



AN ANNOTATED LIST OF LATE QUATERNARY EXTINCT BIRDS OF CUBA

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Abstract · Within the Antilles, Cuba has a peculiarly diverse fossil avifauna. However, information on this avifauna is scattered among the specialized literature. Here I provide an updated annotated taxonomic list of the fossil birds from Cuba. This list includes 35 taxa, of which 17 are endemic, 12 actually extirpated, and 6 are undefined species identified only to genus level. The list is richly diverse in raptors with varied adaptations, including giant owls with limited flight and four large barn-owls, all with anatomical adaptations that suggest pronounced ground-dwelling. The raptor list includes five hawks, five falcons, and three vultures. There are also records of an egret, a stork, a crane, a snipe, and a nighthawk. Most species seem to have become extinct in Cuba, probably during the Late Holocene.

Resumen · Lista de la avifauna fósil de Cuba

Cuba tiene una avifauna fósil peculiarmente diversa. No obstante, la información taxonómica al respecto se encuentra dispersa en la literatura especializada. Se presenta aquí una lista actualizada sobre la taxonomía de la avifauna fósil de Cuba, reconociéndose 35 taxones extintos, incluyendo 17 endémicos y 12 taxones localmente extinguidos o extirpados y 6 taxones identificados solo al nivel de género. Entre la fauna extinguida conocida prevalecen las aves rapaces, incluyendo búhos gigantes, lechuzas y, un teratornítido con adaptaciones que indican capacidades nulas o limitadas de vuelo. Además, hay cinco gavilanes, cinco halcones y tres buitres. También se registran una grulla, una cigüeña, una garza, un alcaraván y otras aves que se han extinguido localmente, posiblemente durante el Holoceno tardío o periodo colonial.

Key words: Antilles · Extinction · Fossil birds · Insularity · Late Holocene · Late Pleistocene · Raptors · Teratorns

INTRODUCTION

Currently, the Cuban archipelago has a diverse avifauna comprising 371 recorded species within 20 orders and 60 families (Garrido & Kirkconnell 2000). Of these, six genera and 21 species are endemic to the archipelago (Garrido & Kirkconnell 2000, González 2012). Bird fossil and/or subfossil specimens indicate a diverse and unique extinct avifauna, whose remains are generally found in Late Quaternary deposits throughout the island. These avian assemblages are peculiarly diverse in endemic birds of prey, including large-sized species with ground-dwelling affinities, limited flight, and relatively large size. Oversized owls of the genus *Ornimegalonyx*, for instance, are among the world's largest strigids (Arredondo 1970, Garrido & Kirkconnell 2000).

Cuba's unique extinct bird fauna was first studied by Alexander Wetmore, who reported La Brea Stork (*Ciconia maltha*), Cuban Macaw (*Ara tricolor*), and Black-chested Buzzard-Eagle (*Geranoaetus melanoleucus*) from fossils found in the thermal baths, sinkhole deposits of Ciego Montero, in central Cuba (Wetmore 1928). Yet we owe the late Cuban paleontologist Oscar Arredondo de la Mata for laying the foundations in the study of the island's paleofauna by publishing over 134 scientific papers on fossil vertebrates between 1945 and 2001, on which he described 38 species, especially birds (Arredondo 2007: 152). His work has been continued and complemented by the efforts of Jiménez (1997, 2001), Jiménez & Arrazcaeta (2008, 2015); Suárez (2000a, 2000b, 2000c, 2004a, 2004b, 2004c), and Suárez & Olson (2001, 2003, 2007, 2009, 2015). These contributors have not only revised Arredondo's records, amending and revising specimens but have also discovered and described new ones that expand the understanding of Cuban and Caribbean ancient avifaunas.

In 1984, Arredondo published a preliminary list which was later updated by Suárez (2004a). These lists have not been revised for over a decade, and do not reflect current taxonomic arrangements. Since Suárez' 2004 list, several new species have been described while other taxa have been synonymized or removed from the record. For instance, specimens assigned to the flightless ibis *Xenicibis*, the vulture *Sarcoramphus*, and the giant hawk *Titanohierax*, previously reported for Cuba, have been removed (Suárez 2001a, 2001b, 2004a). The extinct stork *Ciconia maltha* is now considered a junior synonym of *Ciconia lydekkeri* (Ameghino 1891) (Agnolin 2009), and the enigmatic snipe reported by Suárez (2004) was recently nominated as *Gallinago kakuki* (Steadman & Takano 2016). During the late 1960s and early 1970s, new records based on specimens found in Cueva de Pío Domingo, Pinar del Río, were described (Fischer 1968, 1977; Fischer & Stephan 1971a, 1971b). Most of these records were

subsequently revised by Olson, including *Rallus sumiderensis* and *Fulica picapicensis*, which were identified as the Zapata Rail (*Cyanolimnas cerverai*) and the extinct rail *Nesotrochis picapicensis*, respectively (Olson 1974).

Several amended records and the most recent discoveries, however, have not been assimilated into the recent paleontological and zooarchaeological literature, and are in need of a compilation that can be used by specialists and non-specialists alike. As a summary, here I provide an updated annotated taxonomic list of the extinct and extirpated bird species known from the Late Quaternary record of Cuba, which builds on the previous list of Suárez (2004a), Arredondo, and others. Additionally, the holotypes and new specimens of several species are illustrated in detail for the first time. However, a record of extant birds found in archaeological contexts is not included but will be provided elsewhere. This list can be useful for studies about the evolution of the avian diversity in the Greater Antilles.

METHODS

The list includes only the extinct taxa currently known by fossil or subfossil remains. Although many of these extinct species are known from Latest Quaternary, likely pre-Columbian (Amerindian) Late Holocene deposits, the majority of them do not have direct or associated radiocarbon ages. The few radiocarbon dates associated or directly taken from bird remains will be briefly discussed to provide a framework for the survival or time of extinction.

The inclusion of all existing representative specimens of a given taxon, state of preservation in particular remains, and detailed stratigraphic provenance lie outside the scope of this list. In most cases, this information is not provided in original descriptions or records cited for Cuban extinct birds. In the case of stratigraphy, most remains are usually found in cave deposits which lack discernible stratigraphy or a stratigraphic framework. Nevertheless, to unify criteria on each species account, the following information will be provided: synonyms (when available), holotype, lectotype or other collection number and repository reference, type locality or where it was first discovered in Cuba, status, and remarks as observations on identification or age. Widespread, non-endemic extinct species will be indicated as globally extinct, endemics as extinct endemics, and those extant elsewhere, but locally extinct in Cuba will be denoted as extirpated. Anatomical terminology follows the terms of Baumel & Witmer (1993), and the Handbook of the Birds of the World (HBW) for common names. Radiocarbon dates are given in radiocarbon years before the present (rcyrBP, present being AD 1950) with a standard error. A map of the most important Cuban localities where avian remains were found is provided in Figure 1. Photographs in Figures 2, 5, and 7, are used with the permission and courtesy of L. W. Viñola; the others are from the author.

Institutional abbreviations. Collections and institutions that serve as repositories of Cuban extinct bird remains mentioned in the text include: AC 33: ArqueoCentro, Villa Clara Province, Cuba; AMNH: American Museum of Natural History, New York City, USA.; AV: Colección de la Universidad de La Habana, La Habana, Cuba; BMNH: British Museum of Natural History, London, UK; CAZG: Colección Arqueozoológica del

Gabinete de Arqueología, Oficina del Historiador de La Habana; CZACC: former Colección Zoológica de la Academia de Ciencias de Cuba, La Habana, now at the Instituto de Ecología y Sistemática (IES), Mayabeque, Cuba; DPUH: Departamento de Paleontología, Facultad de Biología, Universidad de La Habana, La Habana; FLMNH-UF: Florida Museum of Natural History, University of Florida, Gainesville, USA; LWV: Lazaro W. Viñola collection, La Habana, Cuba; MCZ: Museum of Comparative Zoology, University of Harvard, Cambridge, Massachusetts, USA; MNHNCu: Museo Nacional de Historia Natural, La Habana, Cuba; OA: Oscar Arredondo collection, La Habana, Cuba; PB: Pierce Brodkorb collection, Florida Museum of Natural History, Gainesville, USA; USNM: United States National Museum, Smithsonian Institution, Washington, DC, USA; WS: William Suárez collection, housed at the MNHNCu.

RESULTS

Pelecaniformes Ardeidae

Tigrisoma mexicanum Swainson 1834

First material reported in Cuba: complete left tarsometatarsus (AC 33), collected in 2004. Locality: Casimba en Los Buentes, a sinkhole deposit in Mal Páez, near Sagua La Grande, Villa Clara Province (Olson & Suárez 2008).

Status: The Bare-throated Tiger-heron is extirpated in Cuba, but with a current wide geographical range in Central America (Butchard & Symes 2018).

Remarks: This specimen was reported in association with *Ara tricolor*, another Cuban extinct endemic (Olson & Suárez (2008). This constituted the first fossil record of the species in the West Indies. In the original report, Olson & Suárez (2008) considered that this specimen could represent an endemic subspecies.

Ciconiiformes Ciconiidae

Ciconia lydekkeri Ameghino 1891

Synonyms: *Jabiru mycteria* Wetmore (1928)

Ciconia maltha (Howard 1942)

C. maltha (Miller 1910: 440). See Agnolin (2009)

Ciconia lydekkeri (as redescribed by Agnolin 2009)

First material reported in Cuba: Right tarsometatarsus and left distal tibiotarsus (AMNH without a number) collected by Barnum Brown and Carlos de la Torre between 1910 and 1918 (Suárez & Olson 2003a).

First fossil locality in Cuba: Ciego Montero thermal bath deposits, Cienfuegos Province (Wetmore 1928).

Holotype of *Ciconia lydekkeri*: Right distal tarsometatarsus (BMNH 18879).

Status: *Ciconia lydekkeri* is a globally extinct species with a pan-American Quaternary distribution (Agnolin 2009).

Ciconia sp.

Type material: Right extreme distal tibiotarsus Museo Nacional de Historia Natural, La Habana, Cuba (MNHNCu P4599).

Type locality: Breas de San Felipe tar deposits, near Martí, Matanzas Province (Suárez & Olson 2003a); locality 13 (Figure 1). The fauna at this locality has yielded Late Pleisto-

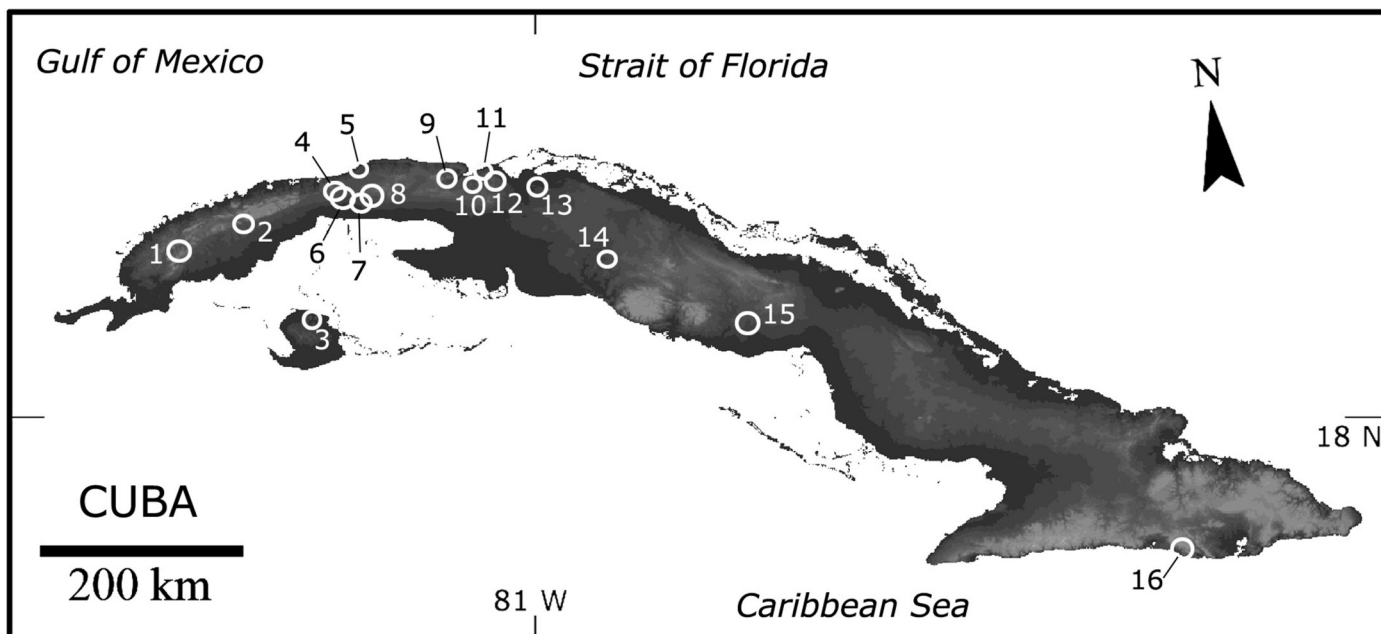


Figure 1. Map of the Cuban archipelago depicting main localities where extinct avifauna has been found: (1) Cueva de Pío Domingo, Sumidero, Pinar del Río Province; (2) Cueva El Abrón, Sierra de la Güira, Pinar del Río Province (Cueva del Mono Fósil is near); (3) Sierra de Caballos, Isla de la Juventud Municipality; (4) Cueva de Sandoval, Caimito, Artemisa Province; (5) Cueva Lamas, Santa Fe, La Habana Province; (6) Cueva de Paredones, San Antonio de los Baños, Artemisa Province; (7) Cueva del Túnel, La Salud, Mayabeque Province; (8) Cuevas Blancas, Quivicán, Mayabeque Province; (9) Cueva de la Caja (or “Cueva de los Nesofontes”), Mayabeque Province; (10) Cueva de Bellamar, Matanzas, Matanzas Province; (11) Cueva del Quinto, Camarioca, Matanzas Province; (12) Cueva de Cantel, Calero, Matanzas Province; (13) Breas de San Felipe (San Felipe tar pits), Martí, Matanzas Province; (14) Baños de Ciego Montero, Cienfuegos Province; (15) Hornos de Cal, Sancti Spiritus Province; (16) Cueva del Indio, Daiquirí, Santiago de Cuba Province.

cene to Late Holocene radiocarbon dates between 4960 ± 280 and $11,880 \pm 420$ rcyr BP (Jull et al. 2004).

Status: Undefined.

Remarks: Species was described by Suárez & Olson (2003a: 151) as “smaller than *C. maltha*.”

Mycteria wetmorei Howard 1935

First material reported in Cuba: Right carpometacarpus (MNHNCu P4602) and a right distal tibiotarsus (MNHNCu P4603).

First report locality in Cuba: San Felipe tar deposits, near Martí, Matanzas Province (Iturralde et al. 2000, Jull et al. 2004).

Status: Globally extinct, with former distribution in North America (Suárez & Olson 2003a). Remarks: Species occurred in sympatry with *Ciconia* sp. at the San Felipe tar deposits (Suárez & Olson 2003a).

Incertae sedis

Teratornithidae

Oscaravis olsoni (Arredondo & Arredondo 1999)

Synonyms: *Teratornis olsoni* Arredondo & Arredondo 1999: 310

Oscaravis olsoni (as redescribed by Suárez & Olson 2009: 106)

Holotype: near complete right femur (CZACC 400-649, now at IES) (Figure 2).

Type locality: Cueva de Paredones, San Antonio de Los Baños, Artemisa Province.

Remarks: Specimens of this species are known from at least five cave sites distributed between the current Artemisa, La Habana, and Mayabeque provinces (Figure 1).

Status: Extinct endemic.

Cathartiformes

Cathartidae

Gymnogyps varonai (Arredondo 1971)

Synonyms: *Antillovultur varonai* Arredondo (1971: 310)

Gymnogyps (Suárez 2000a). See also Suárez & Emslie (2003)

Holotype: Left proximal tarsometatarsus (DPUH 1254).

Type locality: Cueva de Paredones, San Antonio de Los Baños, Artemisa Province.

Status: Extinct endemic.

Cathartes? sp. 1

Cathartidae gen. et sp. indet.

Remarks: Suárez (2001c: 110) mentioned the presence of two undescribed and possibly different New World vultures (Cathartidae). One is probably referable to *Cathartes* but differs from *Cathartes aura* (Suárez 2001). Another taxon of the same family but gen. et sp. indet. could represent a different genus altogether (Suárez 2001c: 110, L. W. Viñola pers. comm.).

Suárez (2000) revised specimens previously identified as fossil *Cathartes aura* from Mayabeque (Arredondo & Varona 1974) and concluded that these represented modern specimens, thus deleting this taxon from the Cuban fossil record (Jiménez & Arrazcaeta 2008). *Cathartes aura* is supposed to have arrived in Cuba during the post-Colombian, so far reported only from 17th-century archaeological contexts from La Habana Vieja (Jiménez & Arrazcaeta 2008). However, a premaxillary specimen of *Cathartes aura* was recently found in a paleontological deposit at Cueva de la Caja, Mayabeque province, where radiocarbon dated specimens yielded

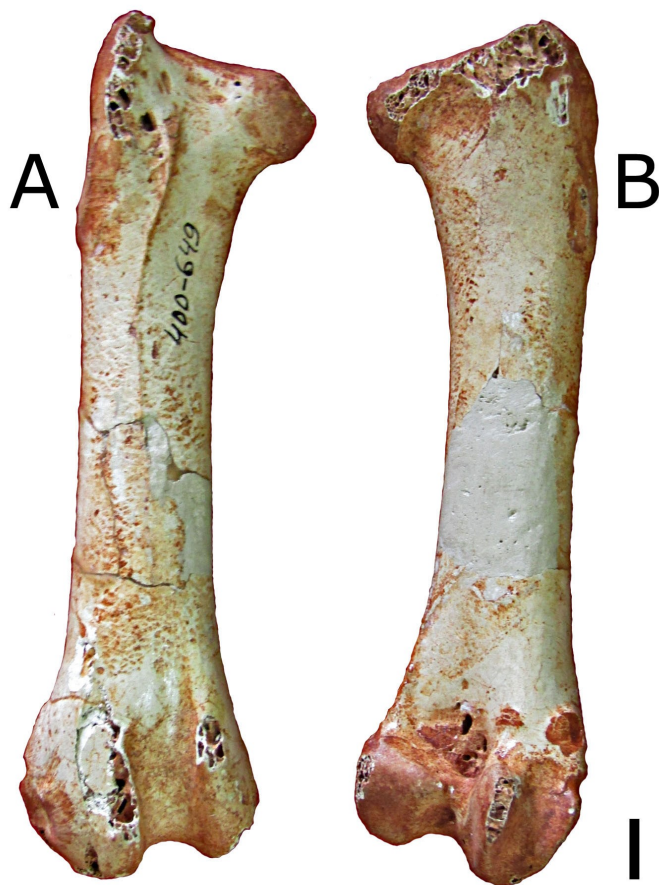


Figure 2. *Oscaravis olsoni* holotype (complete right femur CZACC 400-649) from Cueva de los Paredones, Mayabeque; in (A) cranial and (B) caudal views. Photograph used with the permission and courtesy of L. W. Viñola. Scale bar=10 mm.

ages between 1960 ± 30 and 1290 ± 30 BP (Orihuela unpubl. data). This suggests the presence of *Cathartes aura* well in the pre-Columbian, Late Holocene of Cuba.

Status: Undefined.

Accipitriformes

Accipitridae

Amplibuteo woodwardi (L. Miller 1911)

Synonyms: *Amplibuteo* sp. (Suárez & Arredondo 1997)

First material reported in Cuba: Incomplete associated skeleton, William Suárez collection (WS 365), housed at MNHNCu. First fossil locality in Cuba: Cueva de Sandoval, Caimito, Artemisa Province (Suárez 2004b). Status: Globally extinct.

Remarks: This is an extinct taxon that inhabited North America during the Quaternary. Its fossil remains are known from the western United States and Florida and may be found in other parts of the Caribbean, along with other yet undescribed accipitrids (Suárez 2004a, b: 124).

Buteo lineatus (Gmelin 1788)

First material reported in Cuba: Right proximal femur (MNHNCu P4614), collected in 1988, at San Felipe tar pits, locality II, Martí, Matanzas Province (Suárez & Olson 2003b). Status: Extirpated. The Red-shouldered Hawk is an extant taxon, with a wide distribution in North and Mesoamerica (Ferguson-Lee & Christie 2005: 220).

Remarks: The Cuban remains were described as “more consistently robust” than the comparative material of the Grey

Hawk (*Buteo nitidus*), whose remains may also be expected in West Indian contexts due to its wide distribution (Suárez & Olson 2003b). Fossil remains of *F. lineatus* have been also reported from the Bahamas (Olson 2000).

Buteogallus borrasii (Arredondo 1970)

Synonyms: *Aquila borrasii* Arredondo (1970: 3)

Aquila sp. in Fischer (1977)

Titanohierax borrasii (Olson & Hilgartner 1982, Suárez 2000c)

Few specimens of this species were assigned to *Sarcoramphus* (? sp.) in Acevedo & Arredondo (1982), Arredondo & Arredondo (1999), Garrido & Kirkconnell (2000), Iturralde et al. (2000), and Suárez (2000c, 2001).

Holotype: Left tarsometatarsus (DPUH 1250), deposited at Departamento de Paleontología, Facultad de Biología, Universidad de La Habana, La Habana.

Type locality: Cueva del Túnel, La Salud, Mayabeque Province (locality 7 on Figure 1).

Remarks: Widespread species, known from eight cave deposit localities, including Cueva Lamas, Cueva de Sandoval, Cuevas Blancas, and Breas de San Felipe (Figure 1). *Buteogallus borrasii* was described as more robust and 33% larger than *Buteogallus urubitinga* (Suárez & Olson 2007).

Status: Extinct endemic, although Suárez and Olson insinuated that it may be present in other localities of the Greater Antilles (Suárez & Olson 2007). Olson & Hilgartner (1982) suggested that it should be included in the genus *Titanohierax*. Recently, this taxon was transferred to the genus *Buteogallus*, deleting *Titanohierax* from the Cuban record (Suárez & Olson 2007).

Geranoaetus melanoleucus Swan 1922

First fossil material from Cuba: left carpometacarpus (AMNH 6190 in Wetmore 1928).

First fossil locality from Cuba: Ciego Montero, Cienfuegos Province (Wetmore 1928).

Status: Extirpated. The Black-chested Buzzard Eagle has a modern, wide distribution in South America, especially the southern cone, where it inhabits dry, mountainous scrubland (Ferguson-Lee & Christie 2005: 202).

Remarks: The species has not been reported since.

Gigantohierax suarezi Arredondo & Arredondo 1999

Synonym: *Aquila borrasii* (Arredondo, 1970: 3)

Holotype: Left femur (MNHNCu P574), discovered since the late 1950s.

Type locality: Cueva de Sandoval, Caimito, Artemisa.

Status: Extinct endemic.

Remarks: Specimens of this species were originally included in Arredondo's description of *Aquila borrasii*, some of which remains are now a synonym of *Buteogallus borrasii*.

Falconiformes

Falconidae

Caracara creightoni Brodkorb 1959

Synonyms: *Milvago* sp. of Suárez & Arredondo (1997) was referred to this taxon by Suárez & Olson (2003c: 305). *Caracara plancus* (= *C. cheriway*) in Jiménez (1997). See Suárez & Olson (2003c: 306).

First fossil material from Cuba: Fragmentary skull in Oscar Arredondo's collection (OA 3928). First fossil locality in Cuba:

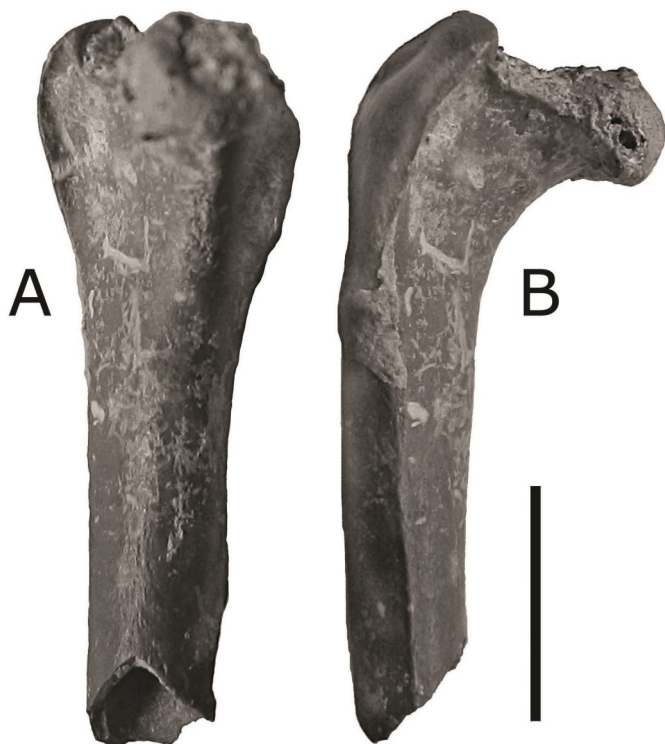


Figure 3. *Nesotrochis picapicensis* referred specimen: proximal end of a right femur (MNHNCu 75.3231) from Cueva de los Nesofontes, Loma del Palenque, Mayabeque Province; in medial (A) and cranial (B) views. Scale bar = 10 mm.

Cueva Calero, Matanzas Province (Suárez & Arredondo 1997;

Suárez & Olson 2001b, 2003c).

Status: Globally extinct.

Remarks: Taxon with a wide distribution in the Quaternary that included Cuba and the Bahamas. Suárez & Olson (2001a) hypothesized a recent arrival to Cuba, along with *Cathartes*. In Cuba, it is known from at least six deposit localities in northwestern and central provinces, suggesting also a widespread distribution within the main island. Archaeological human remains at Cueva Calero have yielded Late Holocene radiocarbon ages ranging between 1670 ± 60 and 1590 ± 70 rcyrs BP (Ulloa 2008, Roksandic et al. 2015). However, whether said material occurred in the archaeological or paleontological context of Calero's deposit was not registered, and thus the specimen's direct age is unknown (Suárez & Olson (2001b, 2003c). Remains of this species have recently yielded a radiocarbon age of 2390 ± 30 rcyrs BP from a deposit in Great Abaco, Bahamas (Steadman & Franklin 2015: Table 2).

Milvago carbo Suárez & Olson 2003

Holotype: Right tarsometatarsus (MNHNCu P4569).

Type locality: San Felipe tar deposits, Martí, Matanzas Province (Iturralde et al. 2000).

Status: Extinct endemic.

Remarks: Occurred in probable sympatry with *Caracara creightoni* at San Felipe (Suárez & Olson 2003).

Milvago sp. 1

Type locality: San Felipe tar pits, Martí, Matanzas Province (Iturralde et al. 2000).

Status: Undefined.

Remarks: The original indication of this species is from

Suárez & Arredondo (1997). Suárez & Olson (2003: 302) noted that although these specimens are too fragmentary to be diagnostic, they are similar in size to *Milvago chimachima*.

Falco femoralis Temminck 1922

First fossil material from Cuba: Right carpometacarpus (MNHNCu P4606), collected in 2001 at San Felipe I, Area C, San Felipe tar pits, Martí, Matanzas Province (Suárez & Olson 2003b). Status: Extirpated.

Remarks: The Aplomado Falcon has an ample modern distribution that includes the southern United States through to southern South America (Ferguson-Lee & Christie 2005).

Falco kurochkini Suárez & Olson 2001

Holotype: Left tarsometatarsus (MNHNCu P3229).

Type Locality: Cueva de Sandoval, Caimito, Artemisa Province (Suárez 2000a, 2000b, 2000c, 2004b).

Status: Extinct endemic.

Gruiformes

Gruidae

Grus cubensis (Fischer & Stephan 1971)

Synonyms: *Baeopteryx cubensis* Fischer (1968)

Grus cubensis (Fischer & Stephan 1971)

Holotype: Skull (CZACC 1/67).

Type locality: Cueva de Pío Domingo, Sumidero, Pinar del Río.

Status: Extinct endemic.

Rallidae

Nesotrochis picapicensis (Fischer & Stephan 1971) (Figure 3)

Synonyms: *Fulica picapicensis* by Fischer & Stephan (1971).

Nesotrochis picapicensis (Olson, 1974)

Holotype: Complete left humerus (AV 832/67).

Type locality: Pío Domingo, Sumidero, Pinar del Río Province.

Status: Extinct endemic.

Remarks: This taxon has been found in mid-late Holocene deposits (mostly in archaeological sites dated between 1190 ± 40 and 3331 ± 17 rcyrs BP; Jiménez pers. Comm. 2018), and post-Columbian cave deposits in Mayabeque (Jiménez 1997, 2001; Orihuela 2010). It is likely that this species became extinct during the post-Columbian-colonial interval (Jiménez & Arrazcaeta 2008, 2015).

Charadriiformes

Burhinidae

Burhinus sp. cf. *B. bistriatus* (Wagler 1829).

First fossil material from Cuba: Left distal humerus (OA 2958).

First fossil locality in Cuba: Cueva de Paredones, San Antonio de Los Baños, Artemisa Province (Arredondo 1984; Suárez 2000b 2004b; Iturralde et al. 2000).

Status: Extirpated.

Remarks: This specimen has been identified as the Double-striped Thick-knee *Burhinus bistriatus* by Suárez (2005). This taxon has a current wide distribution in North and Central America, including parts of the Greater Antilles and The Bahamas.

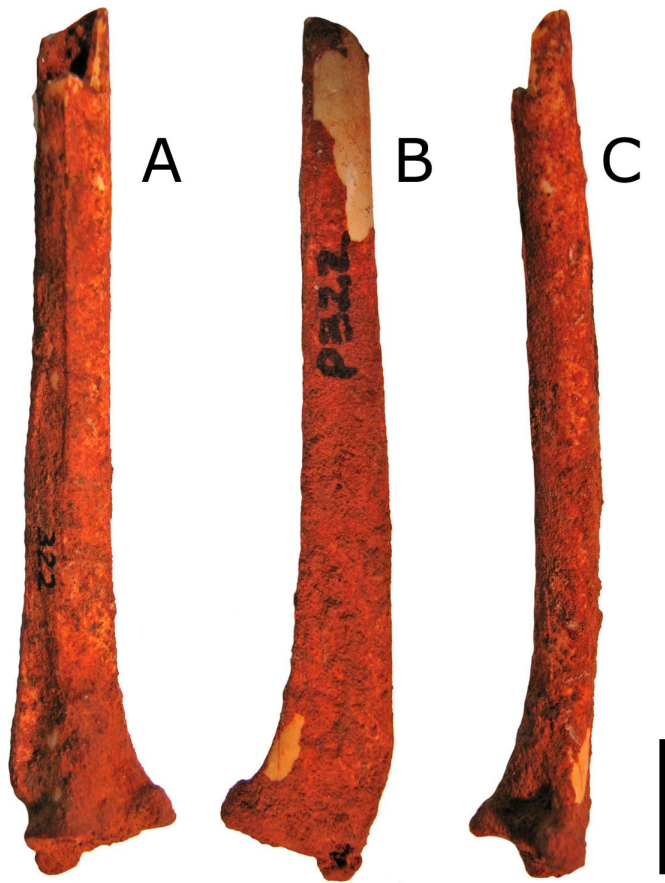


Figure 4. *Tyto noeli* referred specimen (fragmentary right ulna MNHNCu uncatalogued) from Cueva Centella, Matanzas Province; in cranial (A), caudal (B) and dorsal (C) views. Scale bar = 10 mm.

Scolopacidae

Gallinago kakuki Steadman & Takano 2016

Synonyms: *Capella* sp. (Suárez 2004a, 2004c)

First fossil material from Cuba: Right humerus (MNHNCu 75.4709).

First fossil locality in Cuba: El Abrón Cave, Sierra de la Güira, Pinar del Río (Suárez 2004b). See also Suárez & Díaz-Franco (2003).

Gallinago kakuki holotype: Complete right humerus (UF 297382), collected in 1958–1960 from Banana Hole, Bahamas (Steadman & Takano 2016).

Status: Globally extinct.

Remarks: Widespread in the Greater Antilles, including Cayman, Bahamas, and likely within Cuba.

Psittaciformes

Psittacidae

Ara tricolor Bechstein 1811

Synonym: *Ara cubensis* of Wetherbee (1985).

First fossil material from Cuba: Right proximal carpometacarpus deposited at the AMNH without number.

First fossil locality in Cuba: The fossilized material was first discovered at Ciego Montero thermal bath deposits, Cienfuegos Province (Wetmore 1928: 4).

Status: Extinct endemic.

Remarks: Other fossil localities include the Casimba en Los Buentes, where it was associated with remains of *Tigrisoma mexicanum* (Olson & Suárez 2008). Extinct since the mid-late

19th century (Garrido & Kirkconnell 2000, Wiley & Kirwan 2013).

Strigiformes

Tytonidae

Tyto noeli (Arredondo 1972)

Synonyms: *Tyto noelli* (Arredondo 1972a) in Suárez & Olson (2015)

Tyto neddi (Steadman & Hilgartner 1999: 76)

Tyto noeli (Suárez & Olson 2015: 541)

Holotype: Right tarsometatarsus (DPUH 1251), collected in 1968.

Type locality: Cueva del Túnel, La Salud, Mayabeque Province.

Status: Globally extinct.

Remarks: Species with a wide Quaternary record that includes Jamaica and Barbuda (Suárez & Olson 2015). Also with a widespread range in Cuba, where it is known so far from at least ten localities. Occurs in sympatry with *Tyto furcata* in several Cuban cave deposits (Arredondo 1972a, Suárez 2002), and likely with *Tyto cravesae* at Cueva Centella, Matanzas (L. W. Viñola pers. comm.), where *Tyto noeli* has been reported (Orihuela 2013) (Figure 4). Directly radiocarbon dated material of this species from Cueva El Abrón, Sierra de la Güira, Pinar del Río, yielded a Late Pleistocene age of $17,406 \pm 161$ rcyr BP (Suárez & Díaz-Franco 2003: 373). At Drum Cave in Jamaica, remains of this species were associated with radiocarbon dates between 3700 ± 150 and 6410 ± 110 rcyr BP (McFarlane et al. 2002).

Tyto pollens (Wetmore 1937)

Synonym: *Tyto riveroi* Arredondo 1972b: 131, revised by Suárez & Olson (2015: 539)

Holotype: Left femur (MZC 2262), collected in 1937.

Type locality of *Tyto riveroi*: Cueva de Bellamar, Matanzas Bay, Matanzas Province (Arredondo 1972b).

Status: Globally extinct.

Remarks: Known from other Quaternary records in the Bahamas and within Cuba (Suárez & Olson 2015).

Tyto cravesae Suárez & Olson 2015

Synonym: Several specimens of this taxon were included in the original type series of *Tyto noeli* in Oscar Arredondo's collection (OA) (Suárez & Olson 2015).

Holotype: Associated postcranial long bone elements (MNHNCu 75.590), likely representing a single individual collected in 1998.

Type locality: Salón del Pozo, Cueva de Paredones, San Antonio de los Baños, Artemisa Province.

Status: Extinct endemic.

Remarks: This is the rarest of Cuban tytonid owls, known so far from four localities in the provinces of Artemisa, Mayabeque, and Matanzas, northwestern Cuba (Suárez & Olson 2015). Associated with remains of *Oscaravis olsoni* and *Ornimegalonyx "minor"*, *Gymnogyps varonai* and *Puslatrix arredondoii* at the type locality.

Tyto sp. 1

A "small, undescribed species" was reported from Cueva El Abrón, Sierra de la Güira, Pinar del Río (Suárez & Díaz-Franco 2003: 375).

Status: Undefined.



Figure 5. *Bubo osvaldoi* holotype (fragmentary right tarsometatarsus MNHNCu 27.1), from Cueva del Mono Fósil, Province Pinar del Río; in (A) dorsal and (B) plantar views. Photograph used with the permission and courtesy of L. W. Viñola. Scale bar = 10 mm.

Strigidae

Bubo osvaldoi Arredondo & Olson 1994 (Figure 5)

Holotype: Right distal tarsometatarsus (MNHNCu 27.1).

Type locality: Cueva del Mono Fósil, Pinar del Río Province.

Status: Extinct endemic.

Remarks: Found in sites spanning from eastern and western Cuba, suggesting it was widespread on the main island (Arredondo & Arredondo 1999: 18).

Pulsatrix arredondo Brodkorb 1969 (Figure 6)

Holotype: Left tarsometatarsus collected by Oscar Arredondo in 1960, deposited in the Pierce Brodkorb collection (PB 8420, *sensu* Brodkorb 1969).

Type locality: Cueva de Paredones, San Antonio de Los Baños, Artemisa Province. See also Arredondo & González (1982) and Arredondo (1984).

Status: Extinct endemic.

Remarks: Previously known from three localities spanning from Artemisa, Matanzas and Santi Spíritus, now with two additional records in Mayabeque (Jiménez et al. in press). One of the new records is from an archaeological assemblage at Cueva de los Muertos: a distal tarsometatarsus (CAZG04), collected in May 2012 (Jiménez et al. in press). This specimen (Figure 6) yielded a radiocarbon age of $1390 \pm$

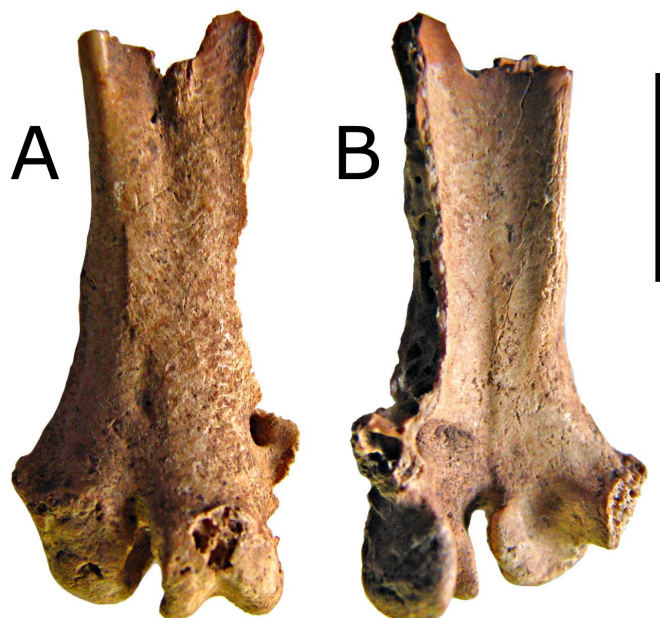


Figure 6. *Pulsatrix arredondo* referred specimen, fragmentary right tarsometatarsus (CAZGA04) from Cueva del Muerto, Mayabeque Province; in (A) dorsal and (B) plantar views.

30 rcyrs BP, which provides a last appearance date for this taxon well into the Late Holocene (Jiménez et al. in press).

Ornimegalonyx

Remarks: All *Ornimegalonyx* species need revision. It is likely that all *Ornimegalonyx* represent a single species. Their size disparity could be due to sexual dimorphism, chrono-temporal or/and individual variation (Alegre 2002, Louchart 2005). This is a well-distributed genus within Cuba. As the wide distribution of other extirpated and extinct raptors suggests, this genus likely inhabited other parts of the Greater Antilles.

Ornimegalonyx oteroi (Arredondo 1958) (Figure 7)

Synonyms: *Ornimegalonyx arredondo* (Arredondo 1958), formerly redescribed by Brodkorb (1961)

Holotype: A left tarsometatarsus lectotype (MZC P-383E) assigned by Brodkorb (1961: 634). Type locality: Cueva de Pío Domingo, Sumidero, Pinar del Río Province.

Status: Extinct endemic.

Remarks: This hypodigm includes several specimens originally assigned to Phorusrhacidae by Arredondo (1958) but included in Strigidae by Brodkorb (1961). Also includes a specimen identified as *Cathartes aura* by Arredondo (1989: 9), but amended by Suárez (2001: 110). Likely a widespread taxon. Specimens are known from at least nine deposit localities throughout the Cuban archipelago (Arredondo 1996).

Ornimegalonyx acevedoi Arredondo 1982

Holotype: Left tarsometatarsus (GEC without catalog number, see Suárez 2004a).

Type locality: Cueva del Quinto, Camarioca, Matanzas.

Status: Extinct endemic.

Ornimegalonyx minor Arredondo 1982

Synonyms: *Ornimegalonyx* sp. (Arredondo 1975)

O. "minor" (Suárez & Olson 2015)

Holotype: Right proximal femur (MCZ P-37).



Figure 7. *Ornimegalonyx oteroi* referred specimen (fragmentary left tarsometatarsus LWV 890) from Cueva Beruvides, Matanzas Province; in (A) dorsal, (B) plantar and (C) lateral views. Specimen record used with permission and courtesy of L. W. Viñola. Scale bar = 10 mm.

Type locality: Cueva de Paredones, San Antonio de los Baños, Artemisa Province (Arredondo 1982, 1984).

Status: Extinct endemic.

Ornimegalonyx gigas Arredondo 1982

Synonym: *Ornimegalonyx* sp. Arredondo (1975: 142–143)

Holotype: Left proximal femur (MCZ 3032).

Type locality: Canteras de Hornos de Cal, Santi Spíritus.

Status: Extinct endemic.

Caprimulgiformes

Caprimulgidae

Siphonorhis daiquiri Olson 1985

Holotype: Right proximal humerus (USNM 336506).

Type locality: Cueva de Los Indios, near Daiquirí, Santiago de Cuba (Figure 1, locality 16; see Anthony 1919 and Suárez 2000b).

Status: Extinct endemic.

Passeriformes

Rhinocryptidae

Scytalopus sp.

First fossil material from Cuba: A right proximal humerus (USNM 33605).

First fossil locality in Cuba: Sierra de Caballos, Isle of Pines, and Cueva de los Fósiles, Camagüey (Olson & Kurochkin 1987).

Status: Extirpated.

Remarks: Possible widespread in the island as suggested by the widely separated record localities, one on the Isle of Pines, western Cuba, and other in Camagüey, central Cuba.

Icteridae

Dolichonyx kruegeri Fischer & Stephan 1971

Holotype: Right complete humerus (AV 877/67).

Type locality: Pío Domingo, Sumidero, Pinar del Río Province.

Status: Likely extirpated or accidental record.

Remarks: Forgotten record since the original description, which may likely represent a misidentified specimen of the Bobolink (*D. oryzivorus*), who is an uncommon transient species in Cuba (Garrido & Kirkconnell 2000: 218).

DISCUSSION

The Cuban avian fossil record indicates a high level of endemism and diversity. The list reveals a total of 35 extinct species, of which 17 are endemic taxa, and 12 are currently extirpated forms. The status of the remaining six taxa (17%) is still uncertain or undefined. These disappearances comprise ~ 9 % out of the total >370 bird species registered for the Cuban archipelago (Garrido & Kirkconnell 2000).

The known assortment of Cuban extinct birds is remarkable in its diversity of diurnal and nocturnal raptors, of which most are endemic and notably oversized with ground-dwelling adaptations, representing 65.7 % of the extinct know fauna. The present avian assemblages include five accipitrids (13%), six falconids (17.1 %), comprised of two large hawks, plus two caracaras and two smaller falcons. The fossil record is particularly diverse in Strigiformes, which comprise 24% total of the currently know avifauna, or 13% if only one *Ornimegalonyx* is counted. These include the six large, flight-limited, endemic strigids of the genus *Ornimegalonyx*, plus two endemic owl species and four extinct *Tyto*. Additionally, there is a large condor and two yet undescribed vultures, which comprise eight percent of the extinct avifauna. Perhaps the most enigmatic of these is the rare *Oscaravis*, an extinct endemic teratorn bird; a probable relic of a more ancient fauna with a South American affinity (Suárez & Olson 2009). Many of the extirpated and globally extinct seem to have been geographically widespread within the Greater Antilles. In this sense, and taking into consideration several of the rich cave deposits being researched in the Bahamas and Hispaniola, it would not be surprising to find several Cuban species in its assemblages, even few of those that are today considered Cuban endemics, as our knowledge of their geographical distribution improves.

Cuba's extinct avifauna is generally assumed to be Late Quaternary in age (Suárez 2004a), although most species and their contexts lack direct radiocarbon dates. For most of the 20th century, many of the species records were arbitrarily considered of Late Pleistocene age, as was the case with other Cuban extinct vertebrates (e.g., Anthony 1919, Wetmore 1928, Acevedo et al. 1975; Arredondo 1958, 1970, 1972a, 1972b). However, recent direct radiocarbon dating has shown that several of the Cuban extinct vertebrates have late appearance dates that extend well into the Amerindian pre-Columbian Late Holocene (MacPhee et al. 1999, Jull et al. 1994, Jiménez et al. 2005, Orihuela 2010, Orihuela & Tejedor 2012).

Of all the extinct Cuban birds, only two have been dated directly by radiocarbon methods: *Tyto noeli*, which yielded a Late Pleistocene date (17,406 ± 161 rcyr BP) from a cave deposit at Cueva El Abrón, in Pinar del Río Province (Suárez & Diaz-Franco 2003; Tyrberg 2009), and *Puslatrix arredondoii* from Cueva de los Muertos (Figure 6), which yielded an age of 1390 ± 30 rcyr BP (Jiménez et al. in press). Others, such as the flightless rail *Nesotrochis picapicensis* have been found associated to radiocarbon dated Amerindian pre- and post-

Columbian assemblages (dated between 1190 and 3331 BP) in latest Holocene cave deposits of western Cuba (Jiménez 1997, 2001; Jiménez & Arrazcaeta 2008, 2015; Orihuela 2010, unpubl. data). The presence of many of these taxa, in association with other small vertebrates in Cuban Amerindian and post Columbian Holocene deposits, not only indicate a very late survival past the climatic fluctuations of the Quaternary, including its Last Glacial Maximum, but also human coexistence for several thousands of years before final extinction that implicate complex responses as causes for their extinction or long lag periods before final extinction or extirpation (MacPhee et al. 1999, Turvey 2009, Orihuela & Tejedor 2012, unpubl. data). In the case of the Cuban extinct endemics, the causes suggest the action of combined threats involving both background climate change and direct human environmental degradation, the introduction of exotic species, deforestation, and some cases overhunting, all especially during the last 500 years (Borroto-Páez & Mancina 2017, Cooke et al. 2017). Although the timing and likely causes leading to extinction are becoming better understood for mammals (Borroto-Páez & Mancina 2017), much remains to be unraveled in the case of birds, many which still require taxonomic definition or lack last occurrence data. Further discovery, analysis, and direct dating of additional fossils will likely increase the list of Cuba's extinct avifauna, shed light on its diversity and the causes and timing of their extinction.

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