FAUNAL REMAINS FROM THE ARCHAIC AND ARCHAIC CERAMIC SITE OF VEGA DEL PALMAR, CUBA

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The earliest occupants of Cuba were hunter-gatherers that arrived from Central America approximately 5,000 years ago. While the broad outlines of Cuban prehistory are known, a lack of quantified faunal data and a limited number of radiocarbon dates hinder our ability to describe the subsistence economy in local and regional contexts. In this paper we present new vertebrate faunal data and radiocarbon dates from the pre-ceramic and early ceramic site of Vega del Palmar which is located near Cienfuegos on the south coast of Cuba, comparing the Archaic occupation with ceramics to the Archaic occupation that lacks ceramics.

Les premiers occupants de Cuba étaient des chasseurs-cueilleurs qui sont arrivés d'Amérique centrale il ya environ 5000 années. Alors que un aperçu général de la préhistoire cubaine est connus, un manque de données faunistiques quantifiés et un nombre limité de dates radiocarbone entravent notre capacité à décrire l'économie de subsistance dans des contextes locaux et régionaux. Dans cet article, nous présentons de nouvelles données faunistiques vertébrés et les datations au radiocarbone du site pré-céramique et début céramique de Vega del Palmar, qui est situé près de Cienfuegos sur la côte sud de Cuba; on compare l'occupation Archaïque avec des céramiques à l'occupation Archaïque qui manque de céramique.

Los primeros habitantes de Cuba fueron cazadores-recolectores que arribaron desde América Central hace aproximadamente 5,000 años. La prehistoria de Cuba se conoce a grandes rasgos, pero nuestra capacidad para describir la economía de subsistencia en contextos locales y regionales es limitada, debido a la falta de información cuantitativa sobre la fauna y al número limitado de fechas de radiocarbono. En este artículo presentamos nuevos datos sobre la fauna vertebrada, y nuevas fechas de radiocarbono del sitio precerámico y cerámico temprano de Vega del Palmar, localizado cerca de Cienfuegos en la costa sur de Cuba. Además analizamos la ocupación arcaica con presencia de cerámica en comparación con la ocupación arcaica con ausencia de cerámica.

Introduction

The broad chronology of the Archaic or preceramic cultures of Cuba is reasonably well known but the subsistence economy is not thoroughly documented due to the limited dated and quantified faunal information for this early time period (deFrance 2013; Newsom and Wing 2004:142). Furthermore, our understanding of Cuban prehistory is hampered by a small set of radiocarbon dates and limited accessibility of research results (Cooper 2010; Cooper and Thomas 2012). Our objectives in this paper are to present quantified vertebrate faunal data from the Vega del Palmar site located in south-central Cuba, present two new radiocarbon dates, and demonstrate the value of museum collections for archaeological research. We selected this site for analysis because it includes both preceramic and early ceramic components containing vertebrate faunal remains. Comparing the vertebrate faunal remains from ceramic and early ceramic occupations at a single site can shed light on the relationship between early pottery production and subsistence.

The ceramics from Vega del Palmar are of the Pre-Arawak Pottery Horizon type (Rodríguez Ramos et al. 2008) not Ostionoid or later types and therefore this study can provide information on changes in subsistence associated with this type of ceramic production on Cuba. The radiocarbon dates contribute to the chronological framework for early ceramic production and the quantified vertebrate faunal data add substantially to the corpus of such information, being nearly unique for Cuba and the broader Caribbean region for the Archaic period.

Yale University and the Peabody Museum of Natural History at Yale had a very active archaeological field research program in the Caribbean region from the 1930s until the 1970s. Some of the objectives of this program were the establishment of a regional chronology and the determination of the origin of the people of the Caribbean islands (Mintz 1960; Osgood 1942). While the various field projects focused on ceramic age cultures of Venezuela, Trinidad, Antigua, Puerto Rico, Haiti and Cuba are fairly well known, there were additional projects that emphasized preceramic or Archaic age sites. The faunal data in this paper are derived from one of those projects, Paul G. Hahn's (1961) late 1950s study of the chronology of preceramic sites in Cuba that included survey and excavations at several archaeological sites as well as museum collections analysis.

At the time of Hahn's research in the late 1950s there were few radiocarbon dates for the Caribbean and prehistoric chronology was based largely on ceramic seriation. Hahn's research focused on establishing a chronological framework for the Cuban preceramic cultures using non-ceramic artifacts. Fortunately, he collected vertebrate fauna and samples of invertebrate fauna and the collections are curated at the Peabody Museum of Natural History at Yale University.

Hahn travelled throughout Cuba in 1956 and 1957 meeting with archaeologists, studying museum collections, visiting archaeological sites, and excavating. Hahn excavated at seven sites and collections from four of those sites are curated at the Peabody Museum of Natural History at Yale University, New Haven, CT. The sites represented in the Yale Peabody Museum collections are Las Obas, Los Caracoles, and El Guayabo from the area north of Manzanillo, and Vega del Palmar near the Bay of Cienfuegos. The collections from La Barrigona 1 and Caney El Gato in southwestern Camaguey province, and Cayo Caracol near the Bay of Cienfuegos, are curated in Cuba (Lourdes Dominguez,

personal communication 2013). The Peabody Museum obtained Hahn's Cuban research field notes on his survey,

excavation, and collections visits as well as some 35mm slides from his family in May of 2013.
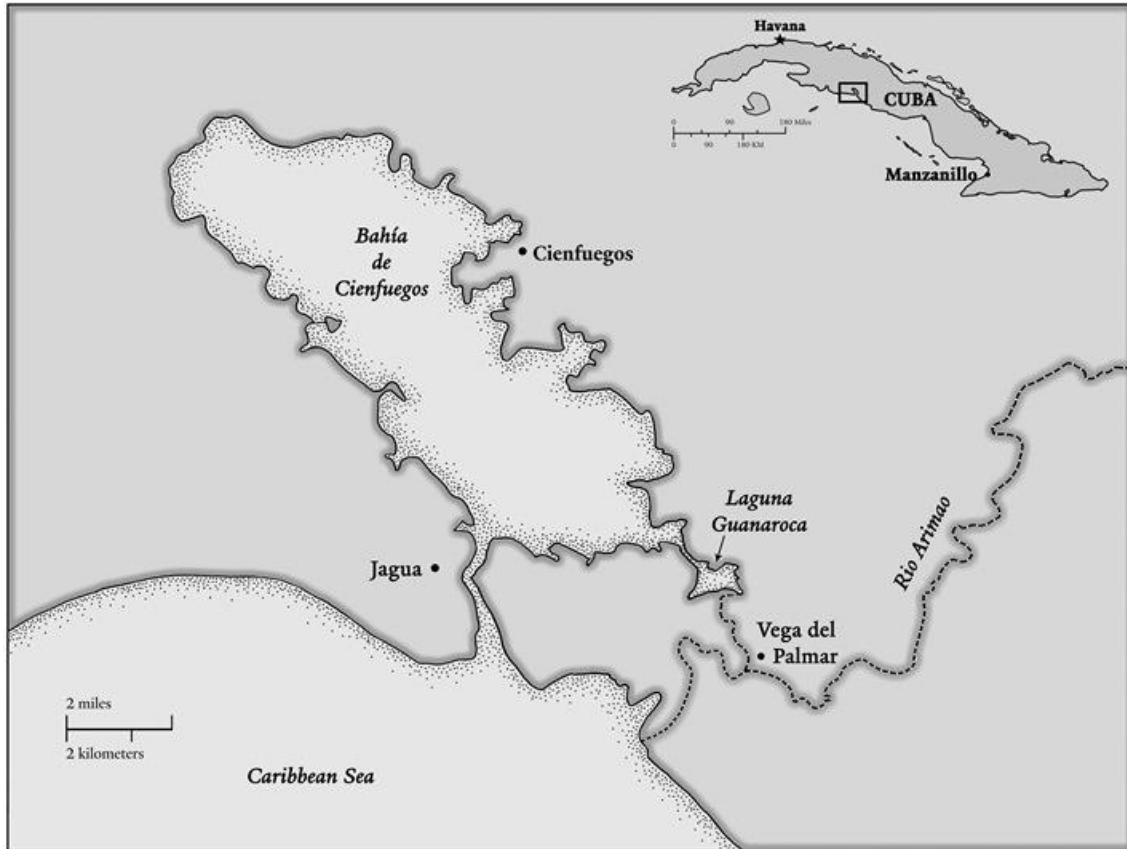

Figure 1. Map of Cuba showing the approximate location of the Vega del Palmar site.

The Vega del Palmar Site

The Vega del Palmar Site is located near the south coast of Cuba southeast of the Bahía de Cienfuegos, in the Cienfuegos province of Cuba (Figure 1). Hahn described the Vega del Palmar site as a refuse midden located on a hilltop near where the Rio Arimao divides into two arms, one leading to the Caribbean on the south coast and the other leading to the Laguna Guanaroca which is connected to the Bahia de Cienfuegos (Hahn 1961:97). Hahn (1961:98) describes the deposit as "a typical shell midden made up of numerous interstratifying layers and lenses composed

of shells, soil, ash, and other refuse." Although Hahn lists the main shell types in each strata (scallop, venus, mussel, conch, oyster, snail, pecten, etc) he did not systematically collect shells. The Vega del Palmar site seems ideally situated to access a variety of ecological zones including the nearby river, the laguna and the bay, the coastal zone, and the local terrestrial habitats. The site had been previously described by Gonzáles Munoz (1952) but published data from the site was limited at the time of Hahn's research.

Hahn excavated a single two meter square unit in the site. The unit was

excavated in 15 cm arbitrary levels to a depth of 1.5 meters. Although Hahn screened soil at some of the other sites he excavated, at Vega del Palmar he does not seem to have used screens but "the soil was carefully searched for artifacts" (Hahn 1961:98). Despite the lack of screening, Hahn recovered about 5,700 bones from this site. Hahn determined the chronology of the site largely by the presence of prehistoric ceramics in the upper levels of the midden and a single radiocarbon date, although that date (Y-465, 960 +/- 60 BP; Devey et al. 1959:168), run in 1959, seems anomalous in light of the two new dates described below. Hahn's radiocarbon sample was an aggregation of small pieces of charcoal found scattered among shells and ash at depths ranging from 110 to 115 cm below surface (Hahn 1961:218), not a single item, which might partially explain the inconsistency between the 1959 radiocarbon date and the recently analyzed samples.

For the current analytical project's radiocarbon dating we picked two individual shells, one from the 15-30 cm level (*Cittarium pica*, the West Indian top shell or magpie shell) and one from the 120-135 cm level (*Lucina pectinatus*, thick lucine). We selected individual shells to ensure that they represent single depositions. One of the levels did not have a single shell large enough for a conventional date so we submitted a portion of a shell from each level for AMS dating, one date for each of the two levels. Unused portions of the shells were retained in the Peabody Museum. Additional, unused shell returned by the radiocarbon laboratory was also retained and curated by the museum for potential future analyses. The date from the 15-30 cm level is 1750 +/- 30 BP (Beta-318170; shell; $\delta13 = 2.6$ 0/00) or roughly A.D. 630 and the date from the 120-135 cm level is 2570 +/- 30 BP (Beta 318171; shell; $\delta13 = -3.0$ 0/00) or roughly 350 B.C.E.. The marine reservoir

effect (Ascough et al. 2005) can affect radiocarbon dates from shells but this issue has not been systematically addressed for Cuba. In the Caribbean region the known Delta R values suggest limited impact from the marine reservoir effect, perhaps making the actual dates only about 50 years older (Broeker and Olson 1961; Lightly et al. 1982).

The new radiocarbon dates are in the expected stratigraphic order with the older date deeper in the ground. These dates are consistent with published Caribbean chronologies for the pre-ceramic or Archaic age (Rouse 1992; Wilson 2007) and the later date is similar to that obtained from Las Obas, another site excavated by Hahn in the 1950s (Colten et al. 2009). These two dates from Vega del Palmar "bracket" those from the Las Obas site and therefore extend the range of dated faunal material derived from Hahn's excavations.

The radiocarbon result received by Hahn (Y-465; charcoal; 960 +/- 60 BP) appears anomalous because it is from relatively deep (105-120 cm) in the site but is younger by several hundred years than the youngest of the two recently obtained dates. It is possible that the charcoal used in the earlier date was contaminated or there was some other problem with the analysis. It is not unusual for dates from Cuba analyzed in the late 1950s to be inconsistent with more recently analyzed samples (Cooper and Thomas 2012). As Hahn noted (1961), Vega del Palmar has ceramics in the upper two levels of the site (0-30 cm) and on the surface. There are a total of eight sherds from these two levels. These ceramics appear to be of the "Pre-Arawak Pottery Horizon" (Keegan 2006; Rodríguez Ramos et al. 2008), not pottery associated with the Ostionoid migration (A.D. 600), and not historic ceramics.

Methods of Analysis

Analysis of the fauna followed standard zooarchaeological methods (Reitz and Wing 2008). Quantification included calculating the number of individual specimens (or the number of identified specimens, NISP), minimum number of individuals (MNI), and bone weight for fish. All taxa other than fish were quantified using just NISP and MNI. NISP refers to the count of the total number of bone fragments present in the sample by taxonomic category. Although NISP is the most fundamental method of quantification it can be affected by recovery techniques, taphonomic processes, and cultural practices (Grayson 1984; Reitz and Wing 2008). In this case, the lack of screening during excavation has surely biased the sample toward larger elements and larger species as small bones may not have been recovered. Bone weight can also be affected by similar cultural and taphonomic processes as bone count. As such, neither NISP nor bone weight are sufficient to determine the relative abundance of fauna from an archeological site by themselves. We primarily use NISP to characterize the faunal assemblage according to broad categories of animals and other methods for the lower level taxonomic comparisons.

MNI provides an additional method for quantifying relative taxonomic abundance. MNI was estimated using paired elements, coupled with differences in element size. For example, if a sample includes 75 right femora, they represent a minimum of 75 individuals. In most cases MNI was calculated for just those elements identified to at least genus level. However, in cases in which only higher taxonomic levels (e.g., Order, Family) were present we estimated MNI at that level. Discussions of relative abundances of taxa from the samples are primarily based on MNI determinations.

Size estimates were also determined for some of the fish from the assemblage. Sizes of the fish are based on their estimated biomass. The biomass determinations were made by applying the following allometric equation:

$$Y = aX^b \quad or \quad log \, Y = log \, a + b \, (log \, X)$$

By measuring the anterior diameter of the centrum of a fish vertebra, then inserting that number in the following equation, the live weight of a fish can be determined:

$$log \, y = 0.872(log \, x) + 2.53$$

where x = centrum diameter in millimeters and y = body weight of fish in grams (Wing 2001:117).

The Faunal Sample

The sample described below includes nearly 5,700 bones of mammals, fish, birds, and reptiles. These are all of the unmodified vertebrate faunal remains recovered by Hahn from this site. Examining the distribution of the number of identified specimens (NISP) by depth there is a bi-modal pattern with few bones in the middle levels suggesting two site occupations (Table 1). In order to assess this further, we counted the flaked stone objects by depth and found a similar but less pronounced pattern (Table 2). We analyzed bones by excavation level and also by aggregating the data into an upper and a lower component which might correspond to two occupations, one with ceramics and one without ceramics – ceramics were only recovered from the surface and the upper two excavation levels of the site (0 – 30 cm). The differentiation of the two components is based on the vertical distribution of bones and flaked stone objects as well as the presence or absence of pottery. For our analysis we grouped the upper levels, 0-75 cm, for the

upper occupation and 75-150 cm for the lower occupation. The upper component is

0-60 cm for fish because there were no fish bones in the 60-75 cm level.

Table 1. Number of Identified Specimens (NISP) per level by class.

Level (cm)	Bird	Category Fish	Reptile	Mammal	Unidentified	Total
0-15	7	79	16	227	90	417
15-30	7	178	81	480	255	1002
30-45	3	85	8	93	70	261
45-60	0	19	2	27	20	69
60-75	0	0	0	2	0	2
75-90	1	44	12	164	80	301
90-105	3	316	16	241	160	739
105-120	5	242	83	758	200	1289
120-135	9	137	71	1030	250	1512
135-150	0	31	12	3846	25	106
Total	35	1131	301	3068	1150	5685

Table 2. Flaked-stone artifacts by level.

Level	Count
Surface	19
0-15 cm	152
15-30 cm	43
30-45 cm	22
45-60 cm	7
60-75 cm	12
75-90 cm	6
90-105 cm	16
105-120 cm	33
120-135 cm	22
135-150 cm	2

Mammals and fish are the most abundant classes of vertebrates in this sample. There are many small bone fragments that are difficult to classify with confidence, but they are likely to be primarily mammal bones. The proportions of broad faunal categories are relatively similar through the depth of the deposit (Table 3). The notable exception

is the 60-75 cm level, which only had two mammal bones and no other bones. There are very few bird bones in the collection, which might be in part due to the recovery methods. Lack of screening might bias the sample against fragile bird bones. The mammals are all small terrestrial mammals. The sample does not include any large mammals or any marine mammals.

Table 3. NISP and percent NISP by component (without unidentified bones).

NISP	Bird	Fish	Reptile	Mammal	Total
0-75 cm	17	361	107	829	1314
75-150 cm	18	770	194	2239	3221
NISP %					
0-75 cm	1.29	27.43	8.13	62.99	100
75-150 cm	0.56	23.82	6	69.28	100

Table 4. Non-fish fauna by level (NISP).

Taxon	Common Name	Level (cm)										Total NISP	MNI *
		0-15	15-30	30-45	45-60	60-75	75-90	90-105	105-120	120-135	135-150		
Aves													
Unidentified bird			7				1	3	5			16	
Mammal													
Boromys offella	Oriente Cave Rat	1										1	1
Boromys sp.	Spiny Rat undiff.							1				1	1
Capromys pilorides	Cuban hutia	12	43	5	2		15	2	6	5		90	35
Geocapromys columbianus	Cuban coney	3	6	2			3	2	6	6		28	12
Mesocapromys nanus	Dwarf hutia							1				1	1
Mysateles prehensilis	Prehensile-tailed hutia	3	1	1		3		1	1		10	7	
Solenodon cubanus	Cuban solenodon								1			1	1
small hutia		30	37	10	9		41	55	82	101	4	369	87
large hutia		129	276	45	8	2	43	57	256	459	16	1291	209
hutia		28	22	29			48	104	332	331	23	917	
large mammal		3										3	
small mammal		21	77	1	7		11	19	74	102	3	315	
mammal			16									16	
Reptile													
Cheloniidae	Sea turtles	1	1		2		1		2	2		11	3
Cyclura nubila	Cuban iguana	1	11						2			14	4
Lepidochelys sp.	Ridley sea turtle		1									1	3
snake		2	6				1	2	6	10		27	
Trachemys decussata	Cuban slider	1	59						8	58	12	138	8
turtle		11	3	8			11	13	64			110	
Unidentified		100	255	73	20		80	160	200	285	25	1198	
Grand Total		343	825	174	49	2	257	420	1046	1363	83	4558	365

[*]MNI calculated by excavation level and summed for this table. MNI for "large hutia," "small hutia," and Solenodon calculated from limb elements, other small mammals calculated from tooth rows.

Mammal Remains

The most abundant mammal in the assemblage is hutia (Table 4). Multiple taxa of hutia have been described for Cuba but there is no current consensus on the total number of species that have existed on the island and several taxa are now extinct (Díaz-Franco 2001). Wilson and Reeder (2005:1593-1597) list 10 hutia taxa from Cuba. Arredonado de la Mata (2012) says that 9 species from 3 genera of capromyid rodents survive in Cuba. Toboada et al. (2007:146) list 11 taxa of capromyid rodents, seven of which are said to be extant. Cuba is the largest island in the Caribbean and should therefore support the most diverse terrestrial fauna so the multiple rodent taxa in this faunal sample might not be considered unusual.

Although differentiating the hutia taxa is best accomplished by examining complete tooth rows (mandibles with all teeth in-situ), those elements are less abundant than post-cranial elements, particularly the major limb elements. Many of the mandibles do not have the teeth in-situ. Although femora, tibiae, and humeri are abundant in the sample, there is limited published information on differentiating hutia based on post-cranial skeletal elements. It is clear from examination of the post-cranial remains that the hutia can, minimally, be sorted into two rough size categories which we refer to as large hutia and small hutia. It is conceivable that further metric analysis might permit the classification of these bones to more precise taxonomic categories. For this analysis, major limb elements were grouped into large and small hutia categories. Probably less than 3 percent of the limb elements have fused epiphyses suggesting that almost all of the animals were sub-adults. Given that both the larger and smaller hutia are sub-adults, it seems unlikely that the smaller individuals are juveniles and the larger

individulas are adults of the same species. Some of the less abundant skeletal elements were simply classified as hutia and highly fragmented bones or those with limited diagnostic potential, such as ribs, were classified as small mammals.

We estimated the numbers of individual hutia using the major limb elements in the large and small hutia categories. When MNI based on limb elements is estimated by excavation level, there are 298 individual hutia with the large hutia almost twice as abundant as the small hutia (Table 5). Aggregating the NISP for hutia limb elements in upper and lower components and recalculating MNI produces similar results, with large hutia out-numbering small hutia more than two-to-one, with a total MNI of 252 (Table 6). The larger hutia are approximately the size of the *Capromys pilorides* specimen from the Yale Peabody Museum vertebrate zoology division used to identify bones in this analysis.

Identifications from the limited number of complete tooth rows were used to determine which taxa are represented in the sample (Table 7). The identifications were made primarily by Samuel Turvey (a zoologist specializing in Caribbean mammals) based, in part, by comparing the cusp patterns of the teeth to published illustrations such as those in Díaz-Franco (2001) and Toboada et al. (2007) and with a specimen of *Capromys pilorides* from the Peabody Museum zoology collections. Among the animals identified from tooth rows the most abundant is *Capromys pilorides* or Desmarest's hutia (MNI = 35), also called the Cuban hutia, which is endemic to Cuba. *Capromys pilorides* is widespread and common in Cuba (Wilson and Reeder 2005:1594) and there are several subspecies that are separate geographically from each other and occupy slightly different habitats (Páez et al. 1992). These

animals can be very common on some parts of the island today (Lisabeth Carlson, personal communication 2013).

Of the living hutia taxa, these animals are the largest as well as the most variable and adaptable to different habitats (Borroto-Páez 2011a). Given that *Capromys pilorides* is the most common of the hutia identified from tooth rows, among the post-cranial elements the large hutia are more abundant than the small hutia, and the large hutia and the comparative specimen from the Peabody Museum are the same size, it seems likely that the large hutia from Vega del Palmar are *Capromys pilorides*.

Geocapromys columbianus, the Cuban coney (MNI = 12), is another Cuban endemic that was widely distributed on the island but is now extinct. *Mysateles prehensilis*, the prehensile-tailed hutia (MNI = 7), live in the western and central regions of mainland Cuba (Toboada et al. 2007:158) and are at least partly arboreal. *Mesocapromys nanus* is the dwarf hutia (MNI = 1) which is endemic to Cuba. The dwarf hutia might survive in the Zapata swamp on the south central coast of Cuba about 90 miles southeast of Havana (Wilson and Reeder 2005:1596), but because no live individuals have been seen since the 1930s it probably is extinct (Borroto-Páez 2011b).

Among the other small mammals in this sample, *Boromys* sp. are spiny rats (MNI = 2) that are now extinct. *Solenodon cubanus*, the Cuban solenodon (MNI = 1), is an unusual insectivore with venomous saliva. The solenodon in this sample was identified from a single humerus. The solenodon still lives in Cuba but it has a limited geographic range.

Level (cm)	Large hutia	Small hutia	Total Hutia
0-15	29	6	35
15-30	45	10	55
30-45	8	5	13
45-60	2	3	5
60-75	1	0	1
75-90	8	10	18
90-105	10	12	22
105-120	42	15	57
120-135	60	25	85
135-150	4	3	7
Total	209	87	298

Table 5. Minimum Number of Individuals (MNI) for hutia identified from limb elements.

In summary, *Capromys pilorides* and *Geocapromys columbianus* are the two most abundant mammals in the collection in both the upper and lower components with *Capromys pilorides* the more abundant of the two taxa in both the younger and older occupations. Among the individuals identified from the post-cranial elements, the larger hutia are more abundant than the small hutia in both the upper and lower components. The other small mammals seem to be evenly distributed among the excavation levels.

Table 6. Hutia MNI identified from limb elements by component.

Component	Large Hutia	Small Hutia	Total
Upper	70	19	89
Lower	110	53	163
Total	190	72	252

Table 7. Minimum Number of Individuals (MNI) for small mammals identified to genus or species based on mandibles.

Level	*Boromys offella*	*Capromys pilorides*	*Geocapromys columbianus*	*Mesocapromys nanus*	*Mysateles prehensilis*
0-15 cm	1	6	1		2
15-30 cm		11	2		
30-45 cm		3	2		1
45-60 cm		2			1
60-75 cm					
75-90 cm		4	1		1
90-105 cm	1	2	1	1	
105-120 cm		4	3		1
120-135 cm		3	2		1
135-150 cm					
Total	2	35	12	1	7

Reptile Remains

Turtles are the most abundant reptiles in the collection, and include both sea turtles and sliders (see Table 4). The most common reptile is the Cuban slider (*Trachemys decussata*) with an MNI of eight when calculated by excavation level. NISP is high for this taxon because the sample contains abundant carapace and plastron fragments. The Cuban slider inhabits fresh and brackish water and is widely distributed on the Cuban archipelago in mangrove swamps, rivers, lakes, and ponds (Estrada and Ruibal 1999:44). This species is endemic to Cuba and is also found on the Cayman Islands (Schwartz and Henderson 1991).

When calculated by excavation level there is an MNI of six sea turtles in the collection. All of the sea turtles are from the family Cheloniidae which includes the Kemp's ridley sea turtle (*Lepidochelys kempii*), the Loggerhead sea turtle (*Caretta caretta*), the Green sea turtle (*Chelonia mydas*), the Olive ridley sea turtle (*Lepidochelys olivacea*), the Hawksbill sea turtle (*Eretmochelys imbricata*) and the Flatback sea turtle (*Natator depressus*). Given the relatively small size of the skeletal elements it is likely that the sea turtles from Vega del Palmar are Kemp's ridley sea turtles although more than one taxa could be present in the sample. The collection does not include any mandibles or mandible fragments, one of the best diagnostic elements for sea turtles (Lisabeth Carlson, personal communication 2013), which makes the identification of these animals challenging. Kemp's ridley sea turtle is the smallest of these sea turtles and has the most restricted range. These animals live primarily in the western Atlantic Ocean and the Gulf of Mexico. The average adult Loggerhead measures around 90 cm (35 in) and weighs approximately 135 kg (300 lb). Loggerhead turtles have a wide distribution around the world and inhabit saltwater and estuarine habitats. Green sea turtles are also

widely distributed and commonly inhabit shallow lagoons. The other members of the Cheloniidae are not found near Cuba.

There is an MNI of four Cuban iguanas (*Cyclura nubila*) in the sample when calculated by excavation level. These iguanas are widely distributed in the coastal regions and on the keys of Cuba (Estrada and Ruibal 1999:55), including the rocky coastal areas of southern Cuba. The snake vertebrae are probably from the endemic Cuban boa (*Epicrates angulifer*). The Cuban boa inhabits grassland and forest environments and is found throughout the island (Estrada and Ruibal 1999:60).

Because there are no non-repetitive elements of snake we have not estimated MNI beyond the obvious presence of at least one individual.

In summary, the turtles, snakes and lizards are from a variety of habitats including marine, freshwater, and terrestrial locations. These animals seem to be evenly distributed between the upper and lower components with no clear differences between the components. The samples size is relatively small when compared to the mammals and fish and therefore might not be representative of the entire site.

Table 8. Identified fish from Vega del Palmar.

Taxonomic Name	Common Name	Upper Levels (0-60 cm)	Lower Levels (75-150cm)
Epinephelus cf. *itijara*	Probable goliath grouper	x	
Epinephelus sp.	Grouper	x	x
cf. *Epinephelus* sp.	Probable grouper	x	
Mycteroperca sp.	Grouper		x
Lutjanus analis	Mutton snapper	x	
Lutjanus cyanopterus	Cubera snapper	x	
Lutjanus sp.	Snapper	x	x
Caranx sp.	Jack	x	x
Centropomus sp.	Snook	x	x
Lachnolaimus maximus	Hogfish	x	
Megalops atlanticus	Tarpon	x	x
Sphyraena barracuda	Barracuda	x	x
Mugil curema	Mullet	x	x
Diodontidae	Porcupinefishes	x	
Haemulon sp.	Grunt		x
Haemulidae	Grunts		x
Serranidae	Groupers		x
Synodontidae	Lizard fishes		x
Calamus sp.	Porgy		x
Carcharhinus sp.	Requiem shark		x

Fish Remain

A total of 1122 fish fragments with a weight of 1043.58 g were analyzed from the Vega Del Palmar site. The preservation of this sample was quite good allowing for the identification of nearly 63percent of the bones to at least the family level. The remaining 37 percent (n=415) could only be identified to class due to their fragmentary condition or the lack of diagnostic features. Bony fishes make up the bulk of the sample

with only a single shark vertebra recovered (Table 8). During the identification phase of this analysis all fauna from each level was treated as a discrete unit and quantified separately. For the discussion of the fish remains the data from each level were combined for the upper four levels (0-60 cm) and from the five lower levels (75-150 cm) in order to compare the two deposits. There were no fish bones recovered from the 60-75 cm level.

Table 9. Total amount of fish bones from the upper levels (0-60 cm).

Level (cm)	NISP	NISP %	Weight	Weight %	MNI	MNI %
0-15	76	21.35	94.89	17.89	15	26.32
15-30	176	49.44	271.60	51.21	24	42.11
30-45	85	24.22	142.32	26.89	14	24.56
45-60	19	5.41	21.58	4.08	4	7.02
Total	356	100	530.37	100	57	100

Upper Levels (0-60 cm). A total of 356 fragments with a weight of 530.37 g were found in the upper levels with a total of 57 individuals (Table 9). More fish bones were found between 15 and 30 cm than in the other upper levels. Whether counted by NISP or bone weight, roughly 50 percent of the fish bones were found at 15 to 30 cm, whereas when counted as MNI, 42 percent were at 15 to 30 cm (Table 9). Nearly 59 percent (206 bones) were identified to family level or lower. Even with the small sample size, seven species, four genera, and one family were identified (Table 10). Snook (*Centropomus* sp.) was the most common fish in upper levels based on all measures (NISP, Weight, and MNI). These fish account for 32 percent of the NISP; this is nearly four times more than the NISP of the next most abundant fish, grouper (*Epinephelu*s sp.), with only unidentified fish (Actinopterygii) being more numerous. In terms of MNI, snook make up nearly 37 percent (MNI=21) of the total individuals in

this sample. A total of 35 (9.83 percent) fragments were identified as grouper and probable goliath grouper (*Epinephelu*s sp., *Epinephelus* cf. *itijara*), and two probable grouper (cf. *Epinephelus* sp.). Overall, grouper were the second most common taxa in terms of NISP and MNI. Most fragments (n=30, 86 percent) could only be identified to genus with a MNI of 9 or 15.79 percent. A single probable goliath grouper was identified from a right dentary, right premaxilla fragment, and a left maxilla fragment. Given the large size of these three elements this fish accounted for 8.60 percent of the total sample weight. Snappers were also very common in the sample accounting for 4.78 percent (n=20) of the NISP and 15.79 percent (n=9) of the MNI. Most (85 percent) could only be identified to genus (*Lutjanus* sp.) with a total MNI of 7 (12.28 percent). A single mutton snapper (*Lutjanus analis*) and cubera snapper (*Lutjanus cyanopterus*) were also identified. Mullet (*Mugil curema*) were the only other

abundant fish in this sample with 21 (5.90 percent) fragments making up an estimated 8 individuals, or 14 percent of the total MNI. Other fish identified include jacks (*Caranx* sp.), barracuda (*Sphyraena barracuda*), tarpon (*Megalops atlanticus*), hogfish

(*Lachnolaimus maximus*), and an unidentified porcupinefish (Diodontidae). Jacks and tarpons were represented by 4 and 2 individuals respectively, whereas the other fish were represented by just single individuals.

Table 10. Summary data by taxa of fish from the upper levels.

Taxa	NISP	NISP %	Weight	Weight %	MNI	MNI %
Actinopterygii	150	42.13	90.74	17.11	-	-
Epinephelus cf. *itijara*	3	0.84	45.63	8.60	1	1.75
Epinephelus sp.	30	8.43	64.97	12.25	9	15.79
cf. *Epinephelus* sp.	2	0.56	1.95	0.37	-	-
Lutjanus analis	1	0.28	0.3	0.06	1	1.75
Lutjanus cyanopterus	2	0.56	22.49	4.24	1	1.75
Lutjanus sp.	17	4.78	41.84	7.89	7	12.28
Caranx sp.	8	2.25	21.02	3.96	4	7.02
Centropomus sp.	114	32.02	221.84	41.83	21	36.84
Lachnolaimus maximus	3	0.84	3.19	0.60	1	1.75
Megalops atlanticus	3	0.84	1.06	0.20	2	3.51
Sphyraena barracuda	1	0.28	3.61	0.68	1	1.75
Mugil curema	21	5.90	11.52	2.17	8	14.04
Diodontidae	1	0.28	0.21	0.04	1	1.75
Total	356	100	530.37	100	57	100

Lower Levels (75-150 cm). Nearly twice as many fish bones were recovered from the lower levels compared to the upper levels (Table 11). In total 766 fragments with a weight of 513.21 g and an estimated MNI of 100 were found between 75 and 150 cm. Most of the bones were recovered between 90 and 105 cm (n=316 or 41.25 percent); however, based on bone weight, the densest deposits were at 105 to 120 cm (156.49, 30.49 percent).

As with the upper levels, a high proportion of the fish was identifiable, with nearly 65 percent (n=501) of the bones identified to the family level or lower. The remaining 265 fragments weighing 101.09 g could only be identified to class (Table 12). In total, one family, eight genera, and three species are present. Mullet were the most

abundant taxon in the lower levels based on all quantification methods (NISP: 349 or 45.56 percent, Wt: 148.86 or 29 percent, and MNI: 40 or 40 percent; Table 12). In fact, these fishes account for nearly four times the NISP and two times the MNI of the next most abundant fish. Snook are the second most abundant fish present with 88 fragments present making up 20 individuals. These two taxa account for 60 percent of the individual fish in the lower levels.

Snappers, groupers, tarpon, and jacks were the only other common fish in the lower levels. Although snapper only make up about 3 percent (n=19) of the NISP, these fishes were the third most common fish present based on MNI, with a total of 10 individuals. Overall, groupers numbered six individuals; most of the groupers were

represented by members of the genus *Epinephelus* (MNI=5), with a single member of the genus *Mycteroperca* present. Tarpon and jacks were also represented by six individuals.

The other fish present include barracuda, grunts (*Haemulon* sp.), a porgy (*Calamus* sp.), and an unidentified lizardfish (Synodontidae); these fish were represented by between one and four individuals respectively. A single requiem shark (*Carcharhinus* sp.) was also identified from a vertebra fragment.

Table 11. Total amount of fish bones from the lower levels (75-150 cm).

Level (cm)	NISP	NISP %	Weight	Weight %	MNI	MNI %
75-90	44	5.74	40.24	7.84	9	9.00
90-105	316	41.25	140.07	27.29	29	29.00
105-120	242	31.59	156.49	30.49	27	27.00
120-135	134	17.49	141.12	27.50	26	26.00
135-150	30	3.92	35.29	6.88	9	9.00
Total	766	100	513.21	100	100	100

Table 12. Summary data by taxa of fish from the lower levels.

Taxa	NISP	NISP %	Weight	Weight %	MNI	MNI %
Actinopterygii	265	34.60	101.09	19.70	-	-
Serranidae	1	0.13	6.74	1.31	-	-
Epinephelus sp.	10	1.31	22.95	4.47	5	5.00
Mycteroperca sp.	1	0.13	8.07	1.57	1	1.00
Lutjanus sp.	19	2.48	51.29	9.99	10	10.00
Caranx sp.	13	1.70	14.22	2.77	6	6.00
Centropomus sp.	88	11.49	133.22	25.96	20	20.00
Megalops atlanticus	6	0.78	5.06	0.99	6	6.00
Sphyraena barracuda	4	0.52	13.97	2.72	4	4.00
Haemulidae	1	0.13	0.38	0.07	-	-
Haemulon sp.	4	0.52	0.71	0.14	3	3.00
Calamus sp.	3	0.39	1.85	0.36	3	3.00
Mugil curema	349	45.56	148.86	29.01	40	40.00
Synodontidae	1	0.13	0.22	0.04	1	1.00
Carcharhinus sp.	1	0.13	4.58	0.89	1	1.00
Total	766	100	513.21	100	100	100

Comparison between Components

In comparing the upper and lower levels there is little difference in the fish taxa present (Table 13). A total of 13 families were represented in this site, with most of the same fish families (54 percent) identified in both the upper and lower levels. Four families (e.g. Grunts, Porgies, Lizardfishes, and Sharks) were only found in the lower levels. The other two families – Hogfishes and Porcupinefishes – were found just in the upper levels. Although there is little difference between the two samples regarding taxa present, there were differences in the relative abundance of specific taxa from the two samples based on MNI. Both samples showed a concentration on just a few species. In the upper levels snook, grouper, snapper, and mullet were the most abundant fishes present. In the lower levels mullet, snapper, and snook were most common. Most of the remaining fishes in both the upper and lower levels were only represented by minor numbers (Table 13).

Snook was abundant in both the lower and upper levels but in the upper levels this fish dominated the sample, accounting for nearly 37 percent of the individuals. In individual excavation levels snook was consistently the most abundant fish, making up between 33 to 36 percent between 0-45 cm and 75 percent for 45-60 cm of the fish in those levels. Snook was also abundant in the lower levels and was the most common fish in the levels between 120 and 150 cm.

Mullet was also well represented at Vega del Palmar in both deposits. However, in the upper levels the mullet ranged in abundance between just one individual at 30-45 cm to 4 individuals at 15-30 cm totaling only 8 individuals (14 percent). In the lower levels their numbers were substantially higher with five times as many individuals compared to the upper levels, or an MNI of 40 (or 40 percent of the individuals). However, the dominance of mullet in the lower levels was restricted to depths of 75 to 120 cm. Snappers were similarly present based on MNI in both samples from this site (Table 13), although snappers account for somewhat more of the sample in the upper levels. The upper and lower levels also differ in the relative abundance of grouper, jack, barracuda, and tarpon. Grouper was far more common in the upper level sample compared to the lower levels, while the jack, barracuda, and tarpon were more common in the lower levels compared to the upper levels.

Table 13. Comparison of fish MNI from the upper and lower levels.

Family	Common Name	MNI		MNI %	
		Upper	Lower	Upper	Lower
Serranidae	Groupers	10	6	17.54	6.00
Lutjanidae	Snappers	9	10	15.78	10.00
Carangidae	Jacks	4	6	7.02	6.00
Centropomidae	Snook	21	20	36.84	20.00
Megalopidae	Tarpon	2	6	3.51	6.00
Haemulidae	Grunts	-	3	0.00	3.00
Sphyraenidae	Barracuda	1	4	1.75	4.00
Sparidae	Porgy	-	3	0.00	3.00
Mugilidae	Mullet	8	40	14.04	40.00
Labridae	Hogfish	1	-	1.75	0.00
Diodontidae	Porcupinefish	1	-	1.75	0.00
Synodontidae	Lizardfish	-	1	0.00	1.00
Carcharhinidae	Sharks	-	1	0.00	1.00
	Totals	57	100	100	100

The fish from Vega del Palmar were exploited from two broad marine habitats. In order to determine how important these habitats were to the occupants of this site and if any change occurred between the early and later occupations of the site, the identified bony fish were classified by their preferred habitats (Table 14). The single shark vertebra identified to genus was excluded since members of this genus can be found in inshore, reef, and offshore habitats. It is often difficult to classify fish as being inhabitants of one habitat or another since most species will inhabit very different habitats during their lifetime. As such, the separation of taxa is based on their primary habitat as adults. As the fish from Vega del Palmar were collected without screening, the fish elements are biased toward larger adult individuals. Since all fish from this site are adults it was not necessary to further separate adults from subadults, a distinction that can be important in habitat analysis.

The estuarine and inshore region includes the tidal swamps and mangroves with interlacing brackish and saline waters, along with the inshore waters with seagrass beds and sandy substrates. The other marine environment exploited was reefs and rocky banks. Although marine habitats appear to be the primary source of fish, freshwater rivers may have also been exploited. Both snook and mullet are as common in freshwater as they are in inshore marine habitats and it is possible that these two species were captured from both marine and freshwater. Vega del Palmar is close to freshwater, the Caribbean Sea, the Laguna Guanaroca, and the Bahía de Cienfuegos and fish may have been acquired from a combination of the those locations.

The bony fish from the lower deposit (75-150 cm) totaled 500 fragments representing 99 individuals. Five of the fish taxa from this sample were identified as inshore inhabitants, including the jack, snook, tarpon, mullet, and lizardfish (Carpenter 2002; Robins et al. 1986). Based on MNI these inshore fish account for nearly 74 percent (MNI=73) of this sample. The two most abundant inshore/riverine species were the mullet (MNI=40) and snook (MNI=20), with the remaining three inshore fish accounting for just 1 to 6 percent. Reef fish from the lower level sample included grouper, snapper, barracuda, grunts, and porgies. Only snapper with a total of 10 MNI (10 percent) made a significant contribution to the MNI of these fish; the other fish account for just 1 to 4 percent.

In the upper deposits (0-60 cm) fish again consist only of inshore and reef species. The inshore species also include five taxa similar to the lower deposits including jack, mutton snapper, tarpon, snook, and mullet. In the upper deposits inshore fish make up 63 percent (MNI=36) of the sample. The snook was the only inshore/riverine fish of significant abundance in this level with 21 individuals (37 percent) and mullet the second most abundant (MNI=8 or 14 percent). The reef fish from the upper levels were also essentially the same as those in the earlier deposits, and included grouper, snapper, barracuda, hogfish, and porcupinefish (Table 13). The reef fish account for 40 percent (MNI=23) of the MNI from this deposit. Grouper (17.54 percent or 10 MNI) and snapper (12 percent or 7 MNI) are the only abundant reef fishes

Overall, the occupants of this site maintained a consistent focus on marine fishes found in inshore or riverine waters and along reefs. The inshore/riverine species of mullet and snook were of particular importance. Reef fishes were apparently of lesser importance compared to the inshore fish but were still consistently exploited; of these, groupers and snappers were the most prevalent. Of particular interest is the

extreme difference in the number of mullet recovered in the lower deposit (40 percent) versus the upper deposit (14 percent). This change could be due to change in procurement techniques with an exploitation focused away from net-fishing for mullet.

Table 14. Fish NISP and MNI by preferred habitat.

Taxa	Habitat	NISP	NISP %	MNI	MNI %
0-60 cm					
Epinephelus cf. *itijara*	Reef/Rocky Bank	3	1.46	1	1.75
Epinephelus sp.	Reef/Rocky Bank	30	14.56	9	15.79
cf. *Epinephelus* sp.	Reef/Rocky Bank	2	0.97	0	0
Lutjanus cyanopterus	Reef/Rocky Bank	2	0.97	1	1.75
Lutjanus sp.	Reef/Rocky Bank	17	8.25	7	12.28
Lachnolaimus maximus	Reef/Rocky Bank	3	1.46	1	1.75
Sphyraena barracuda	Reef/Rocky Bank	1	0.49	1	1.75
Diodontidae	Reef/Rocky Bank	1	0.49	1	1.75
Total Reef		59	28.64	21	36.84
Lutjanus analis	Inshore/Estuarine	1	0.49	1	1.75
Caranx sp.	Inshore/Estuarine	8	3.88	4	7.02
Centropomus sp.	Inshore/Estuarine	114	55.34	21	36.84
Megalops atlanticus	Inshore/Estuarine	3	1.46	2	3.51
Mugil curema	Inshore/Estuarine	21	10.19	8	14.04
Total Inshore		147	71.36	36	63.16
Total 0-60 cm		206	100	57	100
75-150 cm					
Serranidae	Reef/Rocky Bank	1	0.20	0	0
Epinephelus sp.	Reef/Rocky Bank	10	2.00	5	5.05
Mycteroperca sp.	Reef/Rocky Bank	1	0.20	1	1.01
Lutjanus sp.	Reef/Rocky Bank	19	3.80	10	10.10
Sphyraena barracuda	Reef/Rocky Bank	4	0.80	4	4.04
Haemulidae	Reef/Rocky Bank	1	0.20	0	0
Haemulon sp.	Reef/Rocky Bank	4	0.80	3	3.03
Calamus sp.	Reef/Rocky Bank	3	0.60	3	3.03
Total Reef		43	8.60	26	26.26
Caranx sp.	Inshore/Estuarine	13	2.60	6	6.06
Centropomus sp.	Inshore/Estuarine	88	17.60	20	20.20
Megalops atlanticus	Inshore/Estuarine	6	1.20	6	6.06
Mugil curema	Inshore/Estuarine	349	69.80	40	40.40
Synodontidae	Inshore/Estuarine	1	0.20	1	1.01
Total Inshore		457	91.40	73	73.74
Total 75-150		500	100	99	100

Fish Size Analysis

Given the great variability in the size of fish of different taxa quantification that includes biomass can be instructive. Size data are based on the measurement of vertebrae. A total of 263 vertebrae from fish identified to at least family level were measured (Table 15 and Figure 2) and the mean vertebrae width and mean estimated biomass was calculated from those measurements (Table 16). No vertebrae smaller than 4 mm were present probably due to the lack of screening. The smallest vertebra recovered was 5 mm from a mullet and the largest was 44 mm from a grouper which calculates into a biomass range from 436.91 g to 107,135 g (Table 16). The vertebrae from the earlier and later deposits were examined separately to see if any size difference is present between these samples. A total of 98 fish vertebrae were measured from the upper deposits. Most of the measured vertebra (n=62 or 63 percent) are from snook and grouper (n=15 or 15 percent). Mullet was also common with 10 vertebrae, while other fish only had 1 to 3 measurable vertebrae. This deposit has the greatest range in size from 5 mm to 44 mm (436.91 g to 107.14 kg); however, most of the vertebrae (n=58 or 60 percent) range between 11 mm to 17 mm and are predominately from snook (n=38 or 66 percent). The average vertebrae size from this sample is just 12.3 mm.

Table 15. Distribution of measured fish vertebrae.

Vertebrae Size (mm)	0-60 cm Count	%	75-150 cm Count	%
1	0	0.00	0	0.00
2	0	0.00	0	0.00
3	0	0.00	0	0.00
4	0	0.00	0	0.00
5	1	1.02	0	0.00
6	1	1.02	1	0.61
7	2	2.04	0	0.00
8	1	1.02	3	1.82
9	5	5.10	19	11.52
10	3	3.06	37	22.42
11	8	8.16	28	16.97
12	10	10.20	16	9.70
13	10	10.20	14	8.48
14	10	10.20	9	5.45
15	8	8.16	3	1.82
16	6	6.12	8	4.85
17	7	7.14	4	2.42
18	2	2.04	4	2.42
19	5	5.10	2	1.21
20	8	8.16	6	3.64
21	6	6.12	4	2.42
>21*	5	5.10	7	4.24
Total	98	100	165	100

* >21 includes 5 vertebrae ranging from 24mm to 44mm from 0-60cm and 7 vertebrae from 22mm to 33mm from 75-150cm.

Figure 2. Distribution of measured fish vertebrae.
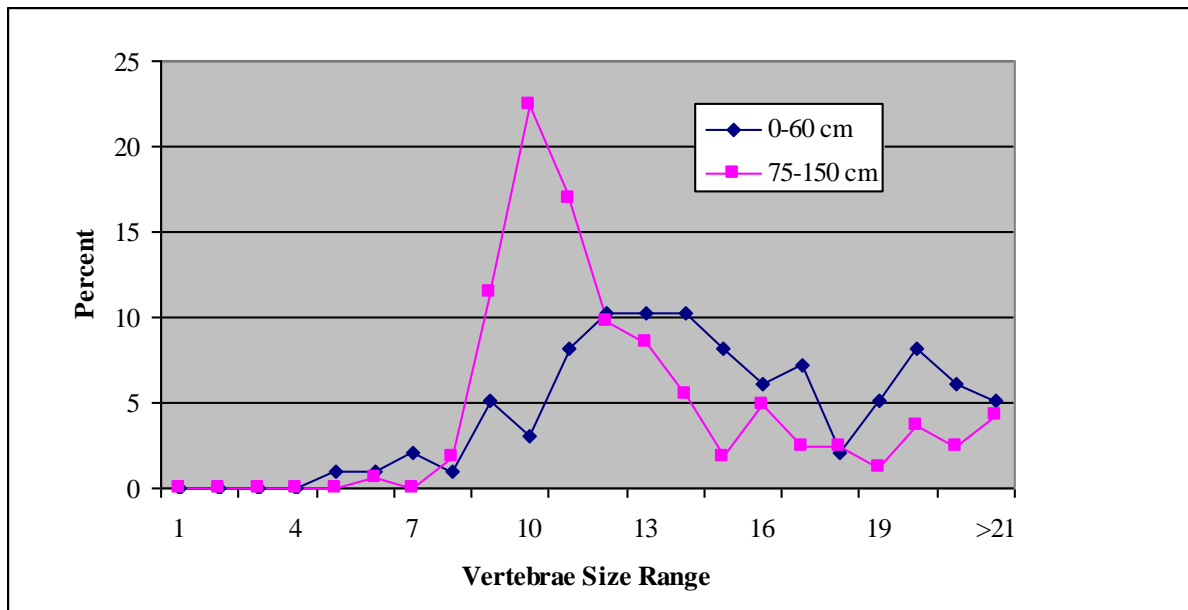
By multiplying the estimated MNI of each fish identified by the average biomass for that fish it was determined that most of the fish biomass from this deposit is derived from inshore species; the estimated total biomass from the measured inshore fish was 211.18 kg, while reef fish provided 156.04 kg. Most of the biomass from the inshore/riverine fish comes from snook (76 percent), whereas grouper accounts for most of the biomass (90 percent) from reef fish.

For the lower deposit 165 fish vertebrae were measured. Nearly 55 percent (n=90) of these vertebrae are from mullet. Snook also account for much of these vertebrae (n=43 or 26 percent). The remaining fish only had 1 to 9 measurable vertebrae. This sample has a wide range in vertebra size from 6 mm to 33.3 mm, with the smallest vertebra from a porgy and the largest from a grouper. However, as with the upper levels most of the vertebrae measured (n=114 or 69 percent) are concentrated, ranging between 9 mm to 13 mm. The

concentration of these vertebrae here is due mostly to mullet, which are common (n=86 or 75 percent) within this size range. However, the average vertebra size from this deposit is 18.1 mm due to the two large grouper vertebrae (32 and 33.3 mm).

The fish from the upper deposit are also relatively large, with biomass estimates ranging between 692.98 g from a porgy to 52.94 kg from a grouper. In the lower deposits inshore fish total 325.33 kg of biomass, whereas reef fish make up 323.44 kg suggesting a nearly equal contribution of fish from these two areas. The six groupers (140.95 kg) contribute most of the biomass of any single reef fish (43 percent), with the 10 snappers (128.01 kg) also providing a significant amount of biomass. Biomass from inshore/riverine fish is almost equally distributed between the 20 snooks with 126.97 kg (39 percent) and the 40 mullet with 125.53 kg (38.81 percent). These two fish account for almost 78 percent of the biomass for inshore/riverine fishes.

Table 16. Mean fish vertebra widths and estimated biomass.

Fish Taxa	No. of Vertebrae	Mean width (mm)	Width Range (mm)	Mean Biomass (g)	Biomass Range (g)
0-60 cm					
Megalops atlanticus	3	11.6	11-12	3673.49	3211.62-4002.47
Mugil curema	10	11.7	5-17	3754.14	436.91-9661.30
Centropomus sp.	62	15.5	7-31	7647.85	1023.52-44171.80
cf. *Epinephelus* sp.	2	15	11-19	7039	3211.62-12801.08
Epinephelus sp.	15	18.9	12-44	12682.10	4002.47-107134.96
Lutjanus sp.	2	13	11-15	4900.91	3211.62-7039
Lutjanus analis	1	8.7	-	1774.12	1774.12
Caranx sp.	2	10.5	9-12	2855.02	1933.01-4002.47
Diodontidae	1	5.5	-	556.05	556.05
Total	98	12.3	-	4260.49	-
75-150 cm					
Megalops atlanticus	6	14	10-26	5911.58	2523.48-28306.27
Mugil curema	90	10.9	9-18	3138.26	1933.01-11164.50
Centropomus sp.	43	14.4	8-28	6348.30	1434.89-34143.64
Serranidae	1	32	-	47866.25	47866.25
Epinephelus sp.	9	15.8	8-20	8027.91	1434.89-14574.91
Mycteroperca sp.	1	33.3	-	52940	52940
Caranx sp.	4	14	12-16	5911.58	4002.47-8287.50
Lutjanus sp.	6	19	13-21	12801.08	4900.91-16489.78
Calamus sp.	3	8.6	6-11	1722.98	692.98-3211.62
Sphyraena barracuda	2	19	14-24	12801.08	5911.58-23117.16
Total	165	18.1	-	11322.09	-

Not all of the reef or inshore fishes are represented in the biomass estimates because some of these fishes had no vertebrae in the sample. Therefore, these findings cannot provide information on the contributions of certain fish taxa to the diet at this site. In the early deposit reef and inshore fishes played a nearly equal part in the contribution of biomass, while in the later deposit inshore fish make up much more of the biomass than reef fish. Additionally, in the early deposits both mullet and snook provided nearly the same amount of biomass but in the later deposit mullet is nearly absent with snook providing the bulk of the biomass. In both deposits, grouper remains the most important fish in regards to biomass. These data provide slightly different results than the MNI analysis in which inshore taxa are more abundant in both the upper and lower components.

Discussion

This is one of the few Archaic or pre-ceramic faunal assemblages from the Greater Antilles that has yet been analyzed. Although this data set may not characterize Archaic subsistence or ecological adaptations for all of Cuba, it is possible to make some general statements about the collection and how Cuban pre-ceramic

faunal exploitation compares to other places and times in the Caribbean region.

Some of the things that distinguish this faunal collection from Archaic or preceramic assemblages from other parts of the Caribbean are the variety of habitats exploited and the relatively high taxonomic diversity of the terrestrial mammals. While most of the Caribbean islands supported only a single species of hutia, Cuba supported many taxa in the past and four are represented in this sample. The relative taxonomic diversity of the Cuban hutias is probably a function of the large size of the island of Cuba. It is well established that larger islands have greater taxonomic diversity than smaller islands (MacArthur and Wilson 1967). The presence of several hutia taxa in this cultural assemblage may reflect an ecologically diversified subsistence strategy practiced by the site's inhabitants.

The large numbers of individual hutia in the collection might indicate specialized hunting or possibly management of these animals. There have been suggestions in the literature that hutia were captive bred or managed in some way (Garner 2002; Newsom and Wing 2004:162-3) but this may not be the case on Cuba. Newsom and Wing (2004:162) describe *Isolobodon portoricensis*, the Porto Rican hutia, as the most widespread managed animal in the Greater Antilles and it is generally accepted that this species was endemic to Hispaniola and transported by Native Americans to Puerto Rico and the Virgin Islands. The situation with the Porto Rican hutia is probably different from the exploitation of the wide array of rodents endemic to Cuba. Given the diversity of endemic hutia taxa on Cuba there may have been little incentive to manage these animals, particularly if the modern abundance of *Capromys pilorides* is any

indication of the prehistoric availability of rodents on the island.

The diversity of hutia taxa in this sample also makes it challenging to use the age structure of a population to characterize the management of these animals as has been done with some Jamaican and Puerto Rican ceramic age archaeological assemblages (Carlson 2012; Carlson and Steadman 2009; Wilkins 2001). Those studies focused on the single taxon that was present on each of those islands. If it were possible to differentiate the Cuban hutia taxa based on the post-cranial elements we might be able to study the age structure of the various hutia populations to assess whether or not they reflect a natural age structure or a managed population. Even if the hutia endemic to Cuba were managed in prehistory, it seems likely that the site's inhabitants would have exploited wild animals in addition to any that were managed.

At the time of Newsom and Wing's (2004:162) publication, hutia had not yet been found in Archaic age sites in the Greater Antilles. These new data demonstrate that the hutia endemic to Cuba are abundant in the faunal assemblage from Vega del Palmar. Hutia were also very abundant at Las Obas (Colten, et al. 2009), another Cuban pre-ceramic site.

The animals represented in this faunal assemblage reflect a diversity of habitats. In addition to the various terrestrial habitats represented by the hutia taxa, there are animals from freshwater and various marine habitats. Sea turtles were likely procured in several ways. One commonly cited manner for harvesting sea turtles is during their nesting period (Wing and Reitz 1982; Stoudemire 1959; Price 1966:1365). During this time female turtles can be found in fairly large numbers on the beach and are easy targets for hunters, and their eggs could also be collected during this time.

Harpooning is also cited as a common method to catch sea turtles worldwide (Carlson 1999:111; McKillop 1984:30; Price 1966:1365). Evidence for such hunting techniques has been identified on sea turtle pleurals with harpoon-produced fractures from the Coralie site on Grand Turk, Turks and Caicos Islands (Carlson 1999:112). Netting of sea turtles with drag nets have also been noted from early accounts by Oviedo (Stoudemire 1959:92).

As with sea turtles, freshwater turtles could have been collected during nesting seasons or otherwise on land while basking. Since these turtles are omnivorous and will eat fish and invertebrates, using a baited trap or hook is a potential means of procurement. This freshwater turtle can also be collected when sleeping in shallow water (Schwartz and Henderson 1991:174). Other reptiles, including lizards and snakes are often found near human habitation sites. It is likely that snakes and lizards were only incidentally collected and not part of any active procurement plan.

The fish remains demonstrate a heavy reliance on inshore/estuarine and riverine habitats for both components when calculated by MNI and a more even relative abundance of inshore/estuarine and rocky reef habitats when calculated by biomass. The data demonstrate some changes through time in the various fish taxa exploited by the site's inhabitants, but there does not appear to be a major shift in fishing locations or fishing strategies. While the fish from the site are common to inshore waters and reef habitats snook and mullet are also found in freshwater rivers and springs. Some of the larger grouper and snapper, notably the probable goliath grouper and the cubera snapper could be found along deep water reefs and open waters. Given the large size of both the goliath grouper and cubera snapper, it is likely both may have been caught from a boat. Hook and line fishing

technologies were likely used to capture these fish. Nets or traps may have also been used for some of the smaller fish and fish that do not readily take bait (mullet).

Conclusions

This research adds to the body of well dated prehistoric faunal assemblages from Cuba, contributes to the island's prehistoric chronological framework, and demonstrates that museum collections have research potential for archaeology and biogeography. Vega Del Palmar has two components, one dated by radiocarbon analysis to roughly 350 B.C. and one dated to roughly A.D. 630. While both components might be considered "pre-ceramic" in the chronological scheme of the region, the later component has limited pottery of the Pre-Arawak Pottery Horizon type which can be dated with the two new radiocarbon dates from this site. The sherds from Vega del Palmar are in the same level or above the younger of the two radiocarbon dates (1750 +/- 30 BP [Beta-318170; shell; $\delta13 = 2.6$ 0/00]), which suggests that the pottery at this site dates roughly to the A.D. 630 time frame. This is somewhat younger than other dates for this pottery from Cuba listed by Rodriguez Ramos et al. (2008) but only by a few hundred years. Moreover, Ceramic Age pottery arrived in Cuba at a relatively late date, with Ostionoid and Meillacoid assemblages post-dating A.D. 900 (Persons 2013).

The vertebrate faunal sample is dominated by hutia of several species, some of which are now extinct. Fish are the second most abundant vertebrates and are primarily from estuarine/riverine and reef/rocky bank habitats. Birds and reptiles were relatively less important than fish and mammals but birds may be underrepresented due to recovery methods. Sea turtles are another marine species represented in the sample, whereas the Cuban slider is a

freshwater animal. The snake and lizard taxa are from drier, rockier habitats. Although we have not quantified the habitat distribution of the entire vertebrate assemblage it is clear that a variety of ecological zones were exploited by the site's inhabitants. The site's location may have been chosen in order to access this diversity of resource zones. The archaeological recovery methods probably reduced the diversity of taxa represented in the sample, particularly among birds and fish, perhaps obscuring some variability in the fauna through the deposit. Rodriguez Ramos et al. (2008:58) note that other sites with Pre-Arawak Pottery Horizon sherds are located in resource rich locations near bodies of water and that some are shell mounds, and Vega del Palmar fits that pattern. They also note that many Archaic sites with Pre-Arawak Pottery Horizon sherds have earlier occupations without pottery (Ramos et al. 2008:57), which is also true of Vega del Palmar.

The differences between the faunal remains in the ceramic and non-ceramic deposits are limited. Fish and mammals are the most abundant faunal categories in both the upper and lower levels although bird, fish, and reptile are a slightly higher percentage of the bones in the upper levels despite a smaller sample size. The hutia that can be identified to species are similar between the upper and lower components. There are some subtle differences in the fish habitats represented in the two components and some variability in fish taxa between the upper and lower levels. In short, the faunal remains in the occupation without ceramics are not much different from those in the ceramic level based on this sample. This pattern is not surprising if these ceramics are a local development. This technological change appears to not have had much immediate impact on the subsistence economy of hunter-gatherers on Cuba, in contrast to the Ostionoid migration, which carried new cultural influences to Cuba.

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