



Universiteit
Leiden
The Netherlands

Avian Remains from Late Pre-colonial Amerindian sites on Islands of the Venezuelan Caribbean

Antczak, M.M.; Antczak, A.T.; Lentino, M.

Citation

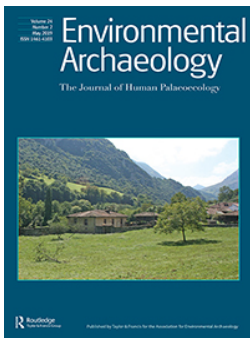
Antczak, M. M., Antczak, A. T., & Lentino, M. (2017). Avian Remains from Late Pre-colonial Amerindian sites on Islands of the Venezuelan Caribbean. *Environmental Archaeology*, 24(2), 161-181. doi:10.1080/14614103.2017.1402980

Version: Not Applicable (or Unknown)

License: [Leiden University Non-exclusive license](#)

Downloaded from: <https://hdl.handle.net/1887/75620>

Note: To cite this publication please use the final published version (if applicable).



Environmental Archaeology

The Journal of Human Palaeoecology

ISSN: 1461-4103 (Print) 1749-6314 (Online) Journal homepage: <https://www.tandfonline.com/loi/yenv20>

Avian Remains from Late Pre-colonial Amerindian sites on Islands of the Venezuelan Caribbean

Ma. Magdalena Antczak, Andrzej T. Antczak & Miguel Lentino

To cite this article: Ma. Magdalena Antczak, Andrzej T. Antczak & Miguel Lentino (2019) Avian Remains from Late Pre-colonial Amerindian sites on Islands of the Venezuelan Caribbean, *Environmental Archaeology*, 24:2, 161-181, DOI: [10.1080/14614103.2017.1402980](https://doi.org/10.1080/14614103.2017.1402980)

To link to this article: <https://doi.org/10.1080/14614103.2017.1402980>



© 2018 The Author(s). Published by Informa UK Limited, trading as Taylor & Francis Group



Published online: 20 Nov 2017.



Submit your article to this journal [↗](#)



Article views: 470



View Crossmark data [↗](#)

Avian Remains from Late Pre-colonial Amerindian sites on Islands of the Venezuelan Caribbean

Ma. Magdalena Antczak^{a,b}, Andrzej T. Antczak^{a,b} and Miguel Lentino^{b,c}

^aFaculty of Archaeology, Leiden University, Leiden, The Netherlands; ^bUnidad de Estudios Arqueológicos, Universidad Simón Bolívar, Caracas, Venezuela; ^cColección Ornitológica, Fundación W. H. Phelps, Caracas, Venezuela

ABSTRACT

This paper presents the results of the analyses of 3793 bird remains archaeologically recovered from seven late pre-Hispanic sites (~AD 1000–1500) on islands of the Venezuelan Caribbean. In order to address subsistence and manufacturing uses of bird bones, we first discuss the recovery process of this unique sample. We proceed to investigate the bones' archaeological contexts as well as the taphonomy in play and analyze diverse bone categories. We found that indigenous peoples consistently targeted several families of birds for food or feathers or both, and that avian bones were used for fashioning tools and adornments. We also discuss possible signatures of island campsite seasonal occupancy as inferred from the bio-ecology of the identified bird taxa. The data suggest that the differentiation of nesting grounds between the Red-footed and Brown Booby in the Southeastern Caribbean may be a result of anthropogenically-induced adaptation. The findings discussed in this paper open challenging avenues for assessing long-term changes in bird communities including the dynamics of resident and wintering bird populations.

ARTICLE HISTORY

Received 1 December 2016
Accepted 1 November 2017

KEYWORDS

Southeastern Caribbean archaeology; avian remains; zooarchaeology; Venezuelan Caribbean archaeology; pre-hispanic archaeology; island archaeology

Introduction

Birds impacted the ways indigenous peoples conceived of their world and dwelt within it through various spatiotemporal frames (Grupe and Peters 2005; Prummel, Zeiler, and Brinkhuizen 2008; Serjeantson 2009; Bejenaru and Serjeantson 2014). The quickly growing field of social zooarchaeology approaches human-animal interrelations interdisciplinarily, not only as regards the diet and subsistence economy domain but also how animals figure in diverse social and symbolic dimensions of the past (Bochenski and Stewart 2002; DeFrance 2009; Armstrong Oma 2010; Russell 2012; Steele 2015). However, apart from the overarching use of anthropocentric ontologies and reductionist epistemologies that maintain the separation between the economic and symbolic use of animals (Overton and Hamilakis 2013) a number of factors complicate any straightforward interpretation of avifaunal remains recovered in archaeological contexts. Archaeologists agree that bone remains recovery is severely hampered by a wide range of physical, chemical and biological agents (Orton 2012). These agents degrade bones during natural taphonomic processes, the results of which may often be confounded with anthropogenic modifications (Stahl 1995, 166; Higgins 1999, 1456). The bias implicit in archaeological excavation also constitutes the factor affecting archaeoavifauna

recoverability. Birds, being considered alongside tortoises and mollusks as 'low ranked resources', were rarely the focus of early zooarchaeological studies (Steele 2015, 170) despite the fact that the importance for indigenous peoples of opportunistic bird-hunting might often have been more important in terms of subsistence than large-scale organised hunting (Steadman, Tellkamp, and Wake 2003). The socio-cultural determinants that governed the deposition of bird bones in what today are archaeological sites also influence avifauna remains recoverability. Many of the quantitative and qualitative configurations of samples are site-specific and directly related to the goal and duration of the past human activities there. The underrepresentation of bird remains as compared to other, especially marine, archaeofauna in Southeastern Caribbean archaeological assemblages has been pointed out (Wing 1989; Antczak 1999; Newsom and Wing 2004), although quantitative comparisons of bird and mammalian remains cannot straightforwardly indicate food choices (Bartosiewicz and Gál 2007; Lyman 2015). Low visibility may be expected if birds were marginally used as food and if the relationship between humans and birds developed and persisted on symbolic rather than subsistence-economic grounds. The ethnographic record from the South American Lowlands indicates that wild game birds provide little to human diet; small birds are largely ignored by adult hunters (Berlin

CONTACT Ma. Magdalena Antczak  m.m.antczak@arch.leidenuniv.nl  Faculty of Archaeology, Leiden University, Postbus 9514, 2300 RA, Leiden, the Netherlands; Unidad de Estudios Arqueológicos, Universidad Simón Bolívar, Caracas, Venezuela

© 2018 The Author(s). Published by Informa UK Limited, trading as Taylor & Francis Group

This is an Open Access article distributed under the terms of the Creative Commons Attribution-NonCommercial-NoDerivatives License (<http://creativecommons.org/licenses/by-nc-nd/4.0/>), which permits non-commercial re-use, distribution, and reproduction in any medium, provided the original work is properly cited, and is not altered, transformed, or built upon in any way.

and Berlin 1983, 310; Hill and Hawkes 1983, 153). It may be expected that birds were likely less important for reasons related to subsistence and economy and more important socio-symbolically not only for low-land societies (Wilbert 1985; Reichel-Dolmatoff 1990, 77–134), but those of the insular Caribbean as well (Roe 1995, 60–80; Boomert 2000, 350; Wing 2001; Grouard 2010).

As birds increasingly attracted the attention of archaeologists elsewhere in the world (see Bochenski and Stewart 2002; Prummel, Zeiler, and Brinkhuizen 2008; Mannermaa 2008; Serjeantson 2009; Kristensen and Holly 2013), Caribbean researchers were able to demonstrate that birds interacted with Archaic Age indigenous peoples for several millennia BP (Hofman and Hoogland 2003; Steadman, Tellkamp, and Wake 2003, 578; Steadman and Takano 2013). Information on bird remains in the archaeological record on Curaçao, Aruba and Bonaire (Haviser 1991, 1987, 28; Oliver 1989) and on Trinidad (Boomert 2000, 332, Table 43, 341, Table 45, 343, 347) and Tobago (Steadman and Stokes 2002; see also Pregill, Steadman, and Watters 1994; Reis and Steadman 1999) is however, scant. On the Venezuelan mainland, references are very rare. Wetmore's report (1935) on bird remains recovered during Alfred Kidder's excavations at the La Cabrera site in 1933 (Kidder 1944), if over-simplified, remained the standard and was unsurpassed for decades (but see Antczak 1999, 250–257). It is the above outlined backdrop that allows us to better understand that 'reading beyond the taxonomic list' of animal remains – a reading based on standardised recovery procedures and analyses – has taken a long time to reach the Southeastern Caribbean study region (Antczak 1999, 178; Newsom and Wing 2004). It also throws into sharp relief the uniqueness of the archaeoavifaunal sample discussed here.

Our aim in this paper is to synthesise the current understanding of bird use on the islands of the Venezuelan Caribbean between AD 1000 and 1500. This synthesis is for the first time possible given that long-term excavations carried out by the first two authors since 1982 as part of the Archaeology of the Islands of Venezuela Project (Antczak and Antczak 2006) provided over 3700 bird bones recovered at seven of the nearly 50 excavated pre-colonial sites. The sites discussed in this paper are only the ones where bird remains were identified. This unique sample enables addressing the seasonal availability of some birds that might have been used for subsistence-related purposes as well as examining the manufacturing uses of bird bones. It also permits synthesising, for the first time, knowledge of human and bird interactions in the study region between AD 1000 and 1500. Although thorough discussion of the ideational aspects of human/bird interactions extends beyond the objective and the length of this paper, some references to this

topic are included here. We draw from the contextual association of bird bones in some of the archaeological sites and also explore analogies between the archaeological data and the ethnographic record with, again, reference to present-day availability and use of birds. We outline future research signalling the need to revise certain biogeographic predictions relating to island-versus-continental avifaunas. Finally, we suggest diachronically nuanced research into anthropogenically induced changes in island vegetation which could have affected birds' nesting habits, especially in mangrove swamps.

The Islands and the Sites

The islands of the Venezuelan Caribbean are an integral part of the Southeastern Caribbean macroregion (Schubert and Moticska 1972, 1973) and, in biogeographic terms, pertain to the Colombian-Venezuelan-Trinidad sub-province (Woodring 1974; Villamizar and Cervigón 2017) (Figure 1). They extend in a chain from west to east across ca 500 km from Las Aves de Sotavento (adjacent to the Dutch island of Bonaire) to Los Testigos archipelagos (close to Grenada). They are separated from the Venezuelan mainland by the Bonaire Trench with a depth of over 1000 metres (Silver, Case, and MacGillavry 1975; Stock 1982). Margarita, Coche and Cubagua (like Aruba and Trinidad) lie on the South American shelf and became continental islands only due to sea-level rise after the onset of Holocene (Alvarez Espejo 1987). The early indigenous peoples who settled Margarita Island some 7.000 BP (Antczak et al. 2017) were dealing with a drastic transition to warm and moist insular environments and considerable sea level rise between 10,000 and 5000 BP. From about 3000 BP to the present, the continuous climatic fluctuations conduced to a very dry environment (Van der Hammen 1978; Schreve-Brinkman 1978; Rull et al. 2010). Although deep-time environmental studies for the Venezuelan Caribbean islands are lacking, it is assumed that the dry and more stable general environmental conditions which characterised the circum-Caribbean in the Late Holocene period (~3000 ¹⁴C yr BP to the present, see Curtis, Brenner, and Hodell 2001, 44–45; Macsotay and Cacéres Hernández 2005) also applied to the temporal and spatial frames addressed in this research.

Moving west to east, bird remains were recovered in Las Aves de Sotavento Archipelago at the AG/A site on Ave Grande and at the CU/A site on Curricai Island (Antczak and Antczak 2015) (Figure 1). These sites represent the temporary campsites of Dabajuroid pottery makers who navigated from the northwestern coast of present-day Falcón State or from the ABC islands or both. Second is the Los Roques Archipelago featuring the DM/A site on Dos Mosquises, the DMN/A site on Domusky Norte, and the CS/D site on Cayo



Figure 1. Venezuelan Caribbean islands and archaeological sites discussed in this paper within the geographical context of the Southeastern Caribbean.

Sal (Antczak and Antczak 2006). Next is the La Orchila Island group represented by the OR/F site at the locality of Los Mangles (Antczak and Antczak 1989). The bearers of the Valencioid and Ocumaroid cultures from the north-central Venezuelan mainland established campsites in Los Roques and on La Orchila Island where specialised groups of adult and adolescent males extracted, processed and preserved such marine resources as queen conch, reef fishes, turtles, and birds for both in situ and delayed consumption (Antczak and Antczak 1991a, 1999). The last site, BL/E, is situated on La Blanquilla Island. The bird remains from this site were attributed to more recent unidentified post-Saladoid occupants of the site dating to after AD 900 (Antczak and Antczak 1991b). All remaining indigenous temporary occupations of the islands discussed here occurred between ~AD 1000 and 1500 (Antczak and Antczak 1993, 2006).

The Archaeoavifaunal Sample

The sample comprises 3793 avian remains (Tables 1 and 2). The total of 1041 identified skeletal elements (NISP) represents over 100 individual birds (MNI) belonging to eight different families. The major limb bones with articular ends, the most robust and diagnostic parts of the avian skeleton, dominate the identified bone sample. Unidentified elements include vertebrae, foot bones, heavily eroded bones and small fragments.

Bird remains are largely absent which suggests that birds may have been decapitated off-site or that the

thin-walled and fragile skulls were considerably affected by butchering, food processing, and subsequent trampling, as well as by consumption, and bioturbation. The possibility of avian sacrificial offerings entailing decapitated heads discarded off-site may also be considered (Hamblin 1984, 95).

As we can observe in Tables 2 and 3, 75% ($N = 778$) of taxonomically identified bones and 88.8% ($N = 2445$) of unidentified bones were recovered at the AG/A site. There is insufficient space here to discuss in depth the relation of bird to other animal remains recovered at the studied sites. However, it should be emphasised that bird remains at the DM/A, DMN/A and CS/D sites in Los Roques Archipelago were quantitatively marginal with respect to the abundance of Queen Conch (*Lobatus gigas*) shells, turtle and fish, and non-local mammalian remains (Antczak 1991, 1995; Antczak et al. 2007; Schapira et al. 2009; Laffoon et al. 2016). This relation also proved remarkable on other island sites such as CU/A, OR/F, and BL/E (Antczak and Antczak 1989, 1991b). We surmise that the small zooarchaeological sample sizes from these sites may be related to the more reduced scale of excavations performed at these sites rather than to socio-cultural determinants. However, these determinants were clearly in play at the AG/A site where bird remains were exceptionally numerous (Antczak and Antczak 2015).

Methodological and Taphonomic Remarks

Given that the different sizes of the samples may well be the result of excavation bias, the richness values among them cannot be compared in a straightforward

Table 1. Number of identified and unidentified bird bones per site.

Identified/unidentified	DM/A	CS/D	OR/F	DMN/A	AG/A	CU/A	BL/E	Total
Identified bones	38	31	3	181	778	2	8	1041
Unidentified bones	41	32	5	212	2445	5	12	2752
Total	79	63	8	393	3223	7	20	3793

Table 2. The taxonomic abundance of identified avian remains per site.

Identified taxa	DM/A		CS/D		OR/F		DMN/A		AG/A		CU/A		BL/E		Total	
	NISP	MNI	NISP	MNI	NISP	MNI	NISP	MNI	NISP	MNI	NISP	MNI	NISP	MNI	NISP	MNI
Sulidae																
<i>Sula sula</i>	4	1	6	2	–	–	29	9	419	37	–	–	5	2	463	54
<i>Sula leucogaster</i>	–	–	–	–	–	–	–	–	153	17	–	–	–	–	153	17
<i>Sula</i> sp.	1	1	1	1	3	2	36	8	120	11	–	–	1	1	162	24
Pelecanidae																
<i>Pelecanus occidentalis</i>	23	3	9	2	–	–	97	11	2	1	1	1	2	2	134	20
Phoenicopteridae																
<i>Phoenicopterus ruber</i>	8	1	5	2	–	–	9	1	–	–	–	–	–	–	22	4
Laridae																
<i>Leucophaeus atricilla</i>	1	1	1	1	–	–	1	1	–	–	–	–	–	–	3	3
Laridae	–	–	1	1	–	–	–	–	2	1	–	–	–	–	3	2
Stercorariidae																
<i>Stercorarius</i> sp. (cf.)	–	–	–	–	–	–	–	–	–	–	1	1	–	–	1	1
Falconidae																
<i>Polyborus plancus</i>	–	–	1	1	–	–	9	1	–	–	–	–	–	–	10	2
Fregatidae																
<i>Fregata magnificens</i> (cf.)	–	–	–	–	–	–	–	–	2	1	–	–	–	–	2	1
Threskiornithidae/Pelecaniiformes																
<i>Ajaia ajaja</i> (cf.)	1	1	7	1	–	–	–	–	–	–	–	–	–	–	8	2
Sternidae																
<i>Anous stolidus</i>	–	–	–	–	–	–	–	–	27	5	–	–	–	–	27	5
<i>Anous</i> sp.	–	–	–	–	–	–	–	–	52	9	–	–	–	–	52	9
Ardeidae																
<i>Ardea herodias</i> (cf.)	–	–	–	–	–	–	–	–	1	1	–	–	–	–	1	1
Total	38	8	31	11	3	2	181	31	778	83	2	2	8	5	1041	145

NISP – Number of Identified Specimens. MNI – Minimum Number of Individuals.

fashion (Grayson 1984, 134). With regard to the differential screening, it should be noted that the majority of taxonomically identified bird bones were large enough for extraction by the 8 mm gauge screen. The bias introduced by the different soil volumes excavated at each site has been partly mitigated by calculating the average number of bone remains recovered per cubic metre in each cultural deposit. An average of nearly two bird remains were recovered in every cubic metre of cultural deposits excavated on all the Venezuelan islands (Table 3). The most abundant in bird remains is the AG/A site where nearly 90 bones were recovered in every cubic metre of cultural deposit. DM/A yielded the lowest average quantity of bird bones (NISP) per cubic metre despite the fact that it has been the most extensively excavated site.

The bone inventory of the identified avian spectrum has been analyzed in two broad categories of non-worked and worked specimens and manufacture debitage (Tables 2–5). The non-worked bones constitute the uses of birds for food, raw materials for the manufacture of tools and adornments, and their possibly symbolic use. This category also comprises specimens that were modified or fractured by humans but which do not show traces of use-wear. The function and meaning of these bones cannot be inferred without ethnographic analogies coupled with rigorous experimental studies. It is important to emphasise that cut marks resulting from butchering, not from artefact production, have thus far not been identified in the studied sample. The worked bones category includes finished forms manufactured with the use of tools

Table 3. The average quantity of bird bones (NISP) in one cubic metre of excavated cultural deposits.

Sites	DM/A	CS/D	OR/F	DMN/A	AG/A	CU/A	BL/E	Total
Average quantity of bird bones (NISP) in one cubic metre of excavated cultural deposit	0.4	2.8	0.44	5.45	89.42	0.66	1.6	19.6

Table 4. Worked bones and manufacture debitage from island sites discussed in the text; unidentified bones specified in brackets.

Worked bones/manufacture debris	DM/A	DMN/A	CS/D	AG/A	BL/E	Total
Worked midshafts (tubular beads)	3(2)	1(1)	1(1)	1(6)	(4)	6(14)
Cut proximal or distal ends of long bones	(2)	1	1(2)	16	–	18(4)
Total	3(4)	2(1)	2(3)	17(6)	(4)	24(18)

Table 5. Identified bird species and skeletal parts used in the production of midshaft beads; site code is given in brackets.

Artefact category	<i>Pelecanus occidentalis</i>		<i>Sula sula</i>		<i>Sula</i> sp. Humerus	Threskiornithidae/Pelecaniiformes Tibio–tarsus	Total
	Femur	Ulna	Humerus	Ulna			
Worked midshafts	1 (DMN/A)	1 (DM/A)	1 (AG/A)	2 (DM/A)	–	1 (CS/D)	6
Cut ends	–	1 (DMN/A)	–	1 (CS/D)	16 (AG/A)	–	18
Total	1	2	1	3	16	1	24

where traces of manufacture are visible. The function of these artefacts, including the manufacture debitage, may be inferred from their overall morphology, use-wear and depositional data, although it cannot always be reliably gleaned from form alone (e.g. Ubelaker and Wedel 1975).

The majority of bones are relatively well-preserved. The surfaces are light brown and smooth indicating that despite the adverse environmental conditions they were not significantly affected by diagenesis. Root-markings similar to those illustrated by Binford (1981) and White (1992), which are usually left by plant roots seeking buried bones as a nutrient source, are visible. The exception to the prevailing good preservation was observed at the CS/D site, where the bones have been severely affected by the proximity to the inner hypersaline lagoon. Rodent bioturbation is absent as rodents are not autochthonous in these islands. The bones were most probably not altered by dogs (Antczak 1999); however, they might have been exposed to scavenging and displacement by lizards, hermit crabs and birds. Further study should consider bone density and structure before degree of preservation can be confidently employed in order to make inferences about environmental or human alterations (Livingstone 1989, 546).

Archaeological Contexts

In all but two island sites, bird bone remains were associated with typical refuse areas where they were found together with potsherds, other animal remains, manufacture debris and hearth features. These exceptional depositional associations were registered in the DM/A and AG/A sites. As much as 72% ($N=26$) of bird remains (NISP) recovered in the DM/A site came from Trench B where the most complex cache-like deposit of Valencioid artefacts was recovered. It included pottery figurines, zoo- and anthropomorphic vessels, tobacco pipes and censers, bone flutes, shell whistles, stone micro-axes and pendants, and pieces of mineral ochre and resin. Functional attributes of these objects and their specific depositional associations indicate that offerings and other ritual activities were carried out at this site (Antczak and Antczak 2006, 2017). This is also the only excavation unit in the entire Venezuelan island region where bird depictions in pottery and shell have been recovered. The abundance of bird bones in this particular trench and their association with ritual contexts may suggest that living or dead birds or both, as well as bird bones and feathers, participated in the activities carried out at this site.

At the AG/A site, bird remains were scattered over the entire area; however, they were significantly more frequent in Trench A (Antczak and Antczak 2015). Here, two small heaps of bird bones were found. The first contained 860 bones of which 57 (NISP) were

identified; the second yielded 625 bones, 150 (NISP) identified. At first glance, this may suggest that the birds were consumed *in situ* and the heaps represent post-consumption refuse. However, inside the heaps, as well as in their immediate surroundings, seven tubular beads made of the mid-sections of booby humeri were found. Sixteen proximal and distal fragments of humeri with one extremity clearly cut were also discarded at this place, suggesting that the bead making occurred there. If the bones were worked when dry, as opposed to 'green' or 'fresh' (White 1992, 358), it may be expected that the AG/A site occupants piled some of the bird bones that were left after consumption. Furthermore, in the periods of time that elapsed between one visit and another, the bones in the heaps would have dried and lost adhered flesh, making them useful to artisans for bead-making. Alternatively, 'dry' bones could have been collected and piled at the beginning of each visit.

Disclosing Human-Bird Interactions

The archaeologically recovered bones represent birds that continue to inhabit or visit the islands today. Boobies account for 74.7% of NISP and 65.5% of MNI of the entire archaeological sample. The most common species is the Red-footed Booby (*Sula sula*) (44.5% of the NISP and 37.2% MNI in the entire sample). Brown Booby remains (*Sula leucogaster*) account for 14.7% of NISP (11.7% MNI). The remains of the Blue-faced Booby (*Sula dactylatra*), a relatively rare inhabitant of these islands (Lentino and Rodner 2002, 148), have not been identified. Some are food species for local fishermen populations (Phelps and Phelps 1951, 1959; Sociedad 1956; Buitrago 1987; Lentino, Luy, and Bruni 1994; Luy and Lentino 1994; Hilty 2003). The largest colony of boobies in Venezuela, up to 5000 individuals, has been reported in the Los Roques Archipelago (Phelps and Meyer de Schauensee 1978, 12; Phelps and Phelps 1951; Ginés and Yépez 1956, 68–69; Esclasans et al. 2009). They are also very common in the Las Aves de Sotavento Archipelago (Lentino, Luy, and Bruni 1994).

The quantitative predominance of Red-footed Booby remains is also significant (NISP 463). In the Venezuelan Caribbean this species nests among mangroves, while the Brown Booby nests on the ground (Luy and Lentino 1994; Luy 1997). Being larger than the Red-footed Booby, the latter would provide the hunter with more meat. Comparing the nesting habits to the present-day distribution of suitable nesting areas for each species creates space for inferences about socio-cultural factors possibly affecting booby species at each island site. Nowadays, the island of Ave Grande presents large mangrove extensions but much-reduced flat and dry surface suitable for on-ground nesting. If this distribution resembles that of the past, then the

Dabajuroid/Caquetío peoples could have hunted Red-footed Boobies nesting among the mangroves; however, Brown boobies would not have been captured on this island during their nesting season. Instead, they might have been hunted year-round while feeding close to the seashore.

A very different ratio emerges on Dos Mosquises and Domusky Norte islands which were occupied by Valencioid and Ocumaroid peoples. Here, the remains of the Red-footed Booby are present although this species does not nest on these islands. The closest nesting areas are the mangrove swamps towards the south-eastern corner of the archipelago at least 20 kilometres distant from the two island sites (Luy and Lentino 1994; Luy 1997). Culturally related sites were reported in this area, so the presence of bones at the two distant sites may be related to either Amerindian mobility or to post-depositional changes in mangrove coverage. The remains of Brown boobies have not been found in Dos Mosquises and Domusky Norte (nor on Cayo Sal) even if this species is nesting in great numbers on nearby Cayo de Agua, Bekebé and Selesky islands. The absence of Brown booby remains at Valencioid/Ocumaroid sites in Los Roques and their presence together with Red-footed boobies at Las Aves Dabajuroid/Caquetío sites obliges us to think about the role of cultural determinants. It seems possible that the Valencioid/Ocumaroid peoples imposed a taboo on the hunting of the Brown booby species. However, the above-discussed phenomena may also be explained by the more diversified nesting habits of boobies in pre-Hispanic times. The latter hypothesis assumes that the differentiation of nesting grounds between Red-footed and Brown boobies observed today in the Venezuelan Caribbean might be considered an anthropogenically-induced adaptation (c.f. Nelson 1978). This opens challenging avenues for future research. The second most-targeted birds were Brown Pelicans (*Pelecanus occidentalis*), also common inhabitants of the islands. Their remains account for 12.8% of NISP (13.8% MNI) in the overall sample. Until recently, pelicans were a food source for modern fishermen from the Los Roques Archipelago. Juvenile specimens, preferred for culinary purposes, were removed from their nests during the breeding season (Amend 1992, 170), a practice that may well extend far back into the past. The Brown or Common Noddy (*Anous stolidus*) was the third most commonly targeted bird, although its NISP reaches only 2.6% (MNI 3.4%). Currently these birds are found on all the Venezuelan islands in small colonies, nesting in mangroves or occasionally on the ground (Luy and Lentino 1994; Lentino and Rodner 2002). Striking, therefore, is the fact that despite their ubiquity, Brown Noddy remains were recovered only at the Ave Grande site.

While the above-discussed bird remains account for 918 NISP and constitute nearly 83% of MNI of the

entire sample, other birds discussed below account for 123 NISP and 17% of MNI. Flamingo bones (*Phoenicopterus ruber*) have been recovered at all three sites in the Los Roques Archipelago (NISP 22, MNI 4). Flamingos could not have been captured on the tiny islands of Dos Mosquises or Domusky Norte because conditions did not exist for this species to feed and breed there. However, they could have been captured on several other islands, especially those with large internal lagoons. Despite their overall scarcity in the Los Roques Archipelago and despite the fact that the body mass of a flamingo is considerably less than that of a pelican (it is similar to that of a booby [Prange, Anderson, and Rahn 1979, 112]), flamingos have been pursued for food by modern inhabitants of the islands (Antczak and Antczak 2006). Amerindians also would have hunted flamingos for food but additionally for their splendid rose-pink plumage. In the case of this species, the historical and archaeological data clearly indicate the shrinking of their nesting and feeding grounds may be due to the anthropogenic encroachments. In the Venezuelan Caribbean, these birds were breeding in Los Roques Archipelago in the 1880s (Bruni Celli 1968) and were reported on La Orchila and Isla de Aves (Phelps and Meyer de Schauensee 1979, 28). Their feeding localities include Margarita Island, Morrocoy and Laguna de Tacarigua on the mainland coast (Phelps and Meyer de Schauensee 1979; De Boer and Rooth 1976, 40). However, currently, the centre of flamingo reproduction in the Southern Caribbean is Bonaire Island (Rooth 1976, 16). During colonial and possibly pre-colonial times as well, these birds' feeding and nesting grounds were distributed not only over the islands and mainland coast but also inland in the Lake Valencia Basin and on the seasonally flooded western plains southwards (Von Humboldt 1995[1814–1825], 152, 182).

The next bird represented in the sample, the Crested Caracara (*Polyborus plancus*), is not a contemporary food species. This is the representative of the family Falconidae. Its remains have been recovered at the CS/D and DMN/A sites (NISP 10, MNI 2). This medium-sized bird of prey is a common visitor to the arid and marshy open areas of South America (Bond 1985, 331; Rodríguez-Ferraro 2008). Even if this species has never been reported in Los Roques (Sociedad 1956; Phelps and Meyer de Schauensee 1979; Lentino, Luy, and Bruni 1994; Lentino and Rodner 2002), the possibility that it occasionally visited these islands in the past cannot be discounted. Between 1987 and 1989, the authors observed several caracara on La Blanquilla Island as far as 100 km north of Margarita Island. Remarkably, at the Ocumaroid site on Domusky Norte Island (DMN/A) about five miles north of the CS/D site, the majority of caracara bones are complete. Some of them are paired and these pairs may pertain to a single subadult specimen. The deposition of these

bones very close to each other, in a small cluster, seems to suggest that this bird might have been brought to the island as a pet, then died or was sacrificed *in situ* (see also Bovy et al. 2016 for the natural death possibility). Some caracara birds might have been prepared as head adornments or headdresses on the mainland for use in ritual activities on the islands. Whole dead birds are still used as ceremonial accoutrements (Prinz 1999, 103, 109) while the beaks and wings of some species are still being used as a raw material for the manufacture of corporal adornments by some Venezuelan Amerindian societies (Herzog-Schröder 1999, 65; Prinz 1999, 109). Nevertheless, the meanings of these remains may prove exceptionally resistant to interpretation. Both the determination of natural versus socio-cultural deposition of avian remains in archaeological deposits and their identification as food or manufacture debris – if not manifestations of ritual or religious activities – requires sophisticated methodology and complex interdisciplinary research strategies (Schäfer 1972, 42–43; Livingstone 1989; Ucko 1989; Grant 1991).

The remains of pelagic species of Threskiornithidae/Pelecaniiformes from the DM/A and CS/D sites are probably those of the Roseate Spoonbill (*Ajaia ajaja*) (NISP 8), an uncommon species in the Los Roques Archipelago. These birds may have been captured by Valencioid peoples for food or their pink plumage. The authors have observed small groups of these birds feeding in the lagoons of Cayo Sal on several occasions and noted that fishermen capture them for food or keep them as pets in cages. Another contemporary non-food species is a migratory Laughing Gull (*Leucophaeus atricilla*) whose bones were recovered at all three sites in the Los Roques Archipelago (NISP 3). This representative of the Laridae family was also found at the AG/A site. Amerindians could have captured these birds for food or feathers (Morales Muñiz 1993, 6; Chaplin 1971, 158). Although the Laridae are scavengers and as such might have been avoided as food, nevertheless they yield eggs, a valuable resource hardly retrievable from the archaeological record. The eggs of the Laughing Gull and Least Tern (*Sterna albifrons*) are still collected for food by Los Roques fishermen and, until recent times, were ‘exported’ to popular markets on Margarita Island and the continental coast. The chicks of this species are often reared in captivity by the contemporary fishermen. It is noteworthy that Olson (1982) suggested that the extinct flightless rail (*Nasotrochis*) was reared in captivity by the prehistoric inhabitants of Puerto Rico and the Virgin Islands. The practice of egg gathering might have constituted one of the complementary food-procuring activities of pre-Hispanic visitors to the Venezuelan islands. The Magnificent Frigate Bird (NISP 2), the most aerial species of tropical American seas, is another contemporary non-

food species. Only two bones of this species were recovered at the AG/A site. The apparent symbolic rather than economic importance of these birds should be tested by future research. Ornithologists have reported nine species of herons in the Los Roques Archipelago (Lentino and Rodner 2002, 149). Only one possible bone of a Blue Heron (*Ardea herodias*) was recovered at the AG/A site. This fact becomes unsurprising if we push the relation between these birds and contemporary fishermen back in time. In the Venezuelan Caribbean, fishermen do not catch herons for food. Instead, they admire them and are pleased to have herons alight on their boats. They offer them food and try to coax the birds into frequent visits to their huts. In interviews with present-day inhabitants of the off-shore islands of Venezuela, we never heard of fishermen capturing or harming herons. It may be cautiously suggested that the ‘respectful’, non-economic relationship that exists between contemporary fishermen and herons might also have existed during republican, colonial, and perhaps even pre-Hispanic times. Finally, a single bone belonging, possibly, to a Parasitic Jaeger (*Stercorarius parasiticus*) does not permit us any interpretive scope. Before turning to discussion of bird bones used as raw material, we may summarise that marine birds such as boobies and pelicans have been widely used as food on the studied islands. This use was, however, very different at the western island sites visited by the Dabajuroid culture bearers, where birds were widely targeted than it was at the central sites seasonally occupied by the Valencioid and Ocumaroid culture bearers, where such subsistence use was relatively meagre. These data seem to suggest that different socio-cultural approaches to birds may have been operative on the part of the bearers of the differing archaeological cultures which visited the islands during the late Ceramic Age.

Several bones in the sample, especially the long ones, are fractured. Some of these fractures are ‘recent’ or ‘contemporary’ and indeed occurred during the excavation process. Some recent fractures seem to follow natural weathering and shrinkage cracks (Tappen and Peske 1970). These can be distinguished from ‘old’ fractures by colour and edge characteristics of the broken surface (White 1992, 358). Within the category of bones with ‘old’ fractures figure specimens that might have been broken intentionally or unintentionally. Attempts at distinguishing between these two categories of bones thus far have been unsuccessful as many ‘old’ fractures may be attributed to trampling during the occupation of the campsite by the Amerindians. Additionally, the discard of large quantities of heavy queen conch shells together with bird bones have undoubtedly affected the integrity of the thin-walled archaeofaunal remains. Given that many of the ‘non-worked bones’ could have been broken either

incidentally or during postdepositional times, the need for more detailed depositional data analyses – aided by use wear research to distinguish them from ‘worked’ bones – is clear.

The worked bone category contains midshafts cut or sawn out of the diaphyses of the long bones of medium-sized birds (Table 4). The discarded proximal and distal ends might have been produced by the modification referred to as ‘grooved and snapped’ in the bird literature (see Parmalee 1977, 1980). The lengths of these objects vary from 3.5 to 4 centimetres. At four sites, the midshafts were produced *in situ*. This is indicated by the presence of distal and proximal ends which, with their respective epiphyses, were discarded during the manufacture process. The BL/E on La Blanquilla is the only site where traces of bird bead manufacture were not recovered (Antczak and Antczak 1991b). In the remaining assemblages, marks resulting from cutting or sawing in the form of fine grooves may be seen on several midshafts and on distal and proximal ends. The morphology, location and orientation of these marks indicate that the cuts were made to facilitate the breaking off of the bones. Some bones certainly were sawn halfway through then broken, for the uneven ends may be noted on the broken edges of some of the distal and proximal ends. The bones might have been cut or sawn with a retouched bladelet or any other stone tool with a sharpened edge (Semenov 1964, 153, Fig. 76, 1–3). However, similar marks also would have been left by a molluscan shell knife (see Toth and Woods 1989; Serrand 1997, 209; Antczak 1999, 190; O’Day and Keegan 2001). While long bird bones were widely used in indigenous South America as tobacco snuff tubes and pipe stems (Wilbert 1987, 60–64; Fig. 27), the island midshafts are relatively short. This may suggest that they were inserted into necklaces together with perforated shell or stone beads and pendants.

Table 5 shows that boobies provided 83.3% of bones used for the production of midshaft beads, and that the skeletal part most frequently used for this purpose was the humerus (70.8%). However, it is interesting to note that bones of different bird species and distinct skeletal parts were used for bead manufacture at different sites. The Dabajuroid preferred the humeri of boobies as raw material for the production of midshaft beads, while the Valencioid and the Ocumaroid used the femur, ulna and tibiotarsus of both boobies and pelicans for the same purpose. In synthesis, we can observe emerging differentiation in the production of bird bone midshafts by the indigenous occupants of western versus central island sites. This seems to confirm the above-discussed finding with respect to the subsistence use of birds: different approaches to birds were operationalised by different human groups that temporarily visited the islands within the same temporal frame. These tendencies should be monitored in future

research in order to confirm such possible cultural selection.

Discussion

This paper fills a significant knowledge gap since for the first time it discusses material evidence recovered from multiple archaeological sites across the islands of the Venezuelan Caribbean and, therefore, provides the baselines for future comparative investigations in the study region and beyond. Below, we discuss some of the major findings of this investigation related to the social uses of birds and the seasonality of site occupation in the study region during late pre-colonial times. We also make some biogeographic predictions.

Ornithologists have reported 95 bird species belonging to 30 families in the Los Roques Archipelago (Lentino and Rodner 2002, 144). The birds represented in the archaeozoological sample from Los Roques account for 20% of families ($N=6$) and 7% ($N=7$) of reported species. The proportion is similar in the samples from Las Aves and La Orchila, although the contemporary avifauna in Los Roques is more diversified than that of the other island groups. These statistics indicate that some important foraging choices were made by the pre-colonial visitors as they focused their attention on a select number of species from the wide spectrum of marine birds available. Bird bone artefacts such as tools and adornments are rare archaeological findings in the studied sites and indicate that birds might have been largely pursued for food. Boobies and pelicans were apparently pursued as a food source, although their contribution to the overall diet, especially when compared to molluscs, turtles and fish, had to be marginal. Bird feathers might have been sought after, especially the colourful feathers of flamingoes. As indicated by the data, the Dabajuroid and Ocumaroid occupants of the islands depended much more on birds as a food source than did the Valencioid peoples, but the situation seems to be reversed on iconographic grounds. However, further discussion of this issue goes beyond the thematic framework of this paper.

Over a long period, bird remains have proven to be of great value in environmental studies and potential indicators of seasonal occupancy of prehistoric sites (Chaplin 1971, 158; for an Caribbean example see Hoffman and Hoogland 2003, 17). However, the applicability of present-day data on birds’ seasonal activity to the distant past is often of limited value for inferring prehistoric seasonal patterning (Grayson 1984, 177). Nevertheless, there remains some room to further explore the explanatory potential of seasonality indicators derived from the archaeoavifauna examined in this paper.

As noted above, documentary data indicate that flamingoes were breeding in the Los Roques Archipelago in the 1880s (Bruni Celli 1968) and on La Orchila

Island in the 1950s (Phelps and Phelps 1959). The presence of one bone of an immature flamingo recovered at the DMN/A site may indicate that these birds were also breeding in Los Roques during pre-Hispanic times. However intriguing, this evidence is not conclusive since two-and-a-half-month-old flamingos from breeding stock on Bonaire have been seen in Los Roques, indicating that these still immature birds are capable of flying across the nearly 170 kilometres that separate the two island groups (Lentino and Rodner 2002, 150; see Rooth 1976).

The reproductive period of pelicans starts earlier on some Venezuelan Caribbean islands and later on others, spanning the six months from March through August (Lentino and Rodner 2002, 148). The laughing gull reproductive season extends from May to July (Phelps and Meyer de Schauensee 1979, 93). This season roughly overlaps the abovementioned pelican breeding period which may suggest that the Amerindian campsites in which bones of immature pelicans and laughing gulls were found might have been occupied during the reproductive season of these birds. However, the presence of only one laughing gull bone per site and but two immature pelican bones in total imposes limits on seasonality research. More samples are necessary to confirm the observed pattern. It becomes essential to determine the approximate age, in months, of the immature birds in order to continue this line of research. For now, the lack of comparative skeletal collections of immature birds and serious gaps in knowledge about the behaviour and migratory schedules of birds in the studied region preclude reaching further conclusions of a reliable nature on this subject.

Following biogeographic predictions (MacArthur and Wilson 1967), the avifauna on small low oceanic islands is more vulnerable to natural or anthropogenic impacts than on larger and higher islands and the continent (Steadman 1989, 178; Steadman et al. 1991, 126; Grayson 2001, 34). The remains discussed here may serve to examine if past bird populations in the South-eastern Caribbean were more 'insular' in their morphologies than their counterparts from the mainland. A similar phenomenon has been documented for Tobago and Trinidad versus the South American continent (Wright and Steadman 2012). Such remains may also permit assessing long-term changes in bird communities, including the dynamics of the resident and wintering bird populations (Steadman et al. 2009; Steadman and Franklin 2014). The hypothesised differentiation between Red-footed and Brown Booby nesting grounds as a result of possible anthropogenically-induced adaptation may also be a result of deep-time human interactions with birds and their habitats. These may date back to the arrival of humans on the Southeastern Caribbean islands some 7000 years BP (Antczak et al. 2017). These environmentally related topics may be of relevance in the Circum-Caribbean

region and beyond, and furthermore inform modern conservation policies. The long-term indication of shrinking flamingo nesting and feeding grounds due to anthropogenic effects is one example of this latter consideration. Finally, further research should also address how this unique record of avian remains from some Venezuelan islands differs from realities on other Caribbean islands. It should also determine whether these differences – or perhaps similarities – can be attributed to a range of natural or cultural processes including pre-colonial and colonial intrusions and extirpations, taphonomy, and excavation biases.

Conclusion

The archaeological record indicates that marine birds affected every indigenous group that visited Venezuelan Caribbean islands during late pre-colonial times. Human/bird interactions exhibited an array of characteristics cohering into markedly different forms and intensities in this relatively homogenous insular environment. While boobies and pelicans were targeted generally as a food source, other species such as flamingos and Roseate Spoonbills may have been sought for their splendid plumage. Still other birds in indigenous cultural taxonomies such as herons and frigate birds could have structured other kinds of interactions. These birds may have been occasionally captured or even tabooed by indigenous peoples. The evidence of bone artefact manufacture on the islands, although limited, reveals varying uses of bird species and their skeletal parts. Subsistence and manufacturing practices clearly diverged between the indigenous Dabajuroid culture-bearing visitors to the western Las Aves islands and the Valencioid arrivals on the central Los Roques islands. These two indigenous groups of peoples exhibit distinct archeological cultures and, remarkably, also spoke different languages: Arawakan and Cariban, respectively (Antczak and Antczak 2015). Further inquiry into the role of avifauna in structuring a range of diachronic socio-ideological trajectories among Southeastern Caribbean indigenous societies remains a challenge for future interdisciplinary research.

In order to further test the hypothesis, included in this paper, of long-term anthropogenically-induced changes in marine bird communities, we need to improve standardised methods of bird remain recovery from archaeological sites, build up locally available osteological reference collections, and, crucially, exert sound chronological control on specific shifts that might have occurred in island environments due to human actions. We may, for example, ask how marine bird populations reacted to the substantial changes that had to have occurred in mangrove communities provoked by the impact of 19th-century steamship firewood provisioning and vegetal carbon-burning

practices, knowing as we do that mangroves provide excellent nesting habitat for many species of marine birds. These changes, as well as the continuation of other transformations already put in motion over several millennia by pre-colonial and early colonial indigenous populations remain unspecified in the Southeastern Caribbean region. Although analyses of bird species diversity in the Lesser Antilles do not seem to show or predict anthropogenic extinction (Ricklefs and Bermingham 2004, 228), our research into Venezuelan Caribbean bird remains suggests that long-term anthropogenic impacts on birds as well as on their feeding and nesting grounds should be more closely monitored. By studying bird remains from the archaeologically informed perspective of human-bird interaction, we improve our understanding of deep-time changes in bird communities and discover whether those changes were anthropogenic in nature. We are confident that our findings will serve as a baseline for comparative analyses within the Southern Caribbean and beyond.

Acknowledgements

We acknowledge Dan Bailey and Konrad A. Antczak for their valuable insights. Marlena and Andrzej Antczak thank the Theodore Dubin Foundation, New York, for its support in the early stages of this research.

Disclosure statement

No potential conflict of interest was reported by the authors.

Funding

This work was supported by the European Research Council under the European Union's Seventh Framework Programme (FP7/2007–2013) ERC Grant agreement no. 319209, under the direction of Prof. dr. C. L. Hofman.

ORCID

Miguel Lentino  <http://orcid.org/0000-0002-6372-7835>

References

- Alvarez Espejo, R. 1987. "Dinámica Sedimentaria en los Canales Marinos entre la Isla Margarita, Coche y la Península de Araya (Venezuela)." *Memoria Sociedad de Ciencias Naturales Louisiana Salle* 47 (127–128): 77–103.
- Amend, T. 1992. "Medio ambiente y recursos naturales del Archipiélago de los Roques." In *Parque Nacional Archipiélago Los Roques*, edited by T. Amend, A. Antczak, Ma.M. Antczak, J. R. Delgado, H. J. Guada, B. Rodríguez, and P. Vernet, 163–184. Caracas: Editorial Torino.
- Antczak, A. 1991. "La pesca marina prehispanica en el Archipiélago de Los Roques, Venezuela: El caso del yacimiento de la Isla Dos Mosquises." In *Proceedings of the 14th Congress of the International Association for Caribbean Archaeology*, 504–519. Barbados.
- Antczak, A. 1995. "Mammal Bone Remains From the Late Prehistoric Amerindian Sites on Los Roques Archipelago, Venezuela: An Interpretation." In *Proceedings of the 16th International Congress for Caribbean Archaeology*, 83–99. Basse Terre, Guadeloupe: Conseil Régional de la Guadeloupe.
- Antczak, A. 1999. "Late Prehistoric Economy and Society of the Islands off the Coast of Venezuela: A Contextual Interpretation of the Non-Ceramic Evidence." Unpublished PhD diss., University College London.
- Antczak, Ma.M., and A. Antczak. 1989. "Arqueología de la Isla La Orchila." *Tópicos* 595: 36–39.
- Antczak, A. T., and Ma.M. Antczak. 1991a. "Análisis del Sistema de los Asentamientos Prehistóricos en el Archipiélago de Los Roques." *Montalbán* 23: 335–386.
- Antczak, Ma.M., and A. Antczak. 1991b. "Arqueología de la Isla La Blanquilla, Venezuela." In *Proceedings of the 14th International Congress for Caribbean Archaeology*, 519–535. Barbados.
- Antczak, A. T., and Ma.M. Antczak. 1993. "Avances en Arqueología de las Islas Venezolanas." In *Contribuciones a la Arqueología Regional de Venezuela*, edited by F. Fernández and R. Gassón, 53–93. Caracas: Fondo Editorial Acta Científica Venezolana.
- Antczak, A. T., and Ma.M. Antczak. 1999. "La Esfera de Interacción Valencioide." In *El Arte Prehispanico de Venezuela*, edited by M. Arroyo, L. Blanco, and E. Wagner, 136–154. Caracas: Fundación Galería del Arte Nacional.
- Antczak, Ma.M., and A. Antczak. 2006. *Los Ídolos de las Islas Prometidas: Arqueología Prehispanica del Archipiélago de Los Roques*. Caracas: Editorial Equinoccio.
- Antczak, Ma.M., and A. Antczak. 2015. "Late Pre-Colonial and Early Colonial Archaeology of the Las Aves Archipelagos, Venezuela." *Contributions in New World Archaeology* 8: 7–44.
- Antczak, Ma.M., and A. Antczak. 2017. "Making Beings: Amerindian Figurines in the Caribbean (Chapter 10)." In *The Oxford Handbook of Figurines*, edited by T. Insoll, 195–220. Oxford: Oxford University Press.
- Antczak, A., J. Buitrago, Ma.M. Antczak, and H. J. Guada. 2007. "Contribution to the History of Marine Turtles in Venezuela." In *Proceedings of the 59th Gulf and Caribbean Fisheries Institute*, 63–73. Belize City, 6–11 Nov, 2006.
- Antczak, A. T., L. A. Lemoine Buffet, Ma.M. Antczak, and V. Rull. 2017. "Early Indigenous Occupations of Margarita Island and the Venezuelan Caribbean." In *Mid to Late Holocene Settlers of the Insular Caribbean*, edited by C. L. Hofman and A. T. Antczak. Albuquerque: Alabama University Press (in press).
- Armstrong Oma, K. 2010. "Between Trust and Domination. Social Contracts Between Humans and Animals." *World Archaeology* 42 (2): 175–187.
- Bartosiewicz, L., and E. Gál. 2007. "Sample Size and Taxonomic Richness in Mammalian and Avian Bone Assemblages From Archaeological Sites." *Archeometriai Műhely* IV (1): 37–44.
- Bejenaru, L., and D. Serjeantson. 2014. "Birds and Archaeology: New Research." *International Journal of Osteoarchaeology* 24: 245–246.
- Berlin, B., and E. A. Berlin. 1983. "Adaptation and Ethnozoological Classification: Theoretical Implications of Animal Resources and Diet of the Aguaruna and Huambisa." In *Adaptive Responses of Native*

- Amazonians, edited by R. B. Hames and W. T. Vickers, 301–325. New York: Academic Press.
- Binford, L. R. 1981. *Bones: Ancient Men and Modern Myths*. New York: Academic Press.
- Bochenski, Z., and J. R. Stewart. 2002. *Proceedings of the 4th Meeting of the ICAZ Bird Working Group*, Kraków, Poland, 11–15 September, 2001 (*Acta Zoologica Cracoviensia* 45 (special issue).
- Bond, J. 1985. *Birds of the West Indies*. London: Collins.
- Boomert, A. 2000. *Trinidad, Tobago and the Lower Orinoco Interaction Sphere: An Archaeological/Ethnohistorical Study*. Alkmaar: Cairi Publications.
- Bovy, K. M., J. E. Watson, J. Dolliver, and J. K. Parrish. 2016. “Distinguishing Offshore Bird Hunting From Beach Scavenging in Archaeological Contexts: the Value of Modern Beach Surveys.” *Journal of Archaeological Science* 70: 35–47.
- Bruni Celli, B. 1968. *Actas de la Sociedad de Ciencias Físicas y Naturales de Caracas (1872–1878), vol. 2, Segundo Período (1872–1878). Colección Histórico-Económica Venezolana, vol. 12*. Caracas: Banco Central de Venezuela.
- Buitrago, J. 1987. “Las Aves del Archipiélago de Los Roques.” *Natura* 82: 13–17.
- Chaplin, R. E. 1971. *The Study of Animal Bones From Archaeological Sites*. London: Seminar Press.
- Curtis, J. H., M. Brenner, and D. A. Hodell. 2001. “Climate Change in the Circum-Caribbean (Late Pleistocene to Present) and Implications for Regional Biogeography.” In *Biogeography of the West Indies: Patterns and Perspectives*, 2nd ed., edited by Ch.A. Woods and F. E. Sergile, 35–54. Boca Raton, FL: CRC Press.
- De Boer, B., and J. Rooth. 1976. “Notes on a Visit to Chichiriviche (Venezuela).” *Stinapa* 11: 40–41.
- DeFrance, S. D. 2009. “Zooarchaeology in complex Societies: Political Economy, status, and Ideology.” *Journal of Archaeological Research* 17: 105–168.
- Esclasans, D., M. Lentino, A. Luy, and C. Bosque. 2009. “The islands of Venezuela.” In *An Inventory of Breeding Seabirds of the Caribbean*, edited by P. Bradley and R. L. Norton, 216–224. Gainesville: University Press of Florida.
- Ginés, Hno, and T. G. Yépez. 1956. “Avifauna de las islas.” In *El Archipiélago de Los Roques y La Orchila*, edited by Sociedad de Ciencias Naturales La Salle, 68–78. Editorial Sucre: Caracas.
- Grant, A. 1991. “Economic or Symbolic? Animals and Ritual Behavior.” In *Sacred and Profane*, edited by P. Garwood, D. Jennings, R. Skeates, and J. Toms, 109–113. Oxford: Oxford University.
- Grayson, D. K. 1984. *Quantitative Zooarchaeology: Topics in the Analysis of Archaeological Faunas*. Orlando: Academic Press.
- Grayson, D. K. 2001. “The Archaeological Record of Human Impacts on Animal Populations.” *Journal of World Prehistory* 15 (1): 1–68.
- Grouard, S. 2010. “Caribbean Zooarchaeology.” In *Estado actual de la arqueozoología latinoamericana*, edited by G. Mengoni Goñalons, J. Arroyo-Cabrales, O. J. Polaco, and F. J. Aguilar, 133–151. Buenos Aires: International Council for Zooarchaeology.
- Grupe, G., and J. Peters. 2005. “Feathers, Grit and Symbolism: Birds and Humans in the Ancient Old and New Worlds.” *Proceedings of the 5th Meeting of the ICAZ Bird Working Group*, Munich, 26.7–28.7, Verlag Marie Leidorf: Munich.
- Hamblin, N. L. 1984. *Animal use by the Cozumel maya*. Tucson: The University of Arizona Press.
- Haviser, J. B. 1987. *Amerindian Cultural Geography on Curaçao*. Amsterdam, Natuurwetenschappelijke Studiekring voor Suriname ende Nederlandse Antillen, No.120.
- Haviser, J. B. 1991. *The first bonairens*. Reports of the archaeological-anthropological institute of the Netherlands Antilles, No.10, Curaçao.
- Herzog-Schröder, G. 1999. “Canjear y Compartir: Sobre el Significado de la Dádiva entre los Yanomami.” In *Orinoco-Parima: Comunidades Indígenas del Sur de Venezuela*, edited by J. L. Delmont, 50–71. Hatje Cantz Verlag: Ostfildern-Ruit.
- Higgins, J. 1999. “Túnel: A Case Study of Avian Zooarchaeology and Taphonomy.” *Journal of Archaeological Science* 26: 1449–1457.
- Hill, K., and K. Hawkes. 1983. “Neotropical Hunting among Aché of Eastern Paraguay.” In *Adaptive Responses of Native Amazonians*, edited by R. B. Hames and W. T. Vickers, 139–188. New York: Academic Press.
- Hilty, S. 2003. *Birds of Venezuela*. Princeton, NJ: Princeton University Press.
- Hofman, C. L., and M. L. P. Hoogland. 2003. “Plum Piece: Evidence for Archaic Seasonal Occupation on Saba, Northern Lesser Antilles Around 3300 BP.” *Journal of Caribbean Archaeology* 4: 12–27.
- Kidder, A. 1944. “Archaeology of Northwestern Venezuela.” *Papers of the Peabody Museum of American Archaeology and Ethnology* 26 (1). Cambridge, MA: Harvard University.
- Kristensen, T. J., and D. H. Holly. 2013. “Birds, Burials and Sacred Cosmology of the Indigenous Beothuk of Newfoundland, Canada.” *Cambridge Archaeological Journal* 23 (1): 41–53.
- Laffoon, J. E., T. F. Sonnemann, Ma.M. Antczak, and A. Antczak. 2016. “Sourcing Nonnative Mammal Remains From Dos Mosquises Island, Venezuela: new Multiple Isotope Evidence.” *Archaeological and Anthropological Sciences* 1–17. doi:10.1007/s12520-016-0453-6.
- Lentino, M., G. A. Luy, and A. R. Bruni. 1994. *Lista de las Aves del Parque Nacional Archipiélago de Los Roques y Otras Dependencias Federales, Venezuela*. Caracas: Sociedad Conservacionista Audubon de Venezuela.
- Lentino, M., and C. Rodner. 2002. “Los Roques: una muestra de la riqueza de nuestra avifauna insular.” In *Guía del Parque Nacional Archipiélago de Los Roques*, edited by J. Zamarro, 143–165. Caracas: Ecograph.
- Livingstone, S. D. 1989. “The Taphonomic Interpretation of Avian Skeletal Part Frequencies.” *Journal of Archaeological Science* 16: 537–547.
- Luy, A. 1997. “Caracterización de la Avifauna del Parque Nacional Archipiélago Los Roques.” In *Ciencia y Conservación en el Sistema de Parques Nacionales de Venezuela*, edited by I. Novo, M. L. González, C. T. Rodríguez, G. Martínez, and I. de Hertelendy, 265–269. Caracas: Econatura.
- Luy, A., and M. Lentino. 1994. “El uso de unidades paisajísticas para la caracterización de las comunidades de aves en el Parque Nacional Archipiélago de Los Roques.” Paper Presented at the Segundo Congreso Venezolano de Ecología, 22–26 Febrero, 1994. Guanare.
- Lyman, R. L. 2015. “On the variable Relationship Between NISP and NTAXA in Bird Remains and in Mammal Remains.” *Journal of Archaeological Science* 53: 291–296.
- MacArthur, R. H., and E. O. Wilson. 1967. *The Theory of Island Biogeography*. Princeton, NJ: Princeton University Press.

- Macsotay, O., and R. Cacéres Hernández. 2005. "Palaeoclimatology of the Pleistocene-Holocene Using Marine Molluscs and Hermatypic Corals From Northern Venezuela." *Caribbean Journal of Earth Science* 39: 93–104.
- Mannermaa, K. 2008. "Archaeology of Wings: Birds and People in the Baltic Sea Region During the Stone Age." Doctoral diss., University of Helsinki, Helsinki.
- Morales Muñiz, A. 1993. "Ornithoarchaeology: The various Aspects of the Classification of Bird Remains From Archaeological Sites." *Archaeofauna* 2: 1–13.
- Nelson, J. B. 1978. *The Sulidae: Gannets and Boobies*. Oxford: Oxford University Press.
- Newsom, L. A., and E. S. Wing. 2004. *On Land and Sea: Native American Uses of Biological Resources in the West Indies*. Tuscaloosa: The University of Alabama Press.
- O'Day, S. Jones, and W. F. Keegan. 2001. "Expedient Shell Tools From 1 HE NOW1 Hern West Indies." *Latin American Antiquity* 12 (3): 274–290.
- Oliver, J. R. 1989. "The Archaeological, Linguistic and Ethnohistorical Evidence for the Expansion of Arawakan Into Northwestern Venezuela and Northeastern Colombia." Unpublished doctoral diss., University of Illinois, Urbana-Champaign.
- Olson, S. L. 1982. "Biological Archaeology of the West Indies." *The Florida Anthropologist* 35 (4): 162–168.
- Orton, D. C. 2012. "Taphonomy and Interpretation: An Analytical Framework for Social Zooarchaeology." *International Journal of Osteoarchaeology* 22 (3): 320–337.
- Overton, N. J., and Y. Hamilakis. 2013. "A Manifesto for a Social Zooarchaeology. Swans and Other Beings in the Mesolithic." *Archaeological Dialogues* 20 (2): 111–136.
- Parmalee, P. W. 1977. "The Avifauna From Prehistoric Sites in South Dakota." *Plains Anthropologist* 22: 189–222.
- Parmalee, P. W. 1980. "Utilization of Birds and Fremont Cultural Groups of Utah." *Los Angeles County Museum Contributions in Science* 333: 237–250.
- Phelps Jr., W. H., and R. Meyer de Schauensee. 1979. *Una Guía de las Aves de Venezuela*. Caracas: Gráficas Armitano.
- Phelps, W. H., and W. H. Phelps Jr. 1951. "Las Aves de las Islas Los Roques y Las Aves y descripción de un nuevo canario de mangle." *Boletín de Louisiana Sociedad Venezolana de Ciencias Naturales* 13 (76): 1–24.
- Phelps, W. H., and W. H. Phelps Jr. 1959. "Las Aves de la Isla La Orchila." *Boletín de Louisiana Sociedad Venezolana de Ciencias Naturales* 93: 252–266.
- Prange, H. D., J. F. Anderson, and H. Rahn. 1979. "Scaling of Skeletal Mass to Body Mass in Birds and Mammals." *The American Naturalist* 113 (1): 103–122.
- Pregill, G. K., D. W. Steadman, and D. R. Watters. 1994. "Late Quaternary Vertebrate Faunas of the Lesser Antilles: Historical Components of Caribbean Biogeography." *Bulletin of Carnegie Museum of Natural History* 30: 1–51.
- Prinz, U. 1999. "Adornarse con Plumas Ajenas: Mito y Arte de los Indígenas de las Tierras Bajas Amazónicas." In *Orinoco-Parima: Comunidades Indígenas del Sur de Venezuela*, edited by J. L. Delmont, 86–113. Ostfildern-Ruit: Hatje Cantz Verlag.
- Prummel, W., J. T. Zeiler, and D. C. Brinkhuizen. 2008. "Birds in Archaeology." Proceedings of the 6th Meeting of the ICAZ Bird Working Group in Groningen, 23.8–27.8, 2008. Barkhuis: Groningen.
- Reichel-Dolmatoff, G. 1990. *Orfebrería y Chamanismo*. Medellín: Editorial Colina.
- Reis, K. R., and D. W. Steadman. 1999. "Archaeology of Trants, Montserrat. Part 5. Prehistoric Avifauna." *Annals of the Carnegie Museum* 68: 275–287.
- Ricklefs, R. E., and E. Bermingham. 2004. "History and the Species-Area Relationship in Lesser Antillean Birds." *The American Naturalist* 163 (2): 227–239.
- Rodríguez-Ferraro, A. 2008. "Community Ecology and Phylogeography of Bird Assemblages in Arid Zones of Northern Venezuela: Implications for the Conservation of Restricted-Range Birds." Unpublished PhD diss., University of Missouri, St. Luis.
- Roe, P. 1995. "Arts of the Amazon." In *Arts of the Amazon*, edited by B. Braun, 17–121. London: Thames and Hudson.
- Rooth, J. 1976. "Ecological Aspects of the Flamingos on Bonaire." *Stinapa* 11: 16–33.
- Rull, V., M. B. Abbott, T. Vegas-Vilarrúbia, M. Bezada, E. Montoya, S. Nogué, and C. González. 2010. "Paleoenvironmental Trends in Venezuela During the Last Glacial Cycle." In *Urumaco and Venezuelan Neotropics: The Fossil Record of the Northern Neotropics*, edited by M. Sánchez-Villagra, O. A. Aguilera, and A. A. Carlini, 55–83. Bloomington: Indiana University Press.
- Russell, N. 2012. *Social Zooarchaeology: Humans and Animals in Prehistory*. Cambridge: Cambridge University Press.
- Schäfer, W. 1972. *Ecology and Paleocology of Marine Environments*. Chicago, IL: The University of Chicago Press.
- Schapira, D., I. A. Montaña, A. Antczak, and J. M. Posada. 2009. "Using Shell Middens to Assess Effects of Fishing on Queen Conch (*Strombus gigas*) Populations in Los Roques Archipelago National Park, Venezuela." *Marine Biology* 156 (4): 787–795.
- Schreve-Brinkman, E. J. 1978. "A Palynological Study of the Upper Quaternary Sequence in the El Abra Corridor and Rock Shelters, Colombia." *Palaeogeography, Palaeoclimatology, Palaeoecology* 25: 1–109.
- Schubert, C., and P. N. Moticska. 1972. "Reconocimiento Geológico de las Islas Venezolanas en el Mar Caribe Entre Los Roques y Los Testigos; Parte I, Introducción e Islas Centrales." *Acta Científica Venezolana* 23: 210–223.
- Schubert, C., and P. N. Moticska. 1973. "Reconocimiento Geológico de las Islas Venezolanas en el Mar Caribe Entre Los Roques y Los Testigos (Dependencias Federales), Parte II, Islas Orientales y Conclusiones." *Acta Científica Venezolana* 24: 19–31.
- Semenov, S. A. 1964. *Prehistoric Technology: an Experimental Study of the Oldest Tools and Artefacts From Traces of Manufacture and Wear*. London: Cory, Adams and Mackay.
- Serjeantson, D. 2009. *Birds. Cambridge Manuals in Archaeology*. Cambridge: Cambridge University Press.
- Serrand, N. 1997. "Recurrent Forms in Tanki Flip." In *The Archaeology of Aruba: The Tanki Flip Site*, edited by A. H. Versteeg and S. Rostain, 189–217. Aruba: Publications of the Archaeological Museum Aruba 8.
- Silver, E. A., J. E. Case, and H. J. MacGillavry. 1975. "Geophysical Study of the Venezuelan Borderland." *Geological Society of America Bulletin* 86: 213–226.
- Sociedad de Ciencias Naturales La Salle. 1956. *El Archipiélago Los Roques y La Orchila*. Caracas: Editorial Sucre.

- Stahl, P. W. 1995. "Differential Preservation Histories Affecting the Mammalian Zooarchaeological Record From the Forested Neotropical Lowlands." In *Archaeology in the Lowland American Tropics; Current Analytical Methods and Recent Applications*, edited by P. W. Stahl, 154–181. Cambridge: Cambridge University Press.
- Steadman, D. W. 1989. "Extinction of Birds in Eastern Polynesia: A Review of the Record, and Comparisons with Other Pacific Island Groups." *Journal of Archaeological Science* 16: 177–205.
- Steadman, D. W., and J. Franklin. 2014. "Changes in a West Indian Bird Community Since the Late Pleistocene." *Journal of Biogeography* 42 (3): 426–438.
- Steadman, D. W., J. R. Montambault, S. K. Robinson, N. Oswalt, T. J. Brandeis, A. Londoño, M. J. Reetz, et al. 2009. "Relative Abundance, Habitat Use, and Long-Term Population Changes of Wintering and Resident Landbirds on St. John, U.S. Virgin Islands." *The Wilson Journal of Ornithology* 121 (1): 41–53.
- Steadman, D. W., T. W. Stafford Jr., D. J. Donahue, and A. J. T. Jull. 1991. "Chronology of Holocene Vertebrate Extinction in the Galapagos Islands." *Quaternary Research* 36: 126–133.
- Steadman, D. W., and A. V. Stokes. 2002. "Changing Exploitation of Terrestrial Vertebrates During the Past 3000 Years on Tobago, West Indies." *Human Ecology* 30 (3): 339–367.
- Steadman, D. W., and O. M. Takano. 2013. "A Late-Holocene Bird Community From Hispaniola: Refining the Chronology of Vertebrate Extinction in the West Indies." *The Holocene* 23 (7): 936–944.
- Steadman, D. W., M. P. Tellkamp, and T. A. Wake. 2003. "Prehistoric Exploitation of Birds on the Pacific Coast of Chiapas, Mexico." *The Condor* 105: 572–579.
- Steele, T. E. 2015. "The Contributions of Animal Bones From Archaeological Sites: the Past and Future of Zooarchaeology." *Journal of Archaeological Science* 56: 268–176.
- Stock, J. H. 1982. "Stygobiont Crustacea Malacostracta From Geologically Older and Younger Antillean Islands: A Biogeographic Analysis." *Bijdragen tot de Dierkunde* 52 (2): 191–199.
- Tappen, N. C., and G. R. Peske. 1970. "Weathering Cracks and Split-Line Patterns in Archaeological Bone." *American Antiquity* 35 (3): 383–386.
- Toth, N., and M. Woods. 1989. "Molluscan Shell Knives and Experimental cut-Marks on Bones." *Journal of Field Archaeology* 16: 250–255.
- Ubelaker, D. H., and W. R. Wedel. 1975. "Bird Bones, Burials, and Bundles in Plains Archaeology." *American Antiquity* 40 (4): 444–452.
- Ucko, P. J. 1989. "Foreword." In *Animals Into Art*, edited by H. Morphy, IX–XV. London: Unwin Hyman.
- Van der Hammen, T. 1978. "Stratigraphy and Environment of the Upper Quaternary of the El Abra Corridor and Rock Shelters (Columbia)." *Palaeogeography, Palaeoclimatology and Palaeoecology* 25: 111–162.
- Villamizar, G., and F. Cervigón. 2017. "Variability and Sustainability of the Southern Subarea of the Caribbean Sea Large Marine Ecosystem." *Environmental Development* 22: 30–41.
- Von Humboldt, A. 1995[1814–1825]. *Personal Narrative of a Journey to the Equinoctial Regions of the New Continent*. London: Penguin Books.
- Wetmore, A. 1935. "Pre-Columbian Bird Remains From Venezuela." *The Auk* 52 (3): 328–329.
- White, T. D. 1992. *Prehistoric Cannibalism at Mancos 5MTUMR-2346*. Princeton, NJ: Princeton University Press.
- Wilbert, J. 1985. "The House of the Swallow-Tailed Kite: Warao Myth and the Art of Thinking in Images." In *Animal Myths and Metaphors in South America*, edited by G. Urton, 145–182. Salt Lake City: University of Utah Press.
- Wilbert, J. 1987. *Tobacco and Shamanism in South America*. New Haven, CT: Yale University Press.
- Wing, E. S. 1989. "Human Exploitation of Animal Resources in the Caribbean." In *Biogeography of the West Indies: Past, Present and Future*, edited by Ch.A. Woods, 137–152. Gainesville, FL: Sandhill Crane Press.
- Wing, E. S. 2001. "The Sustainability of Resources Used by Native Americans on Four Caribbean Islands." *International Journal of Osteoarchaeology* 11 (1–2): 112–126.
- Woodring, W. P. 1974. "The Miocene Caribbean Faunal Province and its Subprovinces." *Verhandlungen der Naturforschenden Gesellschaft in Basel* 84 (1): 209–213.
- Wright, N. A., and D. W. Steadman. 2012. "Insular Avian Adaptations on two Neotropical Continental Islands." *Journal of Biogeography* 39 (10): 1891–1899.

Appendix 1. Parameters of excavation performed at sites referred to in this paper.

Trench	Excavated area (m ²)	Total volume of excavated soil (m ³)	Maximum depth of cultural deposit (cm)	Average thickness of cultural deposit (cm)	Total volume of excavated cultural deposit (m ³)	Excavated area where 1 mm ² mesh was used (m ²)	Volume of cultural deposit sieved with 1 mm ² mesh (m ³)
DM/A Valencioid site							
A	187	93.5	30	20	37.4	86	17.2
B	65	29.5	40	20	13.0	65	13.0
C	150	120	55	25	37.5	79	19.7
D ¹	5	4.5	80 ²	80	4.0	3	2.4
E	8	4	40	20	1.6	8	1.6
F	6	3	25	20	1.2	2	0.4
CS/D Valencioid site							
A	37	37	70	30	11.1	12	3.6
OR/F Valencioid site							
A	15	15	70	45	6.75	15	6.75
DMN/A Ocumaroid site							
Test pits	83	83	75	40	33.2	33	13.2
AG/A Dabajuroid site							
A	43.5	21.7	45	20	8.7	43.5	8.7
CU/A Dabajuroid/Caquetio site							
Test pits	12	8	50	25	3	8 ³	–
BL/E post-Saladoid component							
A	20	16	40	25	5	4 ⁴	–
Total	631.5	435.2	–	–	162.45	358.5	86.55

¹Area of pre-Valencioid cultural deposits whose faunal remains are not taken into account in this paper. ²An additional 20 cm had to be added that correspond to the height of the midden that emerges above the surrounding surface level. ³Eight square millimetre mesh was used in sieving at these sites. ⁴Three square millimetre mesh was used in sieving; bird bones discussed here were associated to post-Saladoid component of this site.

Appendix 2. Identified bird remains in DM/A site, Dos Mosquises Island, Los Roques Archipelago.

Taxa/Excavation unit	Skeletal element /anatomic position	Portion of the element	NISP by level		Catalogue number
			0–20	20–40	
<i>Trench A</i>					
<i>Sula sula</i>	Ulna	Midshaft fragment	1	–	3920
<i>Trench B</i>					
<i>Pelecanus occidentalis</i>	Carpometacarpus	Complete	–	1	4265
<i>Pelecanus occidentalis</i>	Carpometacarpus	Distal fragment	–	1	4229
<i>Pelecanus occidentalis</i>	Coracoids	Fragment	1	–	4221
<i>Pelecanus occidentalis</i>	Femur	Complete	–	1	6321
<i>Pelecanus occidentalis</i>	Femur	Distal end	–	1	648
<i>Pelecanus occidentalis</i>	Mandible, left	Articulation, proximal	–	1	4271
<i>Pelecanus occidentalis</i>	Quadrates	Complete	–	1	4250
<i>Pelecanus occidentalis</i>	Radius	Proximal fragment	–	1	4262
<i>Pelecanus occidentalis</i>	Radius, left	Distal fragment	–	1	4223
<i>Pelecanus occidentalis</i>	Radius, right	Distal fragment	–	1	4275
<i>Pelecanus occidentalis</i>	Radius, right	Proximal fragment	–	1	4218
<i>Pelecanus occidentalis</i>	Synsacrum	Articulation fragment	–	1	4248
<i>Pelecanus occidentalis</i>	Ulna	Fragment	–	1	636
<i>Pelecanus occidentalis</i>	Ulna	Fragment	–	1	4259
<i>Pelecanus occidentalis</i>	Ulna	Fragment	–	1	593
<i>Pelecanus occidentalis</i>	Ulna	Midshaft cut	–	1	4258
<i>Pelecanus occidentalis</i>	Ulna, right	Proximal fragment	–	1	4273
<i>Phoenicopterus ruber</i>	Cervical vertebra	Fragment	–	1	4244
<i>Phoenicopterus ruber</i>	Coracoids	Complete	–	2	4226, 4255
<i>Phoenicopterus ruber</i>	Humerus	Head fragment	–	1	4254
<i>Phoenicopterus ruber</i>	Humerus	Head fragment	–	1	4256
<i>Phoenicopterus ruber</i>	Sternum	Complete	–	1	4249
<i>Sula</i> spp.	Frontal	Complete	1	–	2128
<i>Sula sula</i>	Coracoids, right	Complete	–	1	4246
<i>Sula sula</i>	Ulna	Midshaft fragment	–	1	4236
<i>Sula sula</i>	Ulna, left	Proximal fragment	–	1	4264
<i>Trench C</i>					
Ciconiiformes	Tibio-tarsus	Fragment (eroded)	–	1	1150
<i>Leucophaeus atricilla</i>	Ulna	Fragment	–	1	2127
<i>Pelecanus occidentalis</i>	Femur	Complete	–	1	4806
<i>Pelecanus occidentalis</i>	Radius	Proximal end	–	1	1147

(Continued)

Continued.

Taxa/Excavation unit	Skeletal element /anatomic position	Portion of the element	NISP by level		Catalogue number
			0–20	20–40	
<i>Pelecanus occidentalis</i>	Ulna	Fragment	–	1	1115
<i>Pelecanus occidentalis</i>	Ulna	Fragment	–	1	1142
<i>Pelecanus occidentalis</i>	Ulna	Proximal end	–	1	1591
<i>Phoenicopterus ruber</i> Trench E	Carpal-metacarpal	Complete	–	1	2802
<i>Phoenicopterus ruber</i>	Coracoids	Fragment	1	–	2893
<i>Pelecanus occidentalis</i>	Ulna	Fragment	–	1	16222
Total NISP			4	34	

Appendix 3. Identified bird remains in CS/D site, Cayo Sal Island, Los Roques Archipelago.

Taxa/Excavation unit	Skeletal element /anatomic position	Portion of the element	NISP by level		Catalogue number
			0–20	20–40	
<i>Trench A</i>					
Threskiornithidae/Pelecaniiformes	Tarso-metatarsus	Distal end	1	–	2115
Threskiornithidae/Pelecaniiformes	Tibia	Midshaft	–	1	1853
Threskiornithidae/Pelecaniiformes	Tibia	Proximal end	–	1	2113
Threskiornithidae/Pelecaniiformes	Tibio-tarsus	Proximal end	1	–	2114
Threskiornithidae/Pelecaniiformes	Tibio-tarsus	Proximal end	1	–	2118
Threskiornithidae/Pelecaniiformes	Ulna	Fragment	–	1	2116
Threskiornithidae/Pelecaniiformes	Ulna	Fragment	–	1	1856
Laridae	Humerus	Fragment	1	–	2125
<i>Leucophaeus atricilla</i>	Humerus	Eroded	–	1	2125
<i>Pelecanus occidentalis</i>	Coracoids	Fragment	–	1	4816
<i>Pelecanus occidentalis</i>	Femur	Complete	1	–	2117
<i>Pelecanus occidentalis</i>	Femur	Complete	–	1	2122
<i>Pelecanus occidentalis</i>	Femur	Complete	–	1	4812
<i>Pelecanus occidentalis</i>	Tibio-tarsus, right	Complete	–	1	4841
<i>Pelecanus occidentalis</i>	Trochlea-tarso-metatarsus	Complete	1	–	7917
<i>Pelecanus occidentalis</i>	Ulna	Distal fragment	–	1	3415
<i>Pelecanus occidentalis</i>	Ulna, right	Fragment	–	1	3418
<i>Phoenicopterus ruber</i>	Carpo-metacarpus	Complete	–	1	4813
<i>Phoenicopterus ruber</i>	Femur	Complete	–	1	2121
<i>Phoenicopterus ruber</i>	Tarso-metatarsus	Distal end	1	–	2119
<i>Phoenicopterus ruber</i>	Tarso-metatarsus	Distal end	–	1	2124
<i>Phoenicopterus ruber</i>	Tarso-metatarsus	Proximal fragment	1	–	3426
<i>Polyborus plancus</i>	Ulna, left	Complete	–	1	3557
<i>Sula</i> spp.	Coracoids, right	Complete	–	1	4815
<i>Sula sula</i>	Humerus	Complete	1	–	7918
<i>Sula sula</i>	Humerus, left	Distal fragment	1	–	2744
<i>Sula sula</i>	Humerus, right	Distal fragment	–	1	2429
<i>Sula sula</i>	Ulna, left	Proximal fragment	1	–	3238
<i>Sula sula</i>	Ulna, left	Proximal fragment	1	–	3417
<i>Sula sula</i>	Ulna, right	Distal fragment cut	1	–	3273
Total NISP			13	17	

Appendix 4. Identified bird remains in DMN/A site, Domusky Norte Island, Los Roques Archipelago.

Taxa/Excavation unit	Skeletal element /anatomic position	Portion of the element	NISP by level		Catalogue number
			0–20	20–40	
DMN/A – Trench A					
<i>Leucophaeus atricilla</i>	Humerus	Fragment	–	1	6782
<i>Pelecanus occidentalis</i>	Basicranium	Complete	–	1	2971
<i>Pelecanus occidentalis</i>	Basicranium	Complete	–	1	2977
<i>Pelecanus occidentalis</i>	Coracoids, left	Proximal end	–	2	3729, 3679
<i>Pelecanus occidentalis</i>	Coracoids, right	Complete	–	3	3585, 3673, 3732
<i>Pelecanus occidentalis</i>	Coracoids, right	Proximal end	–	1	3794
<i>Pelecanus occidentalis</i>	Coracoids, right, immature	Complete	–	1	3707
<i>Pelecanus occidentalis</i>	Coris, right	Fragment	–	2	3636, 3633
<i>Pelecanus occidentalis</i>	Femur	Complete	–	1	4952
<i>Pelecanus occidentalis</i>	Femur	Midshaft	–	1	3786
<i>Pelecanus occidentalis</i>	Femur, left	Complete	–	8	4835, 3637, 3639, 3719, 3722, 3724, 3762, 3838

(Continued)

Continued.

Taxa/Excavation unit	Skeletal element /anatomic position	Portion of the element	NISP by level		Catalogue number
			0–20	20–40	
<i>Pelecanus occidentalis</i>	Femur, left	Distal fragment	–	1	3671
<i>Pelecanus occidentalis</i>	Femur, left	Proximal fragment	–	1	3704
<i>Pelecanus occidentalis</i>	Femur, right	Complete	–	8	3713, 3734, 3781, 3725, 3723, 3718, 3721, 3712
<i>Pelecanus occidentalis</i>	Femur, right	Proximal end	–	2	3782, 3615
<i>Pelecanus occidentalis</i>	Femur, right	Proximal fragment	–	1	3659
<i>Pelecanus occidentalis</i>	Humerus	Complete	1	–	3655
<i>Pelecanus occidentalis</i>	Humerus	Distal fragment	–	1	5310
<i>Pelecanus occidentalis</i>	Humerus	Fragment	1	–	4825
<i>Pelecanus occidentalis</i>	Humerus	Fragment	–	2	3577, 9201
<i>Pelecanus occidentalis</i>	Humerus head, left	Complete	–	1	9100
<i>Pelecanus occidentalis</i>	Humerus head, right	Complete	–	1	9089
<i>Pelecanus occidentalis</i>	Humerus, left	Complete	–	1	3703
<i>Pelecanus occidentalis</i>	Humerus, left	Distal end	–	1	3711
<i>Pelecanus occidentalis</i>	Humerus, left	Proximal fragment	–	1	4263
<i>Pelecanus occidentalis</i>	Keel	Fragment	–	3	3726, 9097, 3622
<i>Pelecanus occidentalis</i>	Radius	Proximal fragment	–	1	4242
<i>Pelecanus occidentalis</i>	Sacrum	Fragment	–	2	9088, 9091
<i>Pelecanus occidentalis</i>	Scapula	Complete	–	1	9202
<i>Pelecanus occidentalis</i>	Tarsal	Complete	–	1	6698
<i>Pelecanus occidentalis</i>	Tarsal, left	Complete	–	3	3674, 3715, 3630
<i>Pelecanus occidentalis</i>	Tarsal, left	Proximal end	–	1	3769
<i>Pelecanus occidentalis</i>	Tarsal, left	Proximal fragment	–	1	3642
<i>Pelecanus occidentalis</i>	Tarsal, right	Complete	–	3	3672, 3731, 4839
<i>Pelecanus occidentalis</i>	Tarsal, right	Distal end	–	3	3714, 3741, 3785
<i>Pelecanus occidentalis</i>	Tarsal, right	Proximal end	–	1	3589
<i>Pelecanus occidentalis</i>	Tibia left	Complete	–	5	3638, 3592, 3706, 3710, 3735
<i>Pelecanus occidentalis</i>	Tibia, left	Distal end	–	6	3757, 3773, 3788, 3816, 3598, 3748
<i>Pelecanus occidentalis</i>	Tibia, left	Distal fragment	–	1	3701
<i>Pelecanus occidentalis</i>	Tibia, left	Proximal end	–	4	3602, 3772, 3797, 3812
<i>Pelecanus occidentalis</i>	Tibia, right	Complete	–	2	3591, 3730
<i>Pelecanus occidentalis</i>	Tibia, right	Complete	1	–	3656
<i>Pelecanus occidentalis</i>	Tibia, right	Distal end	–	3	3740, 3739, 3603
<i>Pelecanus occidentalis</i>	Tibia, right	Distal fragment	1	–	3621
<i>Pelecanus occidentalis</i>	Tibia, right	Proximal end	–	1	4840
<i>Pelecanus occidentalis</i>	Tibia, right	Proximal fragment	–	1	3588
<i>Pelecanus occidentalis</i>	Ulna	Complete	1	–	3571
<i>Pelecanus occidentalis</i>	Ulna	Complete	–	1	3593
<i>Pelecanus occidentalis</i>	Ulna	Fragment	–	2	9077, 4805
<i>Pelecanus occidentalis</i>	Ulna	Right distal fragment – cut	–	1	16851
<i>Pelecanus occidentalis</i>	Ulna, immature	Complete	–	1	3590
<i>Pelecanus occidentalis</i>	Ulna, right	Distal fragment – cut	–	1	1685
<i>Phoenicopterus ruber</i>	Carpal, right	Complete	–	1	2808
<i>Phoenicopterus ruber</i>	Coracoids, left	Fragment	–	1	3093
<i>Phoenicopterus ruber</i>	Keel	Fragment	–	1	3665
<i>Phoenicopterus ruber</i>	Mandible	Distal fragment	–	1	4295
<i>Phoenicopterus ruber</i>	Tibia	Complete	–	2	4950, 5413
<i>Phoenicopterus ruber</i>	Tibia	Proximal fragment	1	–	3572
<i>Phoenicopterus ruber</i>	Tibia, left	Distal end	–	1	3844
<i>Phoenicopterus ruber</i>	Ulna, immature	Complete	–	1	3574
<i>Polyborus plancus</i>	Basicranium, (immature?)	Complete	–	1	2970
<i>Polyborus plancus</i>	Femur, right	Proximal fragment	1	–	3654
<i>Polyborus plancus</i>	Humerus, left	Complete	1	–	3688
<i>Polyborus plancus</i>	Humerus, left	Complete	–	1	5386
<i>Polyborus plancus</i>	Humerus, right	Complete	–	1	3680
<i>Polyborus plancus</i>	Tarsal	Complete	–	1	5908
<i>Polyborus plancus</i>	Tarsal, right	Complete	1	–	3699
<i>Polyborus plancus</i>	Tibia, left	Proximal fragment	–	1	3645
<i>Polyborus plancus</i>	Ulna, right	Complete	1	–	3579
<i>Sula</i> sp.	Basicranium	Complete	–	2	2972, 9061
<i>Sula</i> sp.	Carpal, left	Complete	2	–	3694, 3697
<i>Sula</i> sp.	Carpal, left	Proximal end	–	4	3774, 3608, 3751, 3848
<i>Sula</i> sp.	Carpal, right	Complete	1	–	3685
<i>Sula</i> sp.	Carpal, right	Distal end	–	1	3779
<i>Sula</i> sp.	Coracoids	Fragment	–	1	9073
<i>Sula</i> sp.	Coracoids, left	Fragment	–	1	3846
<i>Sula</i> sp.	Coracoids, right	Complete	–	1	4836
<i>Sula</i> sp.	Coracoids, right	Fragment	–	1	3604
<i>Sula</i> sp.	Humerus	Distal end	–	1	3599
<i>Sula</i> sp.	Humerus, left	Distal end	–	2	3709, 3796
<i>Sula</i> sp.	Mandible, right	Complete	–	1	3690
<i>Sula</i> sp.	Metacarpal, left	Complete	–	1	9078
<i>Sula</i> sp.	Radius	Fragment	–	2	9069, 9072
<i>Sula</i> sp.	Ulna	Complete	–	1	3742
<i>Sula</i> sp.	Ulna	Fragment	–	2	3420, 9038
<i>Sula</i> sp.	Ulna	Proximal end	–	1	9084

(Continued)

Continued.

Taxa/Excavation unit	Skeletal element /anatomic position	Portion of the element	NISP by level		Catalogue number
			0–20	20–40	
<i>Sula</i> sp.	Ulna, left	Distal end	–	2	3618, 3682
<i>Sula</i> sp.	Ulna, left	Proximal end	–	1	3890
<i>Sula</i> sp.	Ulna, right	Complete	–	2	9085, 9037
<i>Sula</i> sp.	Ulna, right	Distal end	–	1	3613
<i>Sula</i> sp.	Ulna, right	Distal end	–	2	3754, 3787
<i>Sula</i> sp.	Ulna, right	Proximal end	–	3	3759, 3597, 3780
<i>Sula sula</i>	Humerus, left	Complete	1	–	3596
<i>Sula sula</i>	Humerus, left	Proximal fragment	–	1	3648
<i>Sula sula</i>	Humerus, right	Complete	–	1	3700
<i>Sula sula</i>	Humerus, right	Proximal fragment	–	1	3669
<i>Sula sula</i>	Radius	Complete	–	1	5374
<i>Sula sula</i>	Ulna	Complete	–	4	5368, 5371, 5373, 5376
<i>Sula sula</i>	Ulna	Complete	–	1	6780
<i>Sula sula</i>	Ulna	Distal fragment	–	1	4891
<i>Sula sula</i>	Ulna	Fragment	–	1	4782
<i>Sula sula</i>	Ulna left	Proximal fragment	–	1	3583
<i>Sula sula</i>	Ulna, left	Complete	1	–	3586
<i>Sula sula</i>	Ulna, left	Complete	–	4	3641, 3643, 3658, 3661
<i>Sula sula</i>	Ulna, left	Distal fragment	–	2	3587, 3652
<i>Sula sula</i>	Ulna, left	Proximal fragment	–	1	3653
<i>Sula sula</i>	Ulna, right	Complete	1	–	3580
<i>Sula sula</i>	Ulna, right	Complete	–	2	3646, 4837
<i>Sula sula</i>	Ulna, right	Distal fragment	–	2	3581, 3670
<i>Sula sula</i>	Ulna, right	Proximal	–	1	3575
<i>Sula sula</i>	Ulna, right	Proximal fragment	1	–	3570
DMN/A – Pit 23					
<i>Pelecanus occidentalis</i>	Humerus	Complete	1	–	4190
<i>Sula sula</i>	Basicranium	Complete	1	–	4189
Total NISP			19	162	

Appendix 5. Identified bird remains in OR/F site, La Orchila Island.

Taxa	Skeletal element /anatomic position	Portion of the element	NISP by level		Catalogue number
			0–20	20–40	
<i>Sula</i> spp.	Coracoids	Complete	–	1	16836
<i>Sula</i> spp.	Pelvis	Complete	–	1	16820
<i>Sula</i> spp.	Pelvis	Fragment	–	1	16819
Total			0	3	

Appendix 6. Identified bird remains in AG/A site, Ave Grande Island, Las Aves de Sotavento Archipelago.

Taxa	Skeletal element /anatomic position	Portion of the element	NISP by level		Catalogue number
			0–20	20–40	
AS/AG/A/1/1 ¹					
<i>Fregata magnificens</i> (?)	Ulna, left	Proximal fragment	–	1	16799
<i>Pelecanus occidentalis</i>	Ulna	Fragment	–	2	7928, 7943
<i>Sula</i> sp.	Humerus	Distal fragment – cut	–	2	16815, 16841
<i>Sula</i> sp.	Humerus	Proximal fragment – cut	–	1	16840
<i>Sula</i> sp.	Humerus, left	Distal fragment	–	1	15343
<i>Sula</i> sp.	Humerus, left	Distal fragment – cut	–	6	16797, 16798, 16807, 16827, 16837, 16845
<i>Sula</i> sp.	Humerus, left	Proximal fragment	–	1	16804
<i>Sula</i> sp.	Humerus, left	Proximal fragment – cut	–	2	16816, 16828
<i>Sula</i> sp.	Humerus, right	Distal fragment	–	1	15340
<i>Sula</i> sp.	Humerus, right	Distal fragment – cut	–	2	16796, 16848, 16806
<i>Sula</i> sp.	Humerus, right	Proximal fragment	–	6	16800, 16803, 16825, 16826, 16829, 16839
<i>Sula</i> sp.	Humerus, right	Proximal fragment – cut	–	3	16801, 16821, 16847
<i>Sula</i> sp.	Radius	Proximal fragment	1	–	13130
<i>Sula</i> sp.	Radius	Proximal fragment	–	2	16818, 16850
<i>Sula</i> sp.	Tibia, right	Distal fragment – cut	–	1	16809
<i>Sula</i> sp.	Ulna, left	Proximal fragment	–	1	16846
<i>Sula</i> sp.	Ulna, right	Distal fragment	–	1	16849
<i>Sula</i> sp.	Ulna, right	Proximal	–	1	16802
<i>Sula</i> sp.	Ulna, right	Proximal fragment	–	1	15342

(Continued)

Continued.

Taxa	Skeletal element /anatomic position	Portion of the element	NISP by level		Catalogue number
			0–20	20–40	
<i>Sula sula</i>	Basicranium	Complete	–	3	7863, 7902, 7903
<i>Sula sula</i>	Carpal	Complete	–	4	7865, 7882, 7886, 7965
<i>Sula sula</i>	Coracoids	Complete	–	2	7883, 7901
<i>Sula sula</i>	Coracoids	Fragment	–	1	7890
<i>Sula sula</i>	Humerus	Midshaft	–	1	7864
<i>Sula sula</i>	Humerus, left	Complete	–	1	7877
<i>Sula sula</i>	Humerus, left	Distal fragment	–	3	7875, 7876, 7889
<i>Sula sula</i>	Humerus, right	Distal fragment	–	1	7880
<i>Sula sula</i>	Keel	Complete	–	2	7888, 7900
<i>Sula sula</i>	Keel	Proximal end	–	1	7887
<i>Sula sula</i>	Ulna	Fragment	–	2	7938, 7940
Total NISP			1	56	

¹This code means Aves de Sotavento, Ave Grande Island, site A, Trench 1, quadrant 1 (each quadrant has 1m²); note same codificación used in Appendix 7.

Appendix 7. Identified bird remains in AG/A site, Ave Grande Island, Las Aves de Sotavento Archipelago (Boxes Nr 1-8).¹

Taxa/Excavation unit	Skeletal element /anatomic position	NISP Level 20–40
AS/AG/A/1/2		
<i>Anous</i> sp.	Coracoids, left	1
<i>Anous</i> sp.	Coracoids, left	2
<i>Anous</i> sp.	Coracoids, right	1
<i>Anous</i> sp.	Coracoids, right	5
<i>Anous</i> sp.	Humerus, left	1
<i>Anous</i> sp.	Humerus, left	1
<i>Anous</i> sp.	Humerus, left, distal	1
<i>Anous</i> sp.	Humerus, left, proximal	2
<i>Anous</i> sp.	Humerus, left, proximal	1
<i>Anous</i> sp.	Humerus, right	2
<i>Anous</i> sp.	Humerus, right, distal	5
<i>Anous</i> sp.	Humerus, right, proximal	2
<i>Anous</i> sp.	Humerus, right, proximal	2
<i>Anous</i> sp.	Ulna	1
<i>Anous</i> sp.	Ulna, fragments	6
<i>Ardea herodias</i>	Femur	1
Laridae	Tibia, distal	1
Laridae	Tibia, proximal	1
<i>Sula leucogaster</i>	Coracoids, left	3
<i>Sula leucogaster</i>	Coracoids, right	1
<i>Sula leucogaster</i>	Humerus, left, distal	2
<i>Sula leucogaster</i>	Humerus, right, distal	4
<i>Sula leucogaster</i>	Humerus, right, proximal	2
<i>Sula</i> sp.	Carpal-metacarpal, fragments	4
<i>Sula</i> sp.	Coracoids, left	3
<i>Sula</i> sp.	Coracoids, left, eroded	1
<i>Sula</i> sp.	Coracoids, right	4
<i>Sula</i> sp.	Coracoids, right, eroded	6
<i>Sula</i> sp.	Coccyx	5
<i>Sula</i> sp.	Phalange, eroded	4
<i>Sula</i> sp.	Humerus, left, distal	7
<i>Sula</i> sp.	Humerus, left, proximal	5
<i>Sula</i> sp.	Humerus, right, distal	9
<i>Sula</i> sp.	Humerus, right, proximal	5
<i>Sula</i> sp.	Scapula	1
<i>Sula</i> sp.	Basicranium	4
<i>Sula</i> sp.	Humerus, left	1
<i>Sula</i> sp.	Humerus, left, distal	2
<i>Sula</i> sp.	Humerus, left, proximal	1
<i>Sula</i> sp.	Humerus, right, distal	4
<i>Sula</i> sp.	Humerus, right, proximal	1
<i>Sula</i> sp.	Humerus, right, proximal	3
<i>Sula sula</i>	Coracoids, left	3
<i>Sula sula</i>	Coracoids, right	4
<i>Sula sula</i>	Femur, left	3
<i>Sula sula</i>	Femur, right	5
<i>Sula sula</i>	Humerus, left, distal	2
<i>Sula sula</i>	Humerus, left, distal	1
<i>Sula sula</i>	Humerus, right, distal	2
<i>Sula sula</i>	Humerus, right, proximal	1
<i>Sula sula</i>	Tarsal, proximal	1

(Continued)

Continued.

Taxa/Excavation unit	Skeletal element /anatomic position	NISP Level 20–40
<i>Sula sula</i>	Tarsal, proximal	5
<i>Sula sula</i>	Tibia, left, distal, eroded	3
<i>Sula sula</i>	Tibia, right, distal, eroded	2
AS/AG/A/1/3		
<i>Sula sula</i>	Basicranium	6
<i>Sula sula</i>	Coracoids, left	9
<i>Sula sula</i>	Coracoids, right	10
<i>Sula sula</i>	Femur, left	5
<i>Sula sula</i>	Femur, right	9
<i>Sula sula</i>	Humerus, left	4
<i>Sula sula</i>	Humerus, right	2
<i>Sula sula</i>	Mandibular ramus, left	3
<i>Sula sula</i>	Rostrum	1
<i>Sula sula</i>	Tarsal	9
AS/AG/A/1/4		
<i>Anous</i> sp.	Coracoids, left	4
<i>Anous</i> sp.	Coracoids, right	5
<i>Anous</i> sp.	Humerus, right	1
<i>Anous</i> sp.	Tarsal, fragment	1
<i>Anous stolidus</i>	Humerus, left	1
<i>Anous stolidus</i>	Humerus, right	6
<i>Sula sula</i>	Basicranium	7
<i>Sula sula</i>	Coracoids (small, eroded)	6
<i>Sula sula</i>	Coracoids, left	18
<i>Sula sula</i>	Coracoids, right	20
<i>Sula sula</i>	Femur (small, eroded)	6
<i>Sula sula</i>	Femur, left	17
<i>Sula sula</i>	Femur, right	28
<i>Sula sula</i>	Humerus, left	4
<i>Sula sula</i>	Humerus, left (eroded)	2
<i>Sula sula</i>	Humerus, right	8
<i>Sula sula</i>	Humerus, right (eroded)	6
<i>Sula sula</i>	Rostrum	1
<i>Sula sula</i>	Tarsal, left	13
<i>Sula sula</i>	Tarsal, right	13
AS/AG/A/1/5		
<i>Anous stolidus</i>	Carpal-metacarpal, left	3
<i>Anous stolidus</i>	Carpal-metacarpal, right	3
<i>Anous stolidus</i>	Coracoids, left	1
<i>Anous stolidus</i>	Coracoids, right	1
<i>Anous stolidus</i>	Femur, left	1
<i>Anous stolidus</i>	Femur, right	1
<i>Anous stolidus</i>	Humerus, left	1
<i>Anous stolidus</i>	Humerus, right	1
<i>Anous stolidus</i>	Tarsus, left	1
<i>Anous stolidus</i>	Ulna, left	3
<i>Anous stolidus</i>	Ulna, right	1
<i>Fregata magnificens</i> (?)	Carpal-metacarpal, left	1
<i>Sula leucogaster</i>	Basicranium	7
<i>Sula leucogaster</i>	Carpal-metacarpal, left	4
<i>Sula leucogaster</i>	Coracoids, left, eroded	1
<i>Sula leucogaster</i>	Coracoids, left, large	10
<i>Sula leucogaster</i>	Coracoids, right, eroded	3
<i>Sula leucogaster</i>	Coracoids, right, large	14
<i>Sula leucogaster</i>	Humerus, left	3
<i>Sula leucogaster</i>	Humerus, right	3
<i>Sula leucogaster</i>	Mandibular ramus, left	4
<i>Sula leucogaster</i>	Mandibular ramus, right	1
<i>Sula</i> sp.	Femur, left	10
<i>Sula</i> sp.	Femur, right	7
<i>Sula</i> sp.	Keel	4
<i>Sula sula</i>	Humerus, left	5
<i>Sula sula</i>	Humerus, right	2
<i>Sula sula</i>	Tarsus	3
<i>Sula sula</i>	Tibia	9
AS/AG/A/1/8		
<i>Anous stolidus</i>	Coracoids, left, fragments	2
<i>Anous stolidus</i>	Femur, left	1
<i>Sula leucogaster</i>	Humerus, left	1
AS/AG/A/1/14		
<i>Sula sula</i>	Basicranium	3
<i>Sula sula</i>	Coracoids, right	2
<i>Sula sula</i>	Femur, left	3
<i>Sula sula</i>	Femur, right	1
<i>Sula sula</i>	Humerus, fragments	1
<i>Sula sula</i>	Tibia	2

(Continued)

Continued.

Taxa/Excavation unit	Skeletal element /anatomic position	NISP Level 20–40
<i>Sula sula</i>	Ulna, fragments	1
AS/AG/A/1/15		
<i>Anous</i> sp.	Carpus-metacarpus	2
<i>Anous</i> sp.	Coracoids, left	2
<i>Anous</i> sp.	Tarsus	1
<i>Anous</i> sp.	Ulna, left	2
<i>Sula sula</i>	Carpus-metacarpus	1
<i>Sula sula</i>	Coracoids, left	3
<i>Sula sula</i>	Coracoids, right	1
<i>Sula sula</i>	Humerus, left	1
<i>Sula sula</i>	Keel	3
<i>Sula sula</i>	Tarsal	1
<i>Sula sula</i>	Tibia	1
AS/AG/A/1/17		
<i>Sula leucogaster</i>	Basicranium	2
<i>Sula leucogaster</i>	Coracoids	1
<i>Sula leucogaster</i>	Coracoids, left	2
<i>Sula leucogaster</i>	Femur, left	1
<i>Sula leucogaster</i>	Humerus, fragments, eroded	2
<i>Sula leucogaster</i>	Humerus, left, distal	2
<i>Sula leucogaster</i>	Humerus, right	1
<i>Sula leucogaster</i>	Humerus, right	2
<i>Sula leucogaster</i>	Humerus, right, distal	3
AS/AG/A/1/19		
<i>Sula leucogaster</i>	Basicranium	2
<i>Sula leucogaster</i>	Carpal-metacarpal	1
<i>Sula leucogaster</i>	Coracoids, left	2
<i>Sula leucogaster</i>	Coracoids, right	4
<i>Sula leucogaster</i>	Humerus, eroded	7
<i>Sula leucogaster</i>	Humerus, fragmented	4
<i>Sula leucogaster</i>	Humerus, left	2
<i>Sula leucogaster</i>	Humerus, right	3
AS/AG/A/1/26		
<i>Anous</i> sp.	Humerus, left	1
<i>Sula sula</i>	Coracoids, left	1
<i>Sula sula</i>	Coracoids, right	2
<i>Sula sula</i>	Femur, left	2
<i>Sula sula</i>	Humerus, fragments	2
<i>Sula sula</i>	Tarsal	1
AS/AG/A/1/28		
<i>Sula sula</i>	Basicranium	10
<i>Sula sula</i>	Coracoids, left	16
<i>Sula sula</i>	Coracoids, right	10
<i>Sula sula</i>	Femur, left	12
<i>Sula sula</i>	Femur, right	9
<i>Sula sula</i>	Humerus, left	23
<i>Sula sula</i>	Humerus, right	16
<i>Sula sula</i>	Mandibular ramus, left	2
<i>Sula sula</i>	Rostrum	2
<i>Sula sula</i>	Tarsal	4
AS/AG/A/1/29		
<i>Sula leucogaster</i>	Basicranium	5
<i>Sula leucogaster</i>	Coracoids, left, large	9
<i>Sula leucogaster</i>	Coracoids, right, large	10
<i>Sula leucogaster</i>	Humerus	6
<i>Sula leucogaster</i>	Humerus, left	7
<i>Sula leucogaster</i>	Humerus, right	5
<i>Sula leucogaster</i>	Keel, eroded	3
<i>Sula leucogaster</i>	Rostrum	3
<i>Sula leucogaster</i>	Tarsal, fragment	1
Total NISP		721

¹This table contains only the NISP of complete and semi-complete bird bones contained in the referred boxes.

Appendix 8. Spatial distribution of identified bird remains in CU/A site, Curricai Island, Las Aves de Sotavento Archipelago.

Taxa/Excavation unit	Skeletal element /anatomic position	Portion of the element	NISP by level		Catalogue number
			0–20	20–40	
Pit 1					
<i>Pelecanus occidentalis</i>	Skull	Orbital fragment, possibly immature	–	1	16864
<i>Stercorarius</i> sp.(?)	Humerus	Right distal fragment	–	1	16865
Total NISP			0	2	

Appendix 9. Spatial distribution of identified bird remains in BL/E site, test pit 1 (section outside the cave), La Blanquilla Island.

Taxa/Excavation unit	Skeletal element /anatomic position	Portion of the element	NISP by level		Catalogue number
			0–20	20–40	
Trench A					
<i>Pelecanus occidentalis</i>	Ulna	Complete	–	1	7928
<i>Pelecanus occidentalis</i>	Ulna	Complete	–	1	7943
<i>Sula</i> sp.	Humerus, right	Complete	1	–	7354
<i>Sula sula</i>	Carpal	Complete	–	1	7965
<i>Sula sula</i>	Humerus, left	Distal fragment	–	1	7953
<i>Sula sula</i>	Humerus, right	Distal fragment	–	1	7355
<i>Sula sula</i>	Ulna	Complete	–	1	7938
<i>Sula sula</i>	Ulna	Complete	–	1	7940
Total NISP			1	7	