' (= Common Whitethroat *Sylvia communis*), received as part of a series of 971 turdid and sylviid skins (1888.2.20.1–971) in the Tweeddale collection (Sharpe 1906: 446); the other refers to a skeleton of a '*Tiga* sp.' woodpecker (= Common Flameback *Dinopium javanense*), which is alone in its series and lacks details regarding from whom it was acquired. The woodpecker skeleton would *prima facie* appear more likely to be relevant here, but still makes little sense. Firstly, *Dinopium* are distinctly smaller than *Campephilus*, so confusion is unlikely; furthermore, the hallux is either reduced in size or completely lacking in *Dinopium*, but not in *Campephilus*. Secondly, in the comprehensive specimen listing by Hargitt (1890), only a single '*Tiga*' skeleton is noted (on p. 416) as being present at NHMUK, and this is accounted for by the still extant specimen 1850.8.15.76 of what is now *Dinopium javanense* purchased from the dealer Warwick. Neither a skeleton of a '*Picus* sp.' with registration number 1896.2.16.12 nor one of a '*Tiga* sp.' with registration number 1888.2.20.1 is currently present in the NHMUK collection, and we have found no other evidence relating to either of them.

Hargitt (1890: 466), however, did indicate that a single skeleton of a female *C. imperialis*, collected at La Ciudad, Durango (see Salvin & Godman 1888–1904: 445, for clarification of locality) and purchased from A. Forrer, was received by NHMUK in or before 1890. Unfortunately, this catalogue does not include specimen registration numbers, but a search of relevant registers revealed that a *C. imperialis* skeleton with these data was registered in September 1886, but with a number, 1886.9.9.1, different from either inscribed on the NHMUK *C. imperialis* skeleton! However, there is no indication of any skeleton of this species being recognised as present in the more recent NHMUK catalogues of Blandamer & Burton (1979) and Knox & Walters (1994).

Reference to the NHMUK archives revealed correspondence showing that in 1882 Alphonse Forrer had indeed collected two *C. imperialis* specimens near the village of Ciudad in the sierra of Durango, Mexico, that he made into skeletons, and which he then offered in early 1886 to NHMUK at £5 each (A. Forrer *in litt.* 19 January 1886; DF200/29/118–119). A subsequent letter confirms that one of these was purchased by NHMUK in the same year (A. Forrer *in litt.* 19 April 1886; DF200/29/121). There is therefore no reasonable doubt that NHMUK formerly held a Forrer *C. imperialis* skeleton.

Alphonse Forrer (1836–99) was born in London and studied languages in Switzerland before his emigration to the USA, where he participated in the American Civil War, siding with the North. After the war, he earned his living as a naturalist and collector, visiting at least western North America in 1880, the Tres Marias Islands in 1881, and mainland western Mexico in 1882 (Breninger 1899, Salvin & Godman 1888–1904, Sharpe 1906). Thus, after decades of political turmoil there lasting from the 1840s until about 1880 (Brown & Clark 2009), Forrer was among the first collectors to visit Mexico and obtain specimens of *C. imperialis* since the 1830s (Sharpe 1906: 368, Prŷs-Jones 2011).

According to Sharpe (1906: 353), the first series of Forrer's Mexican bird collections was obtained by F. D. Godman; this included a pair of *C. imperialis* skins collected in January (no year on label), passed to Godman in 1882 and which subsequently formed part of the great Godman and Salvin donation of Neotropical birds to NHMUK from 1885 (Sharpe 1906: 366). However, Edward Hargitt, who specialised in the study of the Picidae, also acquired a pair of Forrer's *C. imperialis* skins collected on 15 February (no year on label) that NHMUK purchased along with more than 1,800 of his other woodpeckers in 1897 following his death (Sharpe 1906: 380). Moreover, two additional skins of *C. imperialis* collected by Forrer are in the collections of the Natural History Museum, Vienna (Snyder *et al.* 2009; H.-M. Berg *in litt.* 2020), and the Senckenberg Museum Frankfurt am Main holds yet another (SMF 32083) that

was also collected by Forrer at La Ciudad, in Durango, on 15 February (year missing) and acquired from him by Count Berlepsch in December 1882 (G. Mayr *in litt.* 2020). However, no information appears to be available concerning the fate of Forrer's second *C. imperialis* skeleton mentioned in his 1886 correspondence with NHMUK; in this context, USNM and AMNH acquired their skeletons from other sources (Snyder *et al.* 2009, AMNH 2020). As a naturalist who made his living from collecting, very probably Forrer sold this valuable specimen during his lifetime, although on his death in California on 15 March 1899 he retained a substantial residual collection that was shortly thereafter put up for sale by his wife (Barlow 1900, Forrer 1900).

What then can we conclude regarding the identity and provenance of the hitherto unidentified NHMUK skeleton under discussion? First, we are confident that it is a skeleton of *C. imperialis*, one of only three currently known of a now extinct species. Second, we believe that on balance of probability it is extremely likely to be the otherwise missing Forrer skeleton 1886.9.9.1. The multiple documentation confusions that clearly occurred historically concerning this important specimen are quantitatively particularly egregious, especially in light of its rarity, but in our experience qualitatively by no means unique.

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