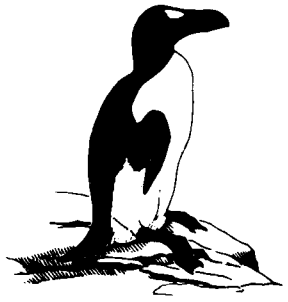

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RELIC OF A LOST WORLD: A NEW SPECIES OF SUNANGEL (TROCHILIDAE: *HELIANGELUS*) FROM "BOGOTÁ"

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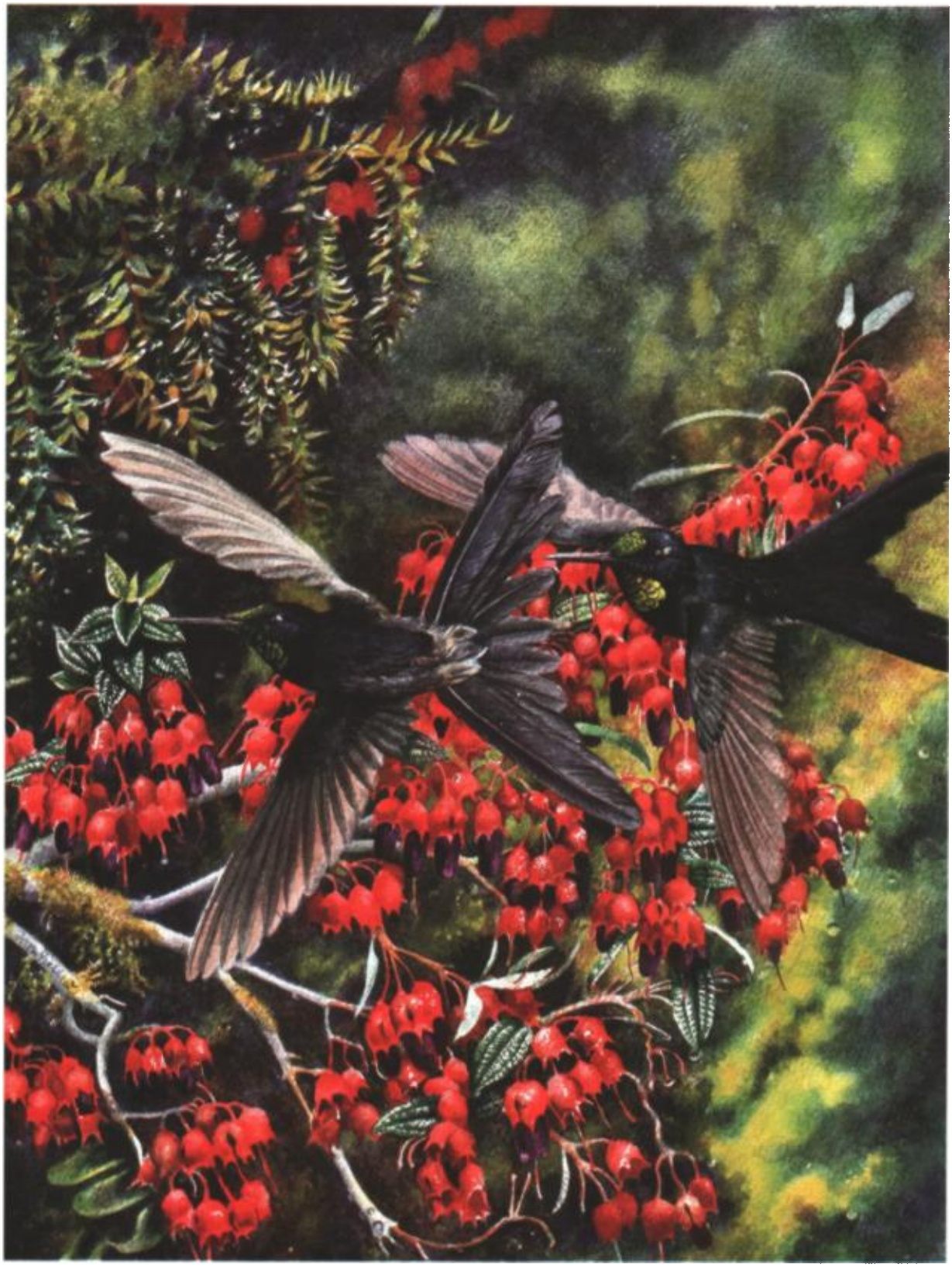
ABSTRACT.—A new species of hummingbird, the Bogotá Sunangel (*Heliangelus zusii*), is described from a unique specimen purchased in 1909 in Bogotá, Colombia. *Heliangelus zusii* is intermediate in plumage between ungorgeted *H. regalis* and the typical gorgeted species in the genus. Now possibly extinct because of habitat destruction, *H. zusii* may have inhabited cloud forest and forest edge in the Eastern Cordillera of the Colombian Andes. *Received 10 April 1992, accepted 6 July 1992.*

FUELED BY the demands of a fashion-conscious public, millions of hummingbirds destined for the millinery trade in Europe and the United States were exported from South America before bird protection laws were passed in the early 20th century. The staggering size of these shipments can hardly be overemphasized. One London auction house alone sold 152,000 hummingbirds between 1904 and 1911 (Doughty 1975), a figure that undoubtedly exceeds the number of hummingbird specimens now housed in the world's museums.

As expected, commerce in avian plumage had a profound effect on science. The golden age of hummingbird taxonomy and systematics was attained much earlier than in other Neotropical bird families (Gould 1861). More than a quarter of all hummingbird species were described during the 1840s and, by 1890, more than 91% had been discovered (Table 1). By comparison, only 73% of all antbird species were described by 1890. As the rate of discovery declined (1860–1895), systematics scoured imports for rarities and described dozens of new trochilid taxa from specimens labeled "Bogotá," Colombia, some of which were actually taken elsewhere. Many of these have now been determined to be hybrids, genetic plumage variants, artifacts, or subspecies of previously described species (e.g. Taylor 1909, Simon 1921, Berlioz and Jouanin 1944, Greenway 1978, Graves 1990). A tantalizing few (e.g. Isaacson's Puffleg, *Eriocnemis isaacsonii* [Parzudaki] 1845) may represent valid species, possibly surviving in some ornithologically unexplored locality or perhaps extinct.

In 1947, Brother Nicéforo María sent a spectacular fork-tailed hummingbird purchased in Bogotá in 1909 to Rudolphe Meyer de Schauensee at the Academy of Natural Sciences of Philadelphia (ANSP) for identification. After receiving the specimen, Meyer de Schauensee asked several of his colleagues to examine the specimen (literature among the archives of ANSP). Although there was little agreement among the correspondents, their ideas constitute some important hypotheses concerning the identity and origin of the specimen.

James L. Peters (in litt., 10 April 1947) wrote,



Frontispiece. Aerial pursuit of male Bogotá Sunangels (*Heliangelus zusii* sp. nov.) above flowering *Brachyotum microdon*, a common melastome in the Eastern Cordillera of the Colombian Andes. Painting by Jon Fjeldså.

TABLE 1. Number of hummingbird and antbird (Thamnophilidae and Formicariidae) species described as new to science by decade (taxonomy of Sibley and Monroe 1990).

Decade	Species	
	Hummingbirds	Antbirds
1750	13	0
1760	5	3
1770	0	1
1780	15	13
1790	1	0
1800	3	1
1810	15	9
1820	26	24
1830	47	14
1840	87	15
1850	33	44
1860	21	33
1870	14	11
1880	11	10
1890	9	8
1900	3	19
1910	4	7
1920	2	12
1930	1	5
1940	2	2
1950	2	3
1960	2	1
1970	2	1
1980	1	7

"Assuming your bird to be a hybrid, one of the parents is probably one of the Colombian purple-tailed forms of *Aglaiocercus*; the shape of the bill, color and general shape of the tail and luminous plaques on forehead and throat could quite conceivably result from a union between *Aglaiocercus* and some form of *Heliangelus*, but in such a case I should expect the body plumage of the product to be green.... Now what ♂ crossed with a ♀ of predominately green coloration (or vice versa) would produce a steel-blue offspring? Damned if I know. If *Helianthea* [*Coeligena*] *prunellei* is involved I should expect a longer billed result at least; *Eriocnemis nigrivestis* can be dismissed as a geographic impossibility. Suppose *Neolesbia* to be distinct, should not the resultant product have at least a slightly decurved bill?... It's all very puzzling and I am afraid I haven't been any help."

Meyer de Schauensee (in litt., 19 May 1947 to Alexander Wetmore) reported the observations of John T. Zimmer of the American Museum of Natural History, "Zimmer saw it and thought it could possibly be a hybrid between *Aglaiocercus kingi* and *Heliangelus squamigularis*."

Finally, Alexander Wetmore (in litt., 5 May 1947) wrote, "I have never seen a bird like it.... I am inclined to doubt any hybrid origin for this bird, on the contrary I would suppose that it is a specimen of an unknown species.... If I were planning a description of this specimen I would compare it closely with *Agelaiocercus* [sic] to determine whether it should be placed in that genus or named as a distinct genus."

Meyer de Schauensee (1947:113) concluded, "Were it not for the fact that I have examined *Metallura purpureicauda* and *Zodalia thaumasta* and found them to be virtually identical in coloration and pattern, but differing in the shape of the bill, I would not hesitate to describe Brother Nicéforo's bird as a new species and perhaps even a new genus. However, there are so many points of similarity between our specimen and *Neolesbia* that without seeing the type it seems the wisest course to identify it as a third example of *Neolesbia*. It should be noted that both the type and the American Museum specimen have longer bills (19.25, 17 mm) than ours (15.5)."

Recently, Hinkelmann et al. (1991) reaffirmed the identification of the ANSP specimen as an example of the problematic Nehrkorn's Sylph (*Neolesbia nehrkorni*), which they judged to be a hybrid between the Long-tailed Sylph (*Aglaiocercus kingi*) and the Fork-tailed Woodnymph (*Thalurania furcata*). Here I present evidence that the hybrid origin of Brother Nicéforo's specimen can be rejected and that it does indeed represent an undescribed species.

MATERIALS AND METHODS

I compared the specimen (ANSP 159261) directly with all hummingbird taxa in the ANSP and National Museum of Natural History, Smithsonian Institution. Detailed notes and color transparencies of the specimen (Fig. 1) were compared with the trochilid collections of the Museum of Natural Sciences, Louisiana State University and the American Museum of Natural History (AMNH), including a specimen with a molting tail, provisionally identified as *Neolesbia nehrkorni* (AMNH 484177), the type of which cannot now be found (Hinklemann et al. 1991). The specimen was compared with the description and color plate of *Neolesbia nehrkorni* (Berlepsch 1887), and color transparencies of a specimen in the Museum Heineanum Halberstadt, Germany (courtesy of B. Nicolai), that was recently identified as *N. nehrkorni* (Hinkelmann et al. 1991). All color comparisons were made under Examolites (Macbeth Corporation). Descriptions of structural colors are unusually subjective and actual

Fig. 1. Dorsal, ventral, and lateral view of holotype of *Heliangelus zusii*.

color varies with angle of inspection. For this reason I use general color descriptions throughout.

Measurements of wing chord, bill length from anterior edge of nostril, and rectrix length from point of insertion of central rectrices to the tip of the longest rectrix of each pair (from innermost to outermost), were made with digital calipers to the nearest 0.1 mm. Measurements of the Heineanum Halberstadt specimen of *Neolesbia nehrkorni* were provided by B. Nicolai. Diagnostic assumptions and methods of hybrid diagnosis based on plumage characters and morphology follow Graves (1990).

Heliangelus zusii sp. nov.
Bogotá Sunangel

Holotype.—Academy of Natural Sciences of Philadelphia, No. 159261; adult (♂ ?); purchased in Bogotá, Colombia in 1909 by Brother Nicéforo María.

Diagnosis.—*Heliangelus zusii* is a dark bluish-black hummingbird with a deeply forked, dark purple tail, brilliant green frontlet and gorget, and straight bill (see frontispiece). It differs from *H. regalis* in having a frontlet and gorget, a purplish rather bluish-black tail, and pale rather than bluish-black undertail coverts. Other species of *Heliangelus* have green or bronzy-green body plumage and violet, purple, or orange gorgets. *Heliangelus zusii* differs from *Neolesbia nehrkorni* in having a gorget and frontlet, purple rather than bluish-black tail, and a straight rather than decurved bill.

Generic relationships.—The new species can be assigned to the genus *Heliangelus* by a combination of characters (Figs. 1 and 2): (1) short (15.1 mm), straight, unmodified, uniformly dark bill; (2) brilliant frontlet and gorget; (3) unmodified remiges; (4) unmodified rectrices, flat in cross section; (5) lack of puffy tarsal plumes (present in *Eriocnemis* spp.); and (6) nonbrilliant undertail coverts (brilliant in most *Eriocnemis* spp.). *Heliangelus zusii* appears to bridge the gap between males of the ungorgeted, bluish-black *H. regalis* and the more typical members of the genus with contrasting gorgets and predominately green body plumage.

Description of holotype.—Taxidermy mount with glass eyes. Nasal feathers, lores, auriculars, and margins of crown are glittering steel-blue. A brilliant pale golden-green frontlet extends from the forecrown posteriorly to an imaginary line drawn between the centers of the orbits. Feathers of the frontlet are adpressed as in *H. exortis*. Nasal feathers extend 0.85 mm distal to the anterior edge of the nasal flanges. Traces of a white spot are found posterior to the eyes. The hindneck, back, and wing coverts are deep bluish-black, slightly iridescent, turning deep greenish-blue on the lower back and rump and returning to bluish-black on the upper tail coverts. Primaries and secondaries are dark brown with a purplish tint. Secondaries have acuminate rather than broadly rounded tips. The deeply forked tail (fork 54% of length) is glittering dark purple above, duller and less iridescent on the lower surface. Basal portions of the rectrices, obscured in the folded tail, are the same color as the exposed distal tips (unlike species of *Aglaiocercus* and *Lesbia*). Shafts of rectrices are dark brown distally, fading to light brown basally. Rectrices are flat in cross section. The ventral plumage is duller than the dorsum. The chin is dull bluish-black, bordered posteriorly by a brilliant golden-green gorget (same color as frontlet). Gorget feathers have golden-green tips separated from the gray base by a narrow violet band. Gorget and frontlet feathers are broadly rounded rather than narrow or pointed. The gorget is bordered below and on the sides by lustrous bluish-black. When viewed head-on in direct light, the head and breast appear black and contrast greatly with the golden-green gorget and frontlet. Feathers of the upper breast are bluish-black with narrow buffy-gray margins, becoming progressively paler on the lower breast and belly. The midline of the belly is medium gray but faint traces of bluish-black can be observed on barbules under magnification. Sides and flanks are dark bluish-black (same as back). There are no traces of a pectoral band or subterminal white spots on breast feathers (present in some *Heliangelus* hybrids; Graves 1990, Graves and Zusi 1990). Undertail coverts are pale creamy-white with a single lanceolate, subterminal spot at the midline (brownish-gray with blue reflections). Tibial feathers are dull grayish-brown. The tarsi are now bare (formerly feathered?). Soft-part colors in dried specimen: bill black; scutes on feet brown; foot pads yellowish-brown.

Measurements (mm).—See Table 2 for standard measurements. Greatest width of outermost rectrices, 9.2. Gorget length × width, ca. 14 × 10.

Sex, age, and molt.—Although the sex of the holotype is not known with certainty, all plumage characters resemble components of male plumage in *Heliangelus* species. The fully developed gorget and frontlet, unstriated maxillary ramphothecum, and lack of molt in the holotype indicate that it is an adult.

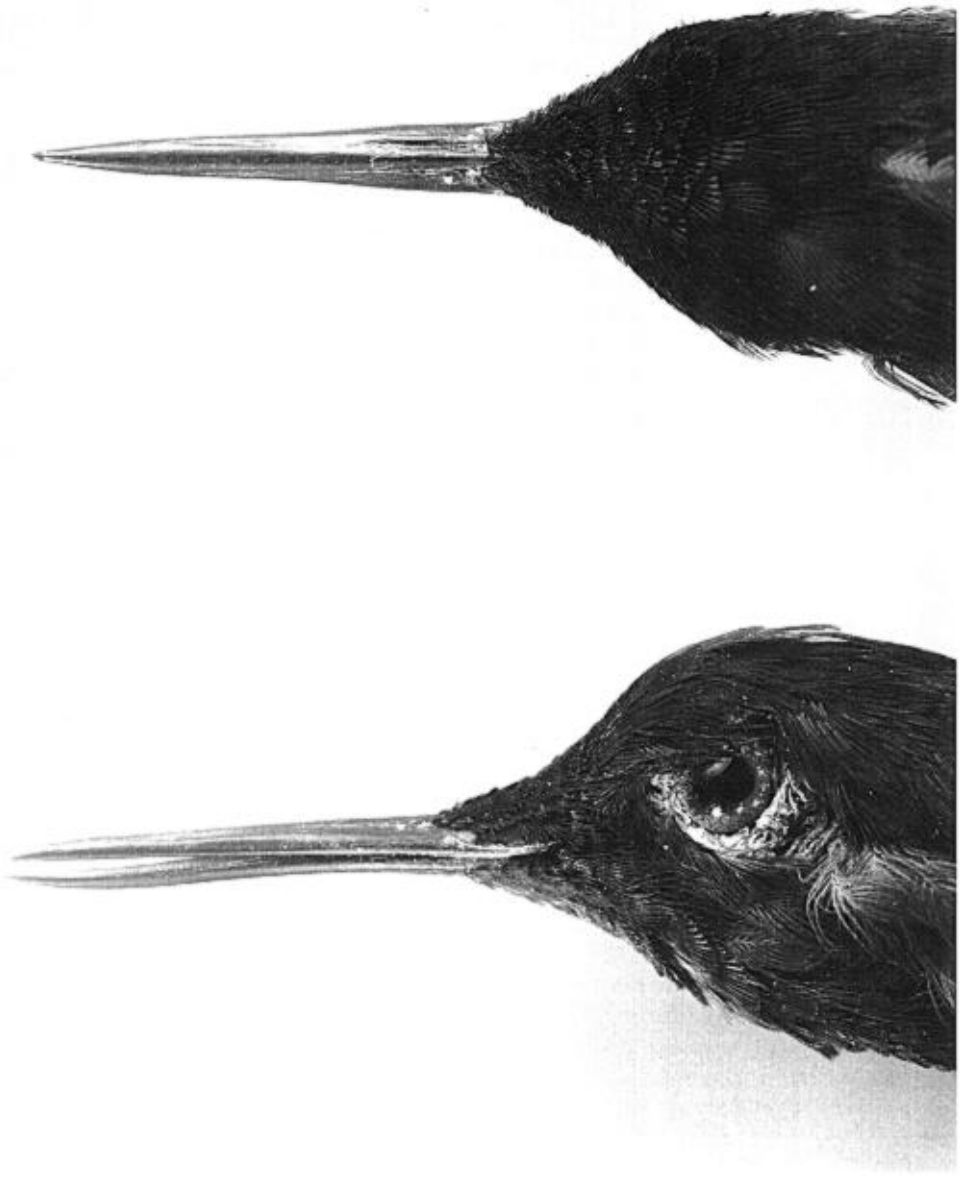


Fig. 2. Dorsal and lateral view of head and bill of the holotype of *Heliangelus zusii.*

Distribution.—Origin and range unknown. See discussion.

Etymology.—I take great pleasure in naming this hummingbird for my friend and colleague, Richard L. Zusi, in recognition of his contributions to the systematics of hummingbirds. The English common name commemorates the nominal origin of *Heliangelus zusii* and many other Andean species.

Discussion

Because *H. zusii* is represented by a unique specimen, extraordinary care must be taken to

TABLE 2. Measurements (mm) of holotype of *Heliangelus zusii* and Heineanum Halberstadt specimen of *Neolesbia nehrkorni* (courtesy of B. Nicolai).

Characters	*Heliangelus zusii*	*Neolesbia nehrkorni*
Wing	66.8	63.5
Bill	15.1	18.0
Rectrix 1 (innermost)	30.1	25.5
Rectrix 2	36.6	30.5
Rectrix 3	45.7	37.5
Rectrix 4	56.2	50.5
Rectrix 5 (outermost)	64.8	66.5

rule out or reject alternate taxonomic hypotheses. Below I address the possibility that the specimen represents: (1) *Neolesbia nehrkorni*; (2) a genetic variant or undescribed subspecies of some other species; (3) a hybrid; or (4) an artifact.

Neolesbia nehrkorni?—As noted in the diagnosis, *H. zusii* differs from *H. nehrkorni* in having a brilliant gorget and frontlet. Could *H. zusii* represent the mature male plumage of *N. nehrkorni*? Several factors argue against this being the case. *Neolesbia nehrkorni* (wing, 63.5, tail 67.5; Berlepsch 1887) is approximately the same size as *H. zusii* (wing, 66.8, tail 64.8). Because tail length is correlated with age in males of long-tailed hummingbirds (e.g. *Aglaiocercus* spp.), one would expect the type specimens of *N. nehrkorni* and *H. zusii* to be roughly the same age. Yet, *N. nehrkorni* lacks a brilliant gorget and frontlet, characters that are acquired at maturity in *Heliangelus* and are present in *H. zusii*. Significantly, the bill of *N. nehrkorni* is slightly decurved as opposed to straight in *H. zusii* (Berlepsch 1887). Although intraspecific variation in bill curvature in hummingbirds has not been studied, I know of no example where bill curvature varies with age.

Heliangelus zusii and the Heineanum Halberstadt specimen of *N. nehrkorni* also differ significantly in body proportions (Table 2). Despite having a longer wing, *H. zusii* has a shorter bill and less deeply forked tail; the rectrices of *H. zusii* are more evenly graduated in length.

In sum, *H. nehrkorni* and *H. zusii* do not represent different age classes of the same taxon. Discussion of the systematic status of *N. nehrkorni* will appear elsewhere (Graves in prep.).

Genetic plumage variant or undescribed subspecies?—Plumage color polymorphism and melanism, uncorrelated with size and shape variation, has been documented in a number of trochiline species (Hartert 1922, Greenway 1978, Bleiweiss 1985). Because of its unique size and shape (e.g. forked tail, straight bill, etc.), *H. zusii* could not represent a simple genetic plumage variant of another species.

I also considered the possibility that *H. zusii* represents a well-differentiated allopatric form of the ungorgeted Royal Sunangel (*H. regalis*). *Heliangelus zusii* is larger in all dimensions (ca. 25% in wing and tail length) than *H. regalis*. This difference exceeds the magnitude of geographic size variation found within sexes of other species of *Heliangelus* (Bleiweiss 1985; pers. observ.). Significantly, no *Heliangelus* species (males) has "gorgeted" and "ungorgeted" populations or subspecies. Because the differences between *H. zusii* and *H. regalis* are both qualitative (see diagnosis) and quantitative, I believe the two taxa are more genetically differentiated than are many of the component taxa of Andean superspecies (Graves 1980, 1985, 1991).

Hybrid?—Determining whether a unique specimen represents a hybrid or a valid species can be very difficult depending on the circumstances (Graves 1990). Complicating this particular case is the fact that the precise origin of *H. zusii* is unknown. For the purpose of hybrid diagnosis (Graves 1990), the species pool must include all trochiline hummingbird that occur in Colombia, about 120 species (Hilty and Brown 1986). However, the task of determining whether *H. zusii* is a hybrid is simplified by its distinctive characters: (1) deeply forked tail; (2) straight bill; (3) brilliant gorget and frontlet; and (4) bluish-black body plumage.

In correspondence cited above, Peters and Zimmer suggested that *H. zusii* might represent a hybrid of *Aglaiocercus* sp. × *Heliangelus* sp. Several combinations of species from these genera could have produced a hybrid with a deeply forked tail, straight bill, and brilliant gorget and frontlet. However, no species in either genus, other than *H. regalis*, has bluish-black body plumage. Furthermore, *H. zusii* exhibits no traces of the peculiar awn-shaped bill, tapered rectrix tips, or bicolored rectices of *Aglaiocercus* spp. In conclusion, there appears to be no combination of species, considered two at a time, that collectively exhibit the characters of *H. zusii* and bracket its morphological dimensions (Graves 1990).

Artifact?—Many artifacts, specimens created from parts of two or more species, are known

among 19th century collections (pers. observ.). These were created for the amusement of the preparators or to dupe eager collectors of natural-history specimens. The possibility that *H. zusii* is an artifact was rejected after a careful examination of the feathers and skin under magnification (7–30 ×) and *x*-radiographs of the specimen. These procedures revealed no evidence of composite construction of the specimen.

Biogeography.—I speculate that the holotype of *H. zusii* originated from the Eastern Cordillera of the Colombian Andes within a few hundred kilometers of Bogotá, or possibly in the Central Cordillera. The fact that only a single specimen is known suggests that the species had a relictual or restricted geographic distribution when first collected. Sunangels (*Heliangelus*) inhabit Andean cloud forest and shrublands from 1,200 to 3,400 m elevation, a zone that has been largely deforested in the Eastern Cordillera for cultivation of coffee, maize, potatoes, and other crops (Chapman 1917, Instituto Geographico "Agustin Codazzi" 1982, Hilty 1985). Currently, only a single species of sunangel, the Amethyst-throated Sunangel (*H. amethysticollis*), occurs over most of the Eastern Cordillera; two others, the Orange-throated (*H. mavors*) and Tourmaline sunangels (*H. exortis*), have restricted distributions (Hilty and Brown 1986). Although the likelihood that *H. zusii* still survives seems remote, efforts should be made to find it in remnant patches of forest, including second growth, on both slopes of the Eastern Cordillera between 1,400 and 2,200 m. If extinct, *H. zusii* would be the first such instance for a hummingbird species in South America. The only other species of hummingbird that is suspected of being extinct is *Chlorostilbon bracei*, the endemic emerald of New Providence Island, Bahamas (Graves and Olson 1987).

The effects of commercial collecting on 19th-century hummingbird populations in Colombia are unknown, but nearly all species with historically large geographic ranges (>30,000 km²) are common today in pristine habitats (Hilty and Brown 1986). This suggests that habitat destruction, rather than intensive collecting, is the principal threat to most hummingbird species (see Hilty 1985). For example, the Black Inca (*Coeligena prunellei*) was one of commonest species in "Bogotá" collections (Berlioz 1937). Regrettably, the species is known presently from only a few remnant patches of cloud forest in the Eastern Cordillera, where it is common (Snow and Snow 1980, Hilty and Brown 1986, J. Fjeldså in litt.). It, the Bogota Sunangel, and many other presently endangered species are relics of a lost world that existed in the Andes before the arrival of human civilization.

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COLOR PLATE

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