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Animal Utilization in a Growing City

Vertebrate Exploitation at Caracol, Belize

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The lowland Maya site of Caracol, Belize, has been excavated extensively during the last two decades. A substantial amount of vertebrate faunal remains has been recovered from both ceremonial and domestic contexts. Preliminary analysis provides insight into the exploitation of habitats and trading practices from the Late Preclassic/Early Classic transition (ca. 200 B.C.–A.D. 200) to the Terminal Classic (A.D. 800–1000). Changes in resource procurement and animal management practices show how growing complex societies adapted to increasing population and environmental stresses.

This chapter will reveal effects of population growth on the land, subsistence practices, and ceremonial behavior at the Maya site of Caracol, Belize. Located in the western foothills of the Maya Mountains, Caracol is approximately 500 m above sea level. The nearest permanent body of water is the Macal River, 15 km away. The environment today is moist subtropical forest within the Petén Biotic Province and has changed little since the Late Pleistocene (Miller and Miller 1994:18).

Caracol presents a good opportunity for study for many reasons, including the site's continuous occupation from the Preclassic (ca. 600 B.C.) through the Terminal Classic (ca. A.D. 1000). This lengthy history allows us to examine long-term patterns of changing faunal use. Eighteen years of intensive archaeological excavation at this site under the direction of Arlen and Diane Chase (Chase and Chase 1987; D. Z. Chase and A. F. Chase 1994) of the University of Central Florida have produced a diverse and large faunal assemblage from all parts of the site. As of 1998 the Caracol Archaeological Project had excavated approximately 84,763 pieces (or 12,500.99 g) of faunal remains collected from a variety of contexts, including structural fill, living surfaces, burials, and caches throughout Caracol. The recovered bone provides a means to explore patterns of use among Caracol's socioeconomically diverse population.

The size and complexity of this site allows us to ask questions about the relationship between its populace and the surrounding environment. Caracol developed from a small village in the eighth century B.C. to a large Classic Maya city that by A.D. 650 covered approximately 177 km^2 and had a population of more than 115,000 people (A. F. Chase and D. Z. Chase 1994:5) (Figure 11.1). A city of such size would have required a complex infrastructure to meet the subsistence needs of its residents. To meet the food requirements at Caracol, early construction engineers interlaced agricultural terraces in all parts of the city, even within its center (Chase and Chase 1996). Reservoirs were built to provide water for Caracol's populace, typically four to five within 1 km^2. What remains unanswered, however, is how meat was supplied to an expanding population that encroached on the surrounding forest. Several

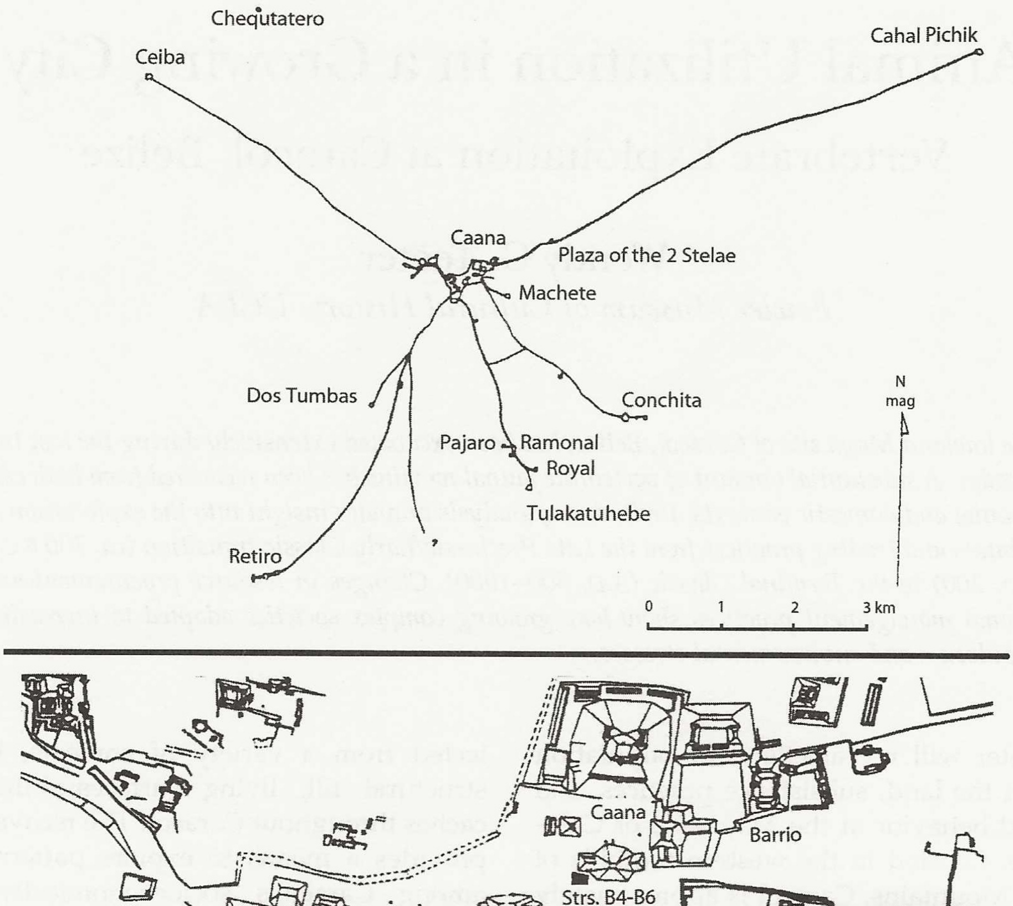


Figure 11.1. Map of Caracol, Belize, showing central square kilometer as mapped through the 1992 field season (from D. Z. Chase and A. F. Chase 1994:3).

technological responses have been offered based on Ford's (1986) postulates for subsistence strategies as they might apply to animal utilization. With changes in environmental resources the Caracol Maya could have (1) increased hunting distances into unused areas; (2) developed methods of animal domestication and/or taming, as well as targeted and managed hunting; or (3) used other previously underutilized fauna. The faunal remains from Caracol will help us to understand how Caracoleños adapted to population pressure and societal complexity using technological responses.

Greater societal complexity within a city can be recognized through adaptive mechanisms of social organization such as the emergence of specialization, increased socioeconomic differentiation, and increased reliance on trade imports. The greater the population, the greater the organizational needs for management and integration of all people (e.g., Carniero 1970; Ford 1986:11; Zeder 1991). From this, powerful centralized leadership emerges to effectively manage the specialization and exchange within the economy (Brumfiel and Earle 1987:2; Polyani 1944). Specialization is a common solution when natural resources are unevenly distributed or when the production process involves some gradually acquired skills or significant economies of scale (Brumfiel and Earle 1987:5; Zeder 1991). Specialization with regard to animal resources can take many forms, from meat distribution to animal management to the production of finished bone products. The distribution of meat is believed to have become increasingly segregated from animal management and thus itself to become a specialized activity (Zeder 1991:250).

The main goal of my research is to investigate the relationships between sociopolitical status, subsistence, and animal use, and how they were affected by increasing social complexity in Maya society at Caracol. This chapter will focus on the variability in animal use between outlying residential groups and the elite groups within the urban epicenter.

SUBSISTENCE CHANGES

It has only been since the 1980s that zooarchaeology has played a prominent role in Maya studies. During this time researchers such as Elizabeth Wing (1980), Mary Pohl (1981, 1983, 1990), Nancy Hamblin (1984), Helen Sorayya Carr (1985), June Morton (1987), and Leslie Shaw (1991; Shaw and Gibson 1986) demonstrated that faunal analysis can do more than just reconstruct paleoenvironments and provide a list of possible menu items from the past. Faunal analysis can reveal complex trade networks, times of population stress, different groups of people within a city, the roles of different socioeconomic groups, and ceremonial practices, all of which this current research continues to address.

Arlen and Diane Chase (A. F. Chase and D. Z. Chase 1994:6) believe that major changes in the environment accompanied the growth of Classic Maya populations, necessitating shifts in subsistence strategies. One such change included the depletion of primary forest growth and the increase in fields and brushy areas (A. F. Chase and D. Z. Chase 1994:6; Lee 1996:413; Miller and Miller 1994:12). These habitat changes would have been more inviting to animals such as opossum, deer, and rabbit, whereas other wild game, such as the jaguar, would have migrated to areas where food was more readily available (Stokes and Stokes 1986).

Tables 11.1 and 11.2 give the distribution of the faunal assemblage from dated contexts with and without the removal of the Terminal Classic A6 floors and fill data. These contexts are removed in Table 11.2 because they contain both refuse deposited after A.D. 890 and the animals that were attracted to the refuse for food and shelter. For instance, 54,651 mammal elements (91 percent, 3,894.78 g) come from the room floors at the top of Structure A6.[1] Showing two tables allows for the acknowledgment of this bias. As a note, raw counts are used in these tables instead of amount per volume excavated because of the differences in excavated contexts.

Burials may have little soil if sealed, whereas units of varying sizes would have more. This mostly intrusive material causes quite a difference in the site patterning. Instead of the great increase in faunal usage at Caracol during the Late Classic, Table 11.2 suggests another story.

Table 11.1. Caracol Fauna by Dated Contexts

Period	Count	Percent	Weight (g)
Late Preclassic	1,479	2.2	451.51
Early Classic	888	1.3	338.95
Late Classic	3,471	5.2	841.56
Terminal Classic	61,427	91.3	5,798.73
Site total	67,265	100	7,430.75

Table 11.2. Caracol Fauna by Dated Contexts after A6 Floor/Fill Removal

Period	Count	Percent	Weight (g)
Late Preclassic	1,479	18.2	451.51
Early Classic	888	11.0	338.95
Late Classic	3,471	42.9	841.56
Terminal Classic	2,260	27.9	1,759.05
Site total	8,098	100	3,391.07

Based on the faunal data it appears that Caracol was already quite efficient in providing meat to households and importing luxury products such as marine fish. There is a decline in utilization of meat during the Early Classic. This may be real or a bias of the data sample. For instance, if there are more structures found from the Late Preclassic than the Early Classic, then the data set may reflect this in total amount of bone recovered. Or, if the disposal of animal remains from the Early Classic was used as fill in the later construction phases of buildings, then this material may not be associated with dated contexts and not applied to the overall patterning at the site. The data from other material remains will help determine which is the most logical explanation. Currently, Arlen Chase (personal communication 2001) believes that there are not enough Early Classic structures excavated at this point.

The spike from Early to Late Classic is logical given the increase in population levels by this point. The proposed defeat of Tikal initiated a florescence of Caracol that was seen in the construction of the majority of plaza groups, causeways, and terraces throughout the city (A. F. Chase and D. Z. Chase 1998). The expansion brought many of the smaller nearby centers within Caracol's polity, and the causeways integrated them within the greater Caracol social fabric. The increase of all faunal material shows the ability of Caracol to provide for its inhabitants both in large game and imports from the sea. A slight decline during the Terminal Classic matches a decline in population levels as people began to leave the city through A.D. 1000 (Chase and Chase 2000).

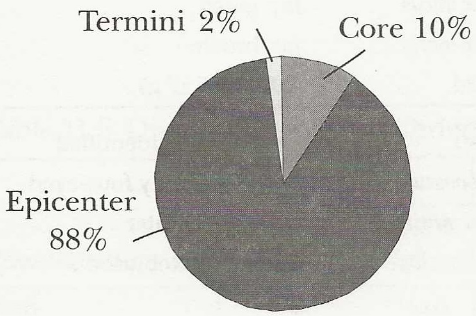
To ensure that the patterns in fauna representation over time are not restricted to a portion of the population, divisions into broad socioeconomic groups are applied, following models by Chase and Chase (Chase and Chase 1987; D. Z. Chase and A. F. Chase 1994). The faunal assemblage is divided among the epicenter (the central locus of administrative and ceremonial activities), the core (residential in nature and outside of the administrative and royal structural complexes), and the termini areas at the end of the causeways (large administrative plazas). Causeway termini, approximately 6 to 8 km away from the epicenter (see Figure 11.1), are not residential in function but probably served as regional administrative centers for the area (Chase and Chase 1996). Based on architectural investment alone, the epicenter and the causeway termini can be classified as elite, likely royal, whereas the core contains households of all socioeconomic strata but can be averaged to the middle majority of Caracol's populace.

Figure 11.2 highlights that the majority of faunal remains can be found in the epicenter. This is significant since only 26 percent of the total 147 discrete excavation areas or operations were located in the epicenter, but remains from the epicenter represent 88 percent of the total site faunal assemblage. In contrast, 65 percent of excavation areas were from the core, but these represent only 10 percent of the total assemblage from just 37 residential groups. It is therefore unlikely that excavation strategies are responsible for the difference in quantities recovered from different site areas.

More likely, some differences are the result of variability in recovery context (see Emery chapter 2 for additional discussion). From the evidence collected so far, the best preservation of bone occurs in sealed environments such as cache vessels with lids, structural fill, and floors sealed by other floors. Degree of preservation within tombs depends on whether the tomb remained sealed or was opened through partial collapse. Protection from the elements (including water, acidic humus soils, plant roots that can burrow through bone) is crucial to bone preservation. Most often excavations in the epicenter are conducted on large structures with only a small covering of soil and then structural fill. Tombs are generally still sealed and have very little debris that might hinder the preservation of included animals, although temperature variability may be a factor. In contrast, the core residential plazas often contain open or partially collapsed tombs with lots of debris from the surrounding environment and are subject to rain and heat, a very poor condition for bone survival. Of course, another reason for recovery differences may be that inhabitants of the epicenter were eating and using the majority of the animals brought into Caracol. Further testing is being conducted using multiple lines of evidence such as stable isotope testing on human remains (Chase et al. 1998) and my own research to understand the dietary habits of different socioeconomic groups (see Teeter 2001).

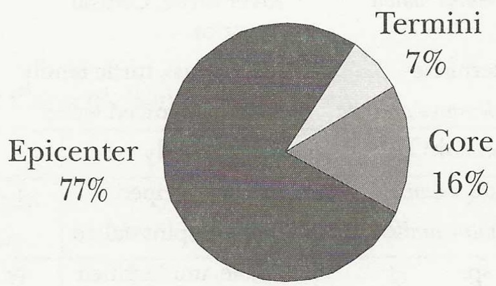
Christine White of the University of Western Ontario is researching information on the diet and nutrition of elite and nonelite Caracol Maya through stable isotope analysis on human bone. White's analysis is helping us to understand what portions of the Caracol diet were maize vs. meat and how dietary patterns were distributed throughout the site (Chase et al. 1998). Early results are finding evidence of meat consumption in all parts of the city through time. However, not surprisingly, the largest diversity in diet is found in the epicenter, showing unequal access to food resources. This was found in the collagen-apatite spacings interpreted by Chase et al. (1998) and seen most dramatically in the faunal remains discussed more fully below.

Figure 11.3 divides the modified faunal remains by epicenter, core, and termini. The unmodified bone is not figured because it follows the same trend as for bone overall (Figure 11.2), since 99.2 percent of the total faunal assemblage is unmodified. Therefore, patterning



Site Area	Pieces	Weight(g)
Core	2,544	1,200.87
Epicenter	81,700	11,053.88
Termini	519	246.24
TOTAL:	84,763	12,500.99

Figure 11.2. Distribution of all animal bone by site area.



Site Area	Pieces	Weight(g)
Core	161	199.76
Epicenter	580	948.82
Termini	13	87.18
TOTAL:	754	1,235.76

Figure 11.3. Distribution of modified animal bone by site area.

shows that the majority of unmodified bone is found in the epicenter. However, the modified animal bone (Figure 11.3), largely found in sealed contexts, is a little more evenly distributed across Caracol.

Besides differences in the amounts of faunal material between the epicenter and outlying areas, there are also significant differences in species represented between the city areas. Table 11.3 presents a list of identified species found at the site, and Table 11.4 shows the distribution of animal remains in the city by order. Table 11.5 presents the distribution of taxa orders by context. The "other" category used in this table refers to material found in poor context, including structural fill, collapse, and surface finds. Species identifications were limited to bone from primary contexts and all fish and modified bone to better understand what behaviors might be represented. Even with this restriction more

Table 11.3. Identified Vertebrate Species from Caracol, Belize

Taxon	Common Name
Dasyatidae	Stingray, unidentified
Ariidae	Sea catfish family
Epinephelus striatus	Grouper, Nassau
Caranx latus	Jack, horse-eye
Lutjanus sp.	Snapper, unidentified
Haemulon sciurus	Grunt, blue-striped
Sphyraena sp.	Barracuda, unidentified
Sparisoma viride	Parrotfish, stoplight
Total fish	197 (54.90 g)
Rhinophrynus dorsalis	Frog, Mexican burrowing (Uo)
Bufo sp.	Toad, unidentified
Rana sp.	Frog, unidentified
Total amphibian	2,716 (64.14 g)
Dermatemys mawii	River turtle, Central America
Kinosternidae	Mud, Musk turtle family
Rhinoclemmys areolata	Turtle, furrowed wood
Gekkonidae	Gecko family
Basiliscus vittatus	Basilisk, striped
Ctenosaura similis	Iguana, spiny-tailed
Anolis sp.	Anole, unidentified
Ameiva festiva	Lagartija Parda
Lepidophyma flavimaculatum	Night lizard, yellow-spotted
Boa constrictor	Boa constrictor
Colubridae	Colubrid family
Bothrops asper	Fer de lance
Total reptile	1,006 (284.22 g)
Buteo sp.	Hawk, unidentified
Micrastur semitorquatus	Falcon, collared forest
Meleagris ocellata	Ocellated turkey
Gallus gallus	Chicken, domestic
Phasianidae	Quail, unidentified
Columba flavirostris	Pigeon, red-billed
Zenaida sp.	Dove, unidentified
Amazona sp.	Parrot, unidentified
Tyto alba	Barn owl, common
Strigidae	Owl family
Momotus momota	Motmot, blue-crowned
Ramphastos sulfuratus	Keel-billed toucan
Cotinga amabilis	Lovely cotinga
Cyanocorax yncas	Jay, green
Cyanocorax morio	Jay, brown
Total bird	4,079 (255.17 g)
Didelphis sp.	Opossum, unidentified
Philander opossum	Opossum, gray four-eyed
Chironectes minimus	Opossum, water
Marmosa robinsoni	Opossum, Robinson's mouse
Caluromys derbianus	Opossum, C. Am. woolly
Cryptotis sp.	Shrew, unidentified
Micronycteris megalotis	Bat, Brazilian small-eared
Carollia brevicauda	Bat, short-tailed
Sturnira lilium	Bat, yellow-shouldered
Artibeus lituratus	Bat, big fruit-eating
Centurio senex	Bat, wrinkle-faced

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Table 11.3. Identified Vertebrate Species from Caracol, Belize (continued)

Taxon	Common Name	Taxon	Common Name
Natalus stramineus	Bat, Mexican funnel-eared	*Canis familiaris*	Dog, domestic
Dasypus novemcinctus	Armadillo, nine-banded	*Procyon lotor*	Raccoon
Sylvilagus sp.	Rabbit, unidentified	*Nasua narica*	Coati, white-nosed
Sciurus sp.	Squirrel	*Puma concolor*	Mountain lion, puma, cougar
Orthogeomys hispidus	Pocket gopher, hispid	*Lepardus pardalis*	Ocelot
Heteromys desmarestianus	Mouse, Demarest's spiny pocket	*Lepardus wiedii*	Margay
Ototylomys phyllotis	Rat, big-eared climbing	*Panthera onca*	Jaguar
Sigmodon hispidus	Rat, hispid cotton	*Tapirus bairdii*	Tapir, Baird's
Agouti paca	Paca	*Tayassu pecari*	Peccary, white-Lipped
Dasyprocta punctata	Agouti, Central American	*Odocoileus virginianus*	Deer, white-tailed
Urocyon cinereoargenteus	Fox, gray	*Mazama americana*	Deer, red Brocket
		Total mammal	59,925 (7,790.46 g)

Table 11.4. Distribution of Taxa Orders across Caracol, Belize

Order	Epicenter		Core		Terminus	
	No.	Weight (g)	No.	Weight (g)	No.	Weight (g)
Fish	173	46.43	24	8.47	0	0.00
Amphibian	2,647	60.02	65	3.99	4	0.13
Reptile	438	148.03	258	60.32	310	75.87
Bird	3,926	214.92	130	33.94	23	6.31
Mammal	57,454	6,753.50	2,296	897.04	175	139.92
Site total	64,638	7,222.90	2,773	1,003.76	512	222.23

Table 11.5. Distribution of Taxa Orders by Context at Caracol, Belize

Identification	Burial		Cache		Floor		Other	
	No.	Weight (g)	No.	Weight (g)	No.	Weight (g)	No.	Weight (g)
Fish	46	16.68	102	23.49	24	9.50	25	5.23
Amphibian	79	5.02	0	0.00	2,637	59.12	0	0.00
Reptile	584	144.61	18	2.30	403	136.50	0	0.00
Bird	1,173	99.67	392	17.21	2,512	137.32	0	0.00
Mammal	3,541	1,470.57	60	8.36	56,168	6,053.77	156	257.76
Site total	5,423	1,736.55	572	51.36	61,744	6,396.21	181	262.99

than 80 percent of the total assemblage was included. There are many interesting trends in these tables that can be examined further.

Fish use at Caracol provides a good example of specific environmental exploitation. For example, although the Macal River lies 15 kilometers away from the city epicenter and would have provided an abundance of fish, no river fish have yet been recovered from excavations. However, evidence for the importation of fish from the Belizean coast has been modest (197 elements) but intriguing. The majority of these fish derived from coral reef areas, and their importation would have been costly, requiring logistical planning. Because their presence begins in the Late Preclassic, a well-developed trade network must have been in place by this point (see Masson this volume for additional discussion). Although only a small amount of fish remains were recovered in the city, their presence is not incidental, based on the stable isotope analysis on human remains, which shows the presence of fish in the diet of elite residents (Chase and Chase 1999). Because of difficulties bringing fish into Caracol, it is doubtful that they ever constituted a major part of the dietary regimen, but the archaeological distribution of these remains suggests that fish were eaten by an affluent segment of the Caracol population both in the epicenter and core. No fish were found at the causeway termini groups, although those groups likely have strong elite ties.

The presence of amphibian remains at Caracol is restricted to frogs and toads. Almost the entire collection (99 percent) was recovered from excavations into trash deposited in the rooms on top of Structure A6. This context dates to after A.D. 890, with a buildup of faunal remains and trash as a result of owl and human contributions (discussed further below). Outside of this context the small portion that is left comes from floor contexts in Structures B19 and B21. This may be indicative of food, but with no cut marks or cooking indications it is hard to tell anything conclusive from only two examples.

The representation of reptiles in the Caracol archaeological record does not reflect changes in the environment over time. Overall, reptile use does increase over time, but it decreases as the city is abandoned. Turtles, iguanas, and boas can all live commensally with humans, and the increase in human population would have increased their available food at Caracol. The recovery of turtles highlights the use of riverine environments, since some of the turtle species (e.g., the Central American River turtle) were not likely found in the city but may have been obtained from the Macal River. Turtles were found most frequently in upper-class groups throughout the city (epicenter, core, and terminus). Iguana and snakes may have contributed to the diet at Caracol, but their presence in only a few contexts makes forming conclusions about their role difficult.

Many of the birds identified from the Caracol faunal assemblage prefer more open land with forest patches, including the ocellated turkey, quail, and barn owl. These birds offer the best glimpse at the surrounding environment of Caracol during its occupation. Far from being denuded of trees, Caracol's larger building clusters were likely surrounded by residential plaza groups connected by agricultural terraces and kitchen gardens with fruit and nut trees. The aesthetic use of trees is also likely, but speculative, as is the argument for a "king's forest" similar to feudal Europe, where royals could hunt for protected wild game (Pohl 1981).

Bird remains were recovered largely from epicentral floors. Significant numbers were found in dated contexts from the Late Preclassic, with a drop in use during the Early Classic. This decline then is followed by a sharp increase to 35.7 percent by the Late Classic. The next augmentation in use during the Terminal Classic period matches northern Belize Maya cities, where an increased reliance is seen on the use of birds and smaller animals. Ocellated turkeys (*Meleagris ocellata*) are responsible for the majority of identified species on floors. Additionally, quail (Columbiformes) and songbirds (Passeriformes) were restricted to the epicenter. Based on the limited evidence, it seems that turkey and other birds represented only a small proportion of Caracol residents' diet.

The presence of mammals in dated contexts through time shows an ever-increasing amount of remains from the Late Preclassic to the Terminal Classic, with the majority from the Terminal Classic. The large augmentation between the Late and Terminal Classic periods matches other northern Belize Maya cities, where an increased reliance is seen in the use of smaller animals. However, this great increase is likely also owing to the preservation of the final Caracol occupation and in particular, the largely intrusive A6 floor remains.

Opossums, bats, armadillos, shrews, rodents, tapir, peccary, and deer are found predominately on floors. Among these represented mammals the majority of the smaller animals (i.e., mouse opossums, shrews, rodents, and bats) were recovered from A6. If the epicenter total is considered without the remains from the Terminal Classic A6 floors, almost half of the epicenter total is taken away but still represents the majority of mammal remains (53 percent) over the entire city. It is interesting that rabbits, carnivores, and artiodactyls continue to dominate epicentral contexts even after the removal of A6 floor materials.

Similar to birds, the mammal data overall suggest some level of restriction on the use of many mammals for food. The representation of opossum, margay, jaguar, raccoon, tapir, and coati on floors is minimal, with little significance as food. It should be noted, however, that even a small amount of tapir would contribute more meat than a half dozen rabbits and was restricted to Structures B4 and B6 in the epicenter.

Good evidence for meat resources derives from rabbit, the third most abundant mammal from floor contexts. However, its presence at Caracol is highly restrictive, being found in only eight structures (B4, B6, B19, B20, B24, B25, B34, and B64), all within several hundred meters of each other.

A similar restriction to the northeast portion of the epicenter (if we don't consider A6 floors) is seen with the *Agouti paca* and *Dasyprocta punctata*. They are restricted to B19, B25, and B118. Likewise, *Urocyon cinereoargenteus* (gray fox) was recovered only in Structures B4, B23, and B64.

As a food, dog is never the most abundantly represented but is still a staple of the Maya from the Formative to the Postclassic (Pohl 1990:159; Wing 1981:25). At Caracol dogs are well represented but restricted in recovery to Structures B4, B5, B6, B19, B25, B64, and, on the Central Acropolis, Structure A39. A fourth of the recovered dog assemblage was worked. It is likely that the remaining contexts represent food refuse and that dog formed a small part of the elite diet.

Peccaries are considered one of the three top meat sources for the Maya (Sharer 1994: 440). At Caracol, however, peccary was limited to the epicenter, based on floor remains being recovered in the B ball-court floor and Structures B21, B24, B64, and D18 in the South Acropolis. The majority of the elements are teeth and not likely representative of food. Since peccary bones are strong and a good choice for bone working, it may be that bone was utilized further after the meat was removed and will be found modified.

The most important meat source has been saved for last. Two species of deer are found at Caracol, the white-tailed and smaller red brocket deer. Although deer availability and use during the Classic period has been questioned, its significance from the Formative through the Spanish periods cannot be denied (Pohl 1985b). At Caracol it is the most abundant species found—mostly in the epicenter, but two fragments were found in Structure C11 of the Los Tabanos group. Clearly deer formed a large part of the epicentral diet. Deer was also often found modified. Like the peccary, deer remains demonstrate the complete utilization of animals. It is difficult to accurately assess how much deer or other meat might have been eaten within a complex society such as Caracol because leftovers may have been completely recycled.

To further look at subsistence activities, faunal remains have been recovered from two types of refuse contexts at Caracol. One, located in

Structure A6, is de facto refuse deposited over a century or more (Chase and Chase 2000). Located in the two central and side rooms, it was a greasy, black soil that appeared to have been periodically burned. Of the faunal remains from Caracol, 71 percent were recovered in this structure. Unfortunately, 87 percent (n = 52,613) of this material is divided among rodents, mouse opossums, and shrew. Archaeological sites provide an excellent habitat for these creatures, as well as a food supply, shelter, and potential traps (Falk and Semken 1998:304). Their presence in the trash deposit is likely the result of animal activity, including owl roosting and carnivore scavenging during the abandonment of these rooms, and not direct human activity.

Excavations at some of the epicentral residential courtyards revealed an additional type of refuse. Provisional trash was a short-term deposit not cleaned from the courtyard before the group was abandoned (Chase and Chase 2000). More than a half dozen examples of this type of refuse area have been identified. Most are Terminal Classic (see Pendergast chapter 15 for additional discussion of this type of refuse), such as Structure B64 and the "Barrio" residential group (located within the northeastern area of the epicenter). Often deer are found in these situations; however, Structure B64 is extremely diverse and includes deer, peccary, rabbit, and snapper.

Unfortunately, refuse in the core areas has not been located. This may be owing to a lack of general preservation or refuse disposal. Diane and Arlen Chase (2000) have suggested that with such a high population density, a more formal garbage disposal system would have been in place at Caracol. Shaw (1985:7) showed evidence for this possibility when she found only low numbers of fish remains from Colha, until a single pit feature was found to contain 1,274 bones of fish and turtle remains. She believes that fish were likely buried quickly to reduce the heavy smell of decomposition. A similar practice may have been to collect and remove refuse from the residential areas to a yet-undiscovered locale. But although preservation or refuse practices are likely factors in identified patterns, White's stable isotope analysis supports meat in the core population's diet through time (Chase et al. 1998). Therefore, it is likely that the Caracol diet included more animal meat than current data suggest.

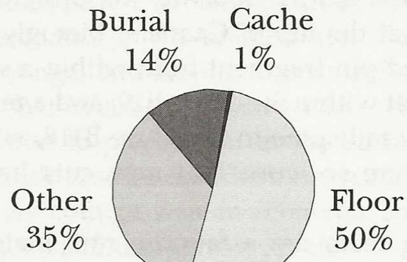
Ceremonial Use of Fauna

Animals also played an ideological role for the Maya. Miller and Taube (1993:118, 148) write that monkeys were patron gods of art, writing, and calculating. People born under the time of "1 Monkey" were likely to be artists or scribes. Ethnographically, Mary Pohl (1983) has described modern-day rituals that include the sacrificing of a bull and a pig. From the ethnographic, historic literature, and zooarchaeological data it is possible to reconstruct how animals were used in rituals and how changes in their accessibility affected their symbolic and economic value. For example, what effect did habitat destruction have on forest animals incorporated into ceremonial practices as Caracol continued to expand over time? The data suggest a number of alternatives. It is possible that the Caracol population modified its ceremonial activities in response to stresses on animal resources. This stress may have caused the population to reevaluate the higher cost of animals for public and private ceremonies and at times to make substitutions of more readily available animals. The alternative may be that the higher cost of rarer animals increased their symbolic and/or ceremonial value and that these animals continued to be used by the elite. The archaeological faunal record shows which animals were preferred in burials and caches through time. If certain animals became more costly but were still used, there should be a change from more widespread use to a restricted presence in higher socioeconomic groups. If a choice of substitution was preferred, then over time there will be a gradual replacement of individual animals that do not tolerate human populations, to more commensal species used within burials and caches. The abundance of faunal material excavated from primary contexts provides a unique opportunity to study the relationship between ideology and subsistence strategies.

Ceremonial activities are most readily identified in two contexts, burials and caches. Burials at Caracol are most often found in cysts (a prepared area with clear outlines, marked either by soil changes or stones), crypts (areas with formal walls and roof but not much larger than necessary for their contents), tombs (formal construction larger than necessary for their contents), and chultuns (subterranean pits carved in bedrock), and the burials may include offerings of meat or even the entire animal (Chase and Chase 1987:57). Purposefully buried objects, or caches, generally consist of a container, such as a lidded urn or bowl, filled with an offering and buried in front of or within a building. Because caches are often sealed at Caracol, the preservation can be extremely good, allowing archaeologists to recover seeds, cloth, and even string (D. Z. Chase and A. F. Chase 1998).

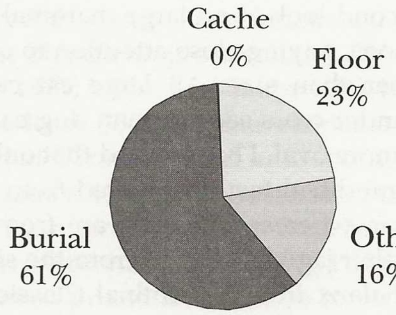
Figure 11.4 shows how faunal remains separate into contexts, with the majority of bone being recovered from floors (50 percent) and mostly midden material. Also, a significant percentage of bone (14 percent) was recovered from burials. Since the majority of the floor material is from small animals, calculating percentages by weight instead of number of specimens (NISP) helps reduce some skewing. In this method the weight percentage for the "other" context category is higher since the majority is heavier deer bone recovered from structural fill on Caana.

The modified bone appears to be radically different from the rest of the assemblage. Figure 11.5 shows that burials are most likely to contain modified bone—generally awls, needles, pins, scoops, tubes, inscribed and carved pieces (such as Figure 11.6, showing a hieroglyphic text carved on a long bone found within a Late Classic tomb in a core residential group), and occasionally figurines. Figure 11.7 shows carved deer-antler figurines recovered from an Early Classic tomb within the epicentral structure D16 (in the South Acropolis). It is interesting to note that within caches only three worked pieces of bone have been found: a shaped fragment of burned bone found in a pit



Context	Pieces	Weight(g)
Burial	4,964	1,695.15
Cache	693	86.58
Floor	73,143	6,384.52
Other	5,963	4,334.74
TOTAL:	84,763	12,500.99

Figure 11.4. Distribution of Caracol animal bone by context.



Context	Pieces	Weight(g)
Burial	598	745.42
Cache	3	2.06
Floor	104	284.98
Other	49	203.3
TOTAL:	754	1,235.76

Figure 11.5. Distribution of modified animal bone by context.

under the north doorway of Structure B19, located at the top of Caana; a hieroglyphically inscribed pin fragment from within a subadult burial pit within Structure B19; and a renotched stingray tail spine in Structure B118, where the sides were so worn that new cuts had to be made.

Dog teeth are a favorite raw material for jewelry at Caracol, with canines often pierced through the root for wearing as a pendant. Research has revealed that dog canines were widely used for jewelry throughout the Maya area (Clutton-Brock and Hammond 1994:825; Hamblin 1984:114). Having conferred with other colleagues, I am convinced that much of what has been identified in the Maya area as jaguar canine is actually dog, based on their large size. When teeth from both are compared, one can see that jaguar teeth are almost twice as large, but most archaeologists have not seen them together to realize this difference. I recommend a second look at all large mammal tooth identifications, paying close attention to overall shape rather than size. All large cat canines have a rounder cross section than dog canines, which are more oval. I have found that only 1 of about 322 modified teeth recovered from Caracol is jaguar, whereas 310 teeth are from dog. The only other jaguar remains from the site are a single phalanx from a Terminal Classic floor in Structure B6; the claws and a third phalanx of a single cat found with a burial of a single adult within Structure B20, on top of Caana, dating to A.D. 537; and the claws of a single cat found within an elite tomb in a very large structure at a group called "Saraguate." These phalanges likely represent the former presence of the jaguar skin, possibly used as a mat, cape, booties, or gloves. The infrequency of jaguar remains and their elite ceremonial contexts are consistent with other interpretations that the jaguar was an animal reserved for rulers as a symbol of their power (Coe 1988:233; Miller and Taube 1993:102; Pohl 1983).

In addition to canines, dog premolars were also utilized for jewelry. In a Late Preclassic burial in front of Structure B34, within the North Acropolis, a person was buried with jewelry made from 299 fourth premolars and 79 large mammal long bones drilled and used as

Figure 11.6. Long-bone shaft with hieroglyphic inscription. Photo courtesy of Caracol Archaeological Project.

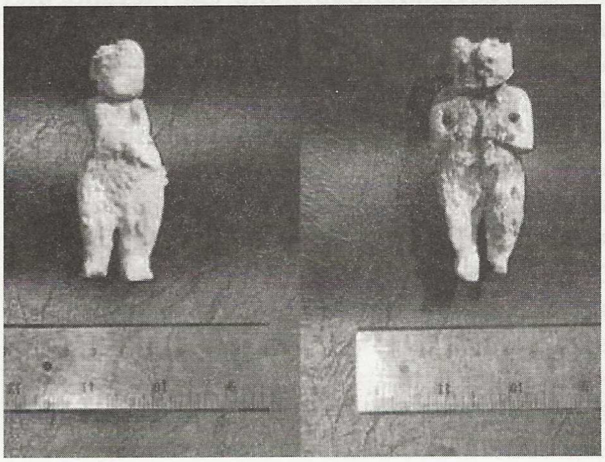


Figure 11.7. Deer antler figurines from an Early Classic tomb. Photos by author.

separators for the beads (Figures 11.8 and 11.9). The beads and spacers formed part of the jewelry worn by the interred woman; the beads formed anklets, and the spacers fit with shell and jadeite beads to form a mantle. This collection of jewelry required a minimum of 99 individual dogs.

Referring in part to Table 11.5, we can see a number of interesting trends. Large mammals, making up a large portion of the diet, were rarely placed in burials or caches unless modified in the form of jewelry or tools. Instead, smaller animals such as birds, reptiles, stingray, and fish were offered. For instance, in Structure A3 a tomb contained 13 quail (Odontophoridae) as a burial offering to a young woman. Often these ceremonially offered animals are whole and seem to have been chosen for reasons other than sustenance in the underworld. The fishes, lovely cotinga, and stoplight parrotfish seem to suggest that beauty may have been a factor in the decision to place them in the burial. However, it could also be that the more readily available lovely cotinga was an economic substitute for the quetzal found farther south.

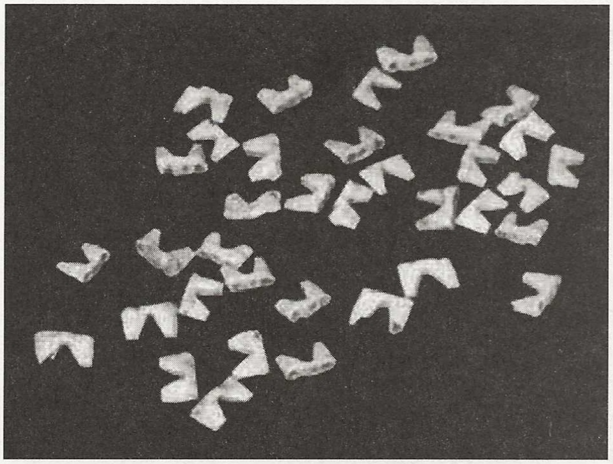


Figure 11.8. Beads made from dog premolars found in a Late Preclassic tomb. Photo by author.

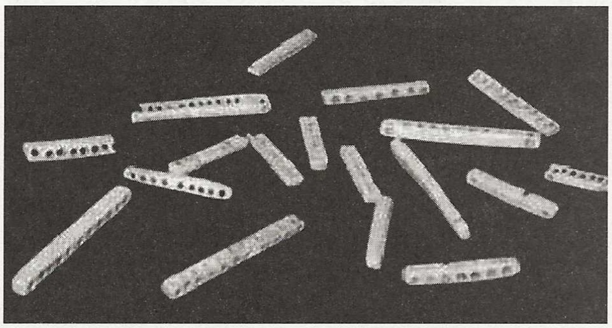


Figure 11.9. "Spacers" found with the above beads in a Late Preclassic tomb. Photo by author.

Excavation and analysis seem to indicate that cache vessels were extremely restrictive as to contents. Although epicentral caches contained almost no modified bone, they generally contained stingray. Stingrays are found on sandy bottoms among sea-grass beds, lagoons, and reefs. They have large thick "wings" that are used to swim and help locate shellfish buried in the sand. For protection stingrays have one or two tail spines, which whip up and over their body as they lie almost motionless in the sand (Humann 1995:389). Their tail spines are often found in Maya burials and caches; it is believed they may have functioned as perforators in bloodletting ceremonies (Borhegi 1961; Chase 1991; Miller and Taube 1993:46).

At least 50 tail-spine elements are represented at Caracol, found in 13 locations, both in royal tombs and in simple burials from the core. They were recovered from 8 caches, 12 burials, and on 2 structure floors (Table 11.6). They must have been prized and hard to come by, considering that one spine found in a floor context was so worn down that no barbs were left. Furthermore, notches were carved along the edges to make it functional again. Although isolated tail spines are most frequently found at Caracol, three caches and a child's burial included spines and vertebrae or cranial elements. This evidence shows that Caracol imported and utilized the entire stingray, not just the spines as many authors assume (e.g., Borhegi 1961; Hamblin 1984). More direct ethnographic evidence of stingray use is found in Diego de Landa's writing of 1566:

> There is another fish on this coast which they call ba, broad and round, and good to eat, but risky to kill or come against. It also does not go into deep water, but

> swims in the shoals, where the Indians hunt it with bow and arrow; but if they are careless in their walking, or step on it in the water, it comes up at once with its long narrow tail, and gives such a wound with a saw it carries that it cannot be removed without greatly enlarging the cut, the teeth being set backwards as in the sketch here given. These small saws the Indians use to cut themselves with in their sacrifices to the evil one, and it was the office of the priest to have them. Thus they had many very fine ones, for the bone is white and curiously shaped like a saw, so sharp and pointed that it cuts like a knife. [quoted in Tozzer 1941:98]

Table 11.6. Number of Instances and Distribution of Stingray Spines across Caracol, Belize

Site area	Burial	Cache	Floor	Total
Epicenter	9	8	2	19
Core	3	0	0	3
Total	12	8	2	22

The presence of stingray and other sea fish supports a long history of trade between Caracol and the coast for marine material. This is seen in the existence of a substantial shellworking industry. *Strombus gigas*, among other shell species, was imported from the Belizean coast as raw material for manufacturing ornaments and other finished goods (Cobos 1994). Shell is denser than fish bone, survives much better in the humid rainforest environment than bone, and is found in large quantities in shell workshops. The trade that kept a steady flow of shell coming into the city from the Late Preclassic through the Late Classic era also provided opportunities for fish to be imported. Besides shell and fish, a few crab claw fragments have also been found at Caracol in the epicenter and core areas. Stark and Voorhies (eds. 1978:300) argue that when an item is unlikely to survive archaeologically, suites of commodities should be looked for together rather than individual examples. Three littoral resources (shrimp, clam, and fish) can be interpreted in terms of a suite of possible coastal exports. Of course this idea relies on ethnographic observations, but it is possible that shrimp and other crustaceans that may not survive archaeologically were also being imported with the crab, shells, and fish.

CONCLUSIONS

The importance of animals in the daily life of the Maya cannot be overstated. This chapter has highlighted briefly some of my research on subsistence and ceremonial activities at Caracol based on faunal analysis. Teeter (2001) further explores and incorporates some of the ethnographic, iconographic, and archaeological data concerning the subsistence and ceremonial use of animals. Although the sample size of Caracol's faunal assemblage is extraordinary, frustration abounds with the lack of good floor representation for the core and terminus areas. Perhaps recycling of bone for tool and jewelry manufacture causes some of the bone recovery patterns. This would explain the high numbers of bone objects made from large mammal long-bone elements. Brian Hayden and Aubrey Cannon (1984) have demonstrated the extent of recycling that the modern Highland Maya use. One can only assume that this was likely in the past.

There does not seem to be a change in the use of mammals in ceremonial or subsistence contexts through time (see Tables 11.1 and 11.2). With the increase in population sizes at Caracol, deer and other large mammals continued to be available and are seen in burials throughout the city. There does not appear to be a shift from mammals found in the general Caracol area to smaller animals over time, as witnessed in the Yucatán (Hamblin 1984; Wing and Steadman 1980). The majority of Caracol burials are dated to the Late Classic, the most highly structured and populated time. However, animals and offerings are found in even simple burials within the core. This suggests that some method of animal management may have existed during this time. Deer, rabbit, turkey, dog, peccary, and coati were easily tamed and could be raised in the household, providing a great source for meat and tool production. However, many of these animals are not found in great numbers at Caracol. Preservation, disposal patterns, and recycling have been offered as possible reasons for this absence. There is no doubt, however, that the majority of Caracol inhabitants enjoyed meat and animal resources from the surrounding environment and abroad from the city's beginning to its abandonment.

The presence of bone artifacts was found throughout the city, whereas bone detritus was highly restrictive and provides evidence that bone workshops existed. These specialized workshops were created by the Late Classic and were found in Structures B88, B108, B118, and "Barrio." This specialization suggests that time for the general populace was better spent doing tasks other than making bone tools and jewelry at the household level. Other bone-working evidence was found in Structures A6 and B64, dating to the Terminal Classic, and suggests a conversion to the household production of bone artifacts before the city was abandoned.

Excavations at Caracol have provided an incredible database to explore changes in the relationship between subsistence and ceremonial activities over long periods. They have also provided enough small-scale data to compare households and socioeconomic status. It is a tribute to the faunal research conducted through the 1980s and 1990s that many of the issues raised and discussed then can now be explored further by new faunal research in Mesoamerica as presented in this volume.

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NOTE

1. Many of the references to specific data sets are not shown in the chapter tables but are available in my dissertation (Teeter 2001).