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IS THE PALM CROW, *CORVUS PALMARUM* (AVES: CORVIDAE), A MONOTYPIC SPECIES?

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Resumen. El Cao habita en la Isla de Santo Domingo (Haití y República Dominicana) y en Cuba, donde se le encuentra en aisladas localidades. Diversos tratamientos han considerado las dos formas Antillanas bajo diversos status taxonómicos como: dos especies; subespecie de *Corvus brachyrhynchos*; subespecie de *C. ossifragus*; y como razas geográficas, *C. p. palmarum* en la Isla de Santo Domingo y *C. p. minutus* en Cuba. Se compararon pieles de estudio de Cuba y la Isla de Santo Domingo, procedentes de varias instituciones norteamericanas y cubanas. Se expone una tabla con los datos merísticos convencionales en milímetros de: corbatura del ala (aplastada contra la regla), cola, tarso y culmen expuesto y ancho del mismo en su base. En base a las medidas obtenidas, y a las descripciones de colorido expuestas por otros autores, concordamos en que las poblaciones cubanas son ligeramente menos lustrosas, y con los tarsos más largos, especialmente en los machos. Las vocalizaciones de ambas formas son comparadas por primera vez y muestran ser diferentes. La voz del Cao de Santo Domingo ha sido comparada con la del Cao nativo *C. leucognaphalus*, y en Cuba con la de *C. nasicus*, pero no se han hecho comparaciones sobre las vocalizaciones de las dos islas. Nuestras grabaciones muestran que sus voces son diferentes, como lo demuestran los sonogramas, y las grabaciones en dos albums, Cantos de Aves en la República Dominicana (1981), y Cantos de Aves en Cuba (1988), publicados por el Laboratorio de Ornitología de Cornell. En las aves de Santo Domingo las frases son cortas, ca. 3 segundos, emitidas rápidamente, con una cadencia de subida y bajada abrupta y en staccato, y con cierto dejo "como de queja". En Cuba, es más larga, con las frases durando. 6 segundos, emitidas más despacio, y con una elevación inicial abrupta y de un sonido diferente, tonalidades corroboradas en las estructuras mostradas en los sonogramas. Todos estos hallazgos sugieren que el Cao se considere de nuevo como su estatus original de dos especies diferentes. *Corvus palmarum* en Haití y República Dominicana, y *Corvus minutus* en Cuba. Hemos considerado las vocalizaciones de diversas especies de cuervos norteamericanos, para tratar de percibir el posible orígen de las dos formas Antillanas. No se hallaron en los sonogramas indicios de conección con las aves de Santo Domingo; pero los sonogramas de Cuba, mostraron una estructura similar al *C. brachyrhynchos* y al de Sinaloa *C. sinaloae*. Los sonogramas de *C. ossifragus* no mostraron similitud alguna con las dos especies Antillanas.

Abstract. The Palm Crow, inhabits Hispaniola and Cuba where is represented by very few scattered populations. Taxonomic treatments have included the status: as two species; as a subspecies of the American Crow (*Corvus brachyrhynchos*); a subspecies of the Fish Crow (*C. ossifragus*) and as *C. palmarum* in Hispaniolan, with the population in Cuba as a subspecies (*C. p. minutus*). Skins of these forms deposited in different Cuban and North American museums and institutions were compared. Conventional measurements (wing, tail, culmen, and tarsus) of populations from the Dominican Republic, Haiti and Cuba are given in Table 1. According to the meristic data, we agree with some other authors that Cuba population have a slightly longer tarsus especially in males. Also they are practically devoid of the lustrous violaceous sheen. Birds from Hispaniola have reported to do a "tail-flicking" movement not observed so far in Cuban birds. Published accounts of the voice in Hispaniola have been compared with those of the native White-necked Crow (*C. leucognaphalus*) and in Cuba, with that of its native Cuban Crow (*C. nasicus*), but we have found no reports comparing Palm Crow interisland vocalizations. Our tape recordings now show their voices are distinctly different, as documented by sonograms and in two record albums, Bird Songs in the Dominican Republic (1981) and Bird Songs in Cuba (1988). In Hispaniola, the phrases are short, ca. 0.3 sec repeated in quick succession, with a rising-falling pitch, harsh and staccato, and with a somewhat "complaining" quality. In Cuba, the longer (0.6) s phrases are slower in delivery, have an abrupt, initial rise in pitch, and different sound quality, confirmed in different harmonic structure shown in the sonograms. We considered vocalizations of several North American *Corvus* species for possible leads in the ancestry of the two islands populations. No connections to the sonograms from Hispaniola were found, but the sonograms from Cuba had a similar structure to sonograms of the American Crow, and the Sinaloa Crow (*C. sinaloae*). Sonograms of the Fish Crow were not like either of the two Palm Crow populations. All the above findings suggests that the Palm Crow should be returned to the two-species status, *Corvus palmarum*, the Hispaniolan Palm Crow, and *C. minutus*, the Cuban Palm Crow. *Accepted 4 June 1996.*

Key words: Corvus palmarum, *Palm Crow, vocalizations, morphology, taxonomy, Cuba, Hispaniola, Dominican Republic, Haiti.*

INTRODUCTION

The Palm Crow (*Corvus palmarum*) was described for the Caribbean Island of Hispaniola by the Duke of Württemberg in 1835. Seventeen years later, Gundlach (1852) described the Cuban population as *Corvus minutus*. Thereafter, the Palm Crow was treated inconsistently by subsequent authors as different species, subspecies, or even as a monotypic species.

Gundlach (1876: 105, 1893: 127) considered the Cuban form as a species different from the Hispaniola form (*palmarum*). Cory (1892: 110) also considered both taxa as different species, but used the name *solitarius* Württemberg, to treat the Hispaniolan populations. This name has eventually been relegated to synonymy. Wetmore & Swales (1931) reported that this name was also cited by Tippenhaver (1832) and Verrill (1909). Ridgway (1904), also considered both populations different, and interestingly, he did not compare these two populations with each other, but the Cuban *minutus* with a North American species. We do not know the reason why Ridgway did not make a comparison between the two West Indian forms. Possibly he may have been aware of their different calls.

Meinertzhagen (1926) made a systematic arrangement that was not followed by most of the subsequent researchers. He considered *palmarum* a race of *C. brachyrhynchos*. Barbour (1923: 106) considered *minutus* as a species, but latter (1943) he followed Bond (1936) considering the Cuban form as a subspecies. Wetmore & Swales (1931), Danforth (1929) and Lönnberg (1929) treated *palmarum* as a species. Wetmore & Swales (1931) made the most extensive revision up to that date after examining a discrete series of birds from Hispaniola. They pointed out some differences between both taxa, and considered Hispaniolan form as a different subspecies. Hellmayr (1934) also made a different systematic proposition not followed either by subsequent authors. He considered *C. palmarum* as a geographical race of *C. ossifragus*. Bond (1936: 270) considered the Cuban form *minutus* as a race of *palmarum*. Although he did not change his arrangement in 1947 or in his Check-list of Birds of the West Indies (1956: 119), in a later supplement (1964: 7), based on the revision of the group undertaken by Johnston (1961: 90—96), he considered these taxa conspecific. Mayr & Greenway (1962: 270) considered *C. palmarum* polytypic: *minutus* and *palmarum* were designated as races for Cuba and Hispaniola.

Garrido & García Montaña (1975: 87) followed Bond (1964), treating *C. palmarum* as a monotypic species. Lack (1976: 351), although he did not specifically say so, apparently recognized both races, since he gave measurements of wing length for both. The A.O.U. (1983), considers the species as monotypic. Most recently, Bond (1990), cites *Corvus palmarum* for Cuba and Hispaniola. Phillips (1986: 71) recognizes both races.

The latest mention of this species is made by Rea (*in* Phillips 1986: App. B: 213). Based on skin comparisons and morphological and anatomic characters, he refuted the previous recommendation of Meinertzhagen (1926) considering *C. palmarum* and *C. brachyrhynchos* conspecific, and that of Hellmayr (1934), considering *C. palmarum* and *C. ossifragus* also conspecific.

It is important to point out that in all previously citations, none of the authors were able to take into account comparisons based on vocalizations, since those of the Cuban form were only recently obtained by Reynard & Garrido (1988).

The main objective of this contribution is to determine if the differences in the metallic sheen of the plumage, tarsus length, and mainly different vocalizations of the Palm Crows in Cuba and Hispaniola, merit a specific status rather than a subspecific one.

MATERIALS AND METHODS

In Table 1 we provide the standard measurements of length of the wing chord (flattened), tail, tarsus and exposed culmen. Limited numbers of examples of culmen width are included because in some museums this measurement was not obtained. Tape recordings were made using Nagra III and Uher 1000 recorder models and sonograms prepared with Kay Elemetrics equipment. A "z" test was used to evaluate the meristic data from specimens examined during the study.

SYSTEMATIC COMPARISONS

Unfortunately, the skins of these two taxa are rather scarce, especially those from Haiti. Johnston (1961) was able to examine 89 skins and we have studied and measured 54 specimens. It is noteworthy that the Cuban Palm Crow is much rarer than its Hispaniolan counterpart. Cuban populations are found locally, in only two widely separated areas; one in the environs of Camagüey, in the province of Camagüey, and the other, in the northern slopes of Sierra de los Organos in the province of Pinar del Río (see Discussion). These sites differ in habitat one is predominantly pines, and the other is characterized by in semi-open areas in, slopes of hills in rural country.

No birds have been collected from the eastern part of Cuba during the past 69 years, and only two have been from La Manaja, near Matahambre, Pinar del Río (Watson and Ripley 1955).

Fermín Cervera collected a good series from Camagüey (deposited at Museum of Comparation Zoology at Harvard). These specimens have been compared with Pinar del Río's showing no significant variation in size or coloration.

Gundlach (1893), Ridgway (1904), Bond (1936, 1947) and Wetmore & Swales (1931) claim that Cuban birds are darker, with less lustrous violet suffusion, but Johnston (1961), who compared specimens of different ages and sexes, claimed that these differences are an artifact of age and season, and found practically no difference in coloration between populations in both islands. We have found these differences in our comparisons, especially with the birds from Haiti that are decidedly more lustrous than Cuban birds, mainly on the upper wing coverts and back. Therefore we disagree with Johnston (1961) in considering that these differences might be an artifact of age and season. On the other hand, Johnston found minor differences in the size of the bill (rather longer and thiner in Hispaniolan birds), differences not found by us whereas Cuban birds (especially the ♂) exhibit longer tarsi according to our analyses. Based only on these meristic variations, and having found no other differences in coloration, Johnston claimed that *Corvus palmarum* should be considered a monotypic species.

Our measurement data are quite similar to those obtained by Wetmore & Swales (1931: 330—331), from *Corvus* in Hispaniola. They showed ♂ with mean values as follows: wing 255.3 mm, tail 146.7 mm, and tarsus 50.6 mm; ♀, wing 246.6 mm, tail 146.6 mm, and tarsus 49.3 mm; all values within our Table 1 ranges.

TABLE 1. Data from *Corvus palmarum* specimens in Hispaniola (Dominican Republic and Haiti) and Cuba.

Locality	Measurements (mm) [$\bar{x}$, ±SD, (N), range]			
	Wing	Tail	Culmen	Tarsus
		♂		
Dominican Republic	247, 5.4, (8) 240—257	147, 8.2, (8) 153—158	42, 6.8, (8) 35—53	50, 2.3, (8) 46—54
Haiti	257, 5.4, (6) 251—264	148, 5.1, (6) 140—156	39, 2.5 (6) 34—42	51, 1.4, (6) 48—52
Cuba	252, 6.7, (15) 242—265	147, 4.3, (10) 140—153	40, 7.1, (10) 31—51	54*, 1.8, (15) 51—57
Dominican Republic	247, 11, (10) 231—266	146, 5.3, (10) 140—160	40, 7.1, (10) 31—51	50, 3.2, (10) 44—55
Haiti	251, 6.3, (8) 241—261	146, 4.8, (8) 140—154	35, 3.5, (8) 32—41	49, 2.1, (8) 47—54
Cuba	245, 8.3, (7) 232—258	139, 6.7, (7) 127—148	40, 5.8, (7) 30—48	51, 1.2, (7) 48—53

* In a "z" test, the only value significantly different at the 5 % level.

Their "culmen from base" values, ♂ 50.3 mm, and ♀ 46.5 mm, are not comparable with our "exposed culmen" values (Table 1). Our (at-base) culmen width data are nearly identical in Cuba and Hispaniola; 9 specimens from the former — mean 16.5 mm, range 15.2—17.7 mm, and from the latter, — 7 specimens, a mean of 16.7 mm, range 15.7—17.5 mm.

VOCALIZATIONS

We have not located any published information comparing the voice of the Palm Crow in Hispaniola with that of the Palm Crow in Cuba. There are several comparisons of its voice with that of the White-necked Crow (*Corvus leucognathalus*) in Hispaniola, and of the Palm Crow voice in Cuba with the voice of the Cuban Crow (*C. nasicus*).

Gundlach (1893) commented that the Cuban Crow's voice seemed to imitate that of humans, and sometimes sounded like screams of a flock of Parrots (*Amazona leucocephala*), but the Palm Crow voice might be described simply as "*á ra- ah.*" Barbour (1923) said the Cuban Crow "cackles and croaks", and the Palm Crow (known then as the Little Pine Crow), had a voice that "recalls that of the Fish Crow." Wetmore & Swales (1931) said the voice of the Palm Crow in Hispaniola was "less musical than that of the White-necked species . . . being a harsher caw, resembling the note of the North American Crow" (*C. brachyrhynchos*). Bond (1990), without reference to location, said the Palm Crow "Utters a harsh *craa-craa* reminiscent of North American Fish Crows or European Carrion Crows", (*C. corone corone*). Finally, Dod (1978) contrasts the comical "*culic calao calao*" of the white-necked Crow in the Dominican Republic with the simpler "*cao, cao*" of the Palm Crow, which is known locally as 'Cao'.

During bird-song recording trips to Haiti and the Dominican Republic, beginning in 1959, and to Cuba, beginning in 1977, it was found that the voice in Cuba was quite different from that in Hispaniola, both in Haiti and in the Dominican Republic. We have secured 8 tape recordings from Haiti, 13 from the Dominican Republic, and 3 from Cuba.

In Hispaniola, one of the recordings was made in a noisy flock in the mountains of extreme southeastern Haiti, 7 July 1961. This was in the Forêt des Pins area, at an elevation of ca 1100 m. A sonogram of one recording (Fig. 1A), includes 5 phrases of an 8 phrase series. The phrases were of short duration, ca 0.3 s, and were delivered at the rate of one phrase every 0.6 s. The sound was harsh and grating, more or

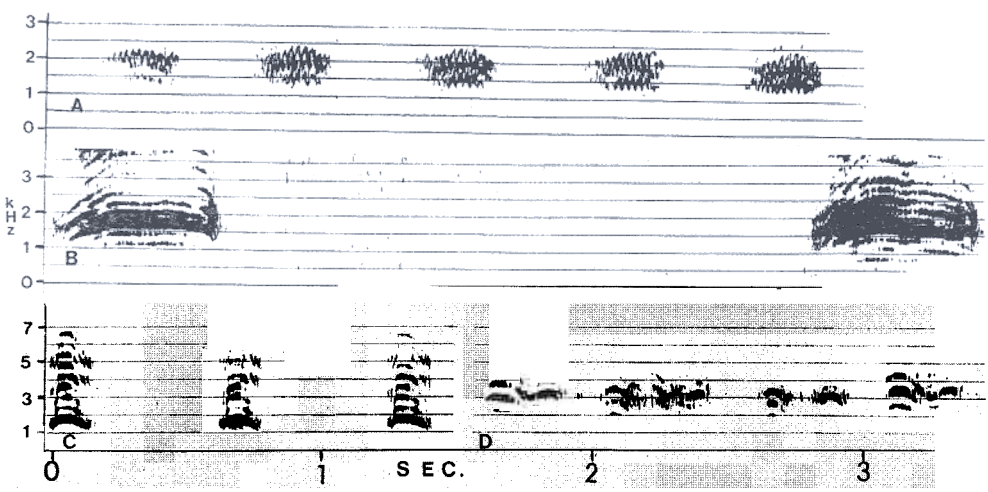

FIG. 1. Sonograms of *Corvus* vocalizations. A. Palm Crow in Hispaniola. B. Palm Crow in Cuba. C. Ameri can Crow in Florida. D. Fish Crow in New Jersey.

less of a 'complaining' quality, with a rising and falling pitch. It could be paraphrased as *'aaar'*, with the vowel sound as in the word 'fast'.

Recordings were made of a Palm Crow in another noisy flock, in the Najasa area of Camagüey Province, Cuba, 17 March 1984. This was also a harsh sound, but inspection of its sonogram (Fig. 1B), reveals many differences. The phrases were of longer duration, ca 0.6 s vs 0.3 s in Hispaniola. Delivery was slower in this series, averaging one phrase every 1.6 s, with a range of 1 per s to one every 2.8 s, the latter from the sonogram shown. These phrases were also distinguished from those in Hispaniola, by the initial, abrupt rise in pitch, before leveling off and falling slightly at the end of the phrase. As noted above, Gundlach (1876) apparently recognized this feature, as he included an acute accent over the initial vowel in his paraphrase, *"á ra-ah."* The voice also differs in having more evident harmonics, contributing to the different sound quality. We suggest the paraphrase 'craa-aao'.

The overall sound, differences in sonogram structure, phrase length and speed of delivery, support our conclusion that in these two populations, we have two, not one species.

As indicated earlier, several authors have suggested that Palm Crows were derived from the Fish Crow, or the American Crow, based on their vocalization characteristics. A sonogram of a typical *'caws'* of an American Crow, this one recorded in Florida (Fig. 1C), is different from that of the Palm Crow in Hispaniola (Fig. 1A), but does show some features of the sonogram from Palm Crows in Cuba (Fig. 1B). Each has a rising and falling, slurred phrase, and numerous harmonics. Evident, however, are the differences in phrase duration and speed of delivery.

The *'ca ha'* call of a Fish Crow, recorded in New Jersey, (Fig. 1D), has a sonogram different from each of the other sonograms in Fig. 1. It has paired-note phrases and a different spread of its ca 2—4 kHz harmonics. Hardy (1990 b) shows a sonogram of the common, single *'caw'* of a fish Crow, and it also is different from those of the Palm and Common crows here.

We have reviewed sonograms from other species of *Corvus*, including *C. imparatus*, the Mexican Crow, formerly called the Tamaulipas Crow, (A.O.U. 1991) and *C. sinaloae*, the Sinaloa Crow, in accounts by Davis (1958), Webber & Hardy (1985) and Hardy (1990 b). Their sonograms of the Mexican Crow voices were not similar to those of the Palm Crows in Hispaniola or Cuba. On the other hand, those from the Sinaloa Crow were like sonograms of the Palm Crow in Cuba, (Fig. 1B), each with rising and falling phrases and similar harmonics patterns. The average phrase length of the Sinaloa Crow, ca 0.33 s, was intermediate between that of the American Crow, 0.17 s, and the Palm Crow in Cuba, 0.6s.

We also reviewed published tape recordings of Mexican and Sinaloa Crow vocalizations by Hardy (1984, 1990 a) and by Coffey & Coffey (1989) to evaluate the speed of singing; i.e., the phrase delivery rate. The Sinaloa Crow averaged, from three song series, one phrase every 3 s, ranging from a phrase per s to one every 4 s. This was slower than that of the Common Crow (Fig. 1C) at 0.6 s, but similar to the 2.8 s rate in the example from a Palm Crow in Cuba, (Fig. 1B). Although these phrase lengths and speed of phrase delivery are from a limited number of examples, and each would certainly vary under various behavior situations (not studied), we felt them worth reporting.

Our findings to date gave no clues concerning the derivation of Palm Crows in Hispaniola, based on vocalizations, but they suggest 'vocalization grouping' for the Common Crow, Sinaloa Crow and the Palm Crow of Cuba.

DISCUSSION AND CONCLUSIONS

Our principal finding, in this study of Palm Crows in Hispaniola and Cuba, is the important and distinctive differences in their voices, determined audibly in the field, and in their sonograms. These differences do not reflect mere dialects, as may be in subspecies or races, but specific differentiation.

Vocalization differences between and among North American *Corvus* species, are not more pronounced than those found here between the two Palm Crow in Hispaniola and Cuba.

The information obtained, either by us or by other authors, tends to show that, regarding meristic measurements of conventional characters (wing chord, tail, tarsus and culmen), the Cuban and Hispaniolan populations of the Palm

Crow are similar, but not identical; the tarsus in males in Cuba is longer.

Although the lustrous sheen of the feathers could well be an artifact of age and season, as Johnston (1961) stated, in general, the Cuban birds are blacker and less lustrous with a violet sheen.

The holotype of *Corvus minutus* is completely black and absolutely devoid of any lustrous sheen, but it must be taken in account that this specimen is very old (about 150 years), although fairly well preserved. Some of the examined specimens display more sheen especially on the upperparts, but others look like the type.

Holyoak (1983: 82) has reported a peculiar "tail-flicking" movement in birds from Hispaniola that has not been observed so far among Cuban birds. "The tail was slowly raised to slightly above horizontal and then sharply flicked down to a position where it pointed downward about 45 degrees below the horizontal. The wing tips were slightly lowered throughout. The tail-flicks were seen to be given at short intervals during a long bout of cawing (but not in time with the calls) as well as by birds that did not call" (Holyoak 1983).

The main objective of this contribution is to elucidate the status between *palmarum* and *minutus*. Just like Lack (1976: 351), we agree with Johnston (1961) in that the crows provide another example of congeneric species replacing each other on different islands in the West Indies (Greater Antilles), but are derived from different mainland species, despite the fact of Johnston's contradiction to his own statement when he claimed that *Corvus palmarum* should be considered monotypic.

Therefore, *Corvus palmarum* Württemberg 1835 should be considered endemic to the Island of Hispaniola, inhabiting both countries, Haiti and Dominican Republic, where it is not rare. *Corvus minutus* Gundlach 1852, should be considered as endemic to Cuba, presently inhabiting only two regions of the Island. The actual distribution is: Tayabito, El Jardín, San Pablo, San Miguel, Jimaguayú, La Panchita, El Delirio and Santa Rosa, in the province of Camagüey, where it is quite rare; and El Francisco, La Manaja, Asiento Viejo, and Los Acostas in the northwestern part of Sierra de los Organos in the Province of Pinar del Río where it is even rarer. No birds from this province have been reported during the last 30 years despite a special search by the senior author during the 1970s.

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