Very good paper

A GEOGRAPHICAL ANALYSIS OF SELECTED ASPECTS OF THE ZOOARCHEOLOGY OF THE DE LEON SITE, SA 26-1

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submitted to

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INTRODUCTION

This paper focuses on the spatial aspects of vertebrate resource utilization in colonial St. Augustine. Catchment analysis, an approach described by Higgs and Vita-Finzi (1972) is applied to data from zooarcheological analysis of a portion of a recently excavated site. Background information from three major studies (Larson 1970; Deagan 1974; Cumbaa 1975) is used to interpret and assess the results.

The Site

Excavations at the de Leon site, SA 26-1, were carried out during the spring and summer of 1976 by the Florida State University Archeological Field School under the direction of Dr. Kathleen A. Deagan. The site was chosen with the objective of defining the early portion of the First Spanish Period occupation. SA 26-1 is located south of the plaza, on the southwest corner of Marine Street and Bravo Lane, in a portion of the city believed to be the "oldest nine blocks" of St. Augustine (Singleton 1976:4). No documentation for the 16th and 17th century occupations of the site has yet been uncovered. The earliest reference is the 1764 Puente map which indicates Don Lorenzo Joseph de Leon as owner (ibid:5). However, archeological evidence for an early First Spanish Period occupation is abundant. Analysis of the cultural material from the de Leon site is still in progress and will be presented as a Master's Thesis by Theresa Singleton; preliminary studies point to a very early date. According to Bostwick (1976:5),

of familiar subsistence resources. Arable land within a safe distance of the fort was severely limited, thin-soiled, and poorly drained. Pasturage for domestic animals was similarly scarce; the coastal strip behind the barrier islands was a forbidding wilderness of swamps and tangled hammocks. The Europeans soon found themselves dependent on supply ships from Spain and her New World colonies, and when these failed, on the aborigines (ibid:8-11).

The aboriginal inhabitants encountered by the Spanish were the Saturiwa tribe of the Eastern Timucua, semi-sedentary part-time horticulturalists relying upon a spatially, temporally, and formally diverse subsistence base: fresh and salt-water fish and shellfish, hunting and collecting of mammals, reptiles and birds, gathering of a wide variety of wild fruits and roots, and cultivation in small, scattered plots of maize, beans, pumpkins, cucumbers, citrons, and gourds (Deagan 1974:2). Seasonal movement allowed access to a large exploitation territory, compensating for relatively thinly distributed resources.

The Timucua were, from the beginning, friendly and helpful to the Spanish colonists; relationships were mediated through the mission system and generally were non-exploitative. Because of the poverty of the colony, the friars adopted aboriginal subsistence and shelter strategies rather than imposing their own (Deagan 1974:9-10; Arnade 1959:9). For most of the 16th and 17th centuries Indian acculturation was limited to religious and political matters, while the Spanish showed acculturative

St. Johns series sherds comprise 35 percent of the ceramics from closed contexts, indicating the presence of Timucuan potters supplying utilitarian wares to the city. This would suggest an occupation prior to 1675, for by that date the native population had been largely decimated (ibid:7).

The St. Augustine Context

Since 1972 active archeological research has greatly expanded our knowledge of St. Augustine culture (see Deagan 1974, 1976; Cumbaa 1975; McMurray 1975; Shepard 1975; and Beidleman 1976). Several studies in historical geography have treated the Spanish presence in Florida from a broader perspective (Dunkle 1955; Boniface 1971; and Matter 1972). Singleton's thesis (1977, in preparation) will provide a description of the comparatively little-known early First Spanish Period.

Because the de Leon site will be dealt with at length in a forthcoming study, and original ethnohistorical research is beyond the scope of this paper, only a brief historical framework will be offered here. The objective of this sketch is to indicate the population elements and technological level of the 16th and 17th century St. Augustine society.

St. Augustine was founded by the Spanish in 1565 on a naturally defended harbor strategically positioned for control of the Bahama Channel. The fortified city was built on a narrow strip of land, surrounded by salt-marsh and water except on the north (Chatelaine 1941:14). While relatively secure from a military viewpoint, the site offered little in terms

change in the more basic areas of foodways and housing (Deagan 1974:13; Cumbaa 1975; Manucy 1962). An additional cultural process occurring was the differentiation of Spanish society into peninsulares (individuals born in Spain), criollos (New World-born individuals of European descent), and mestizos (persons of mixed European-Indian descent)(Deagan 1974). Finally, by 1602 black slaves were a significant element in St. Augustine society (Arnade 1959:8-9).

Few references to the presence of Timucua within the town of St. Augustine during the early First Spanish Period are known. By the late 17th century disease and slaving raids by the English had reduced their numbers to less than a hundred and the missionized Guale of the Georgia coast were moving into the St. Augustine area and the town itself to receive what protection the Spanish could offer. The consequent formation of alliances between Spanish men and Indian women resulted in intensive cultural interaction and mestizaje during the 18th century (Deagan 1974:16).

To summarize, the two major population components in the 16th and 17th century were the Spanish colonists and the Timucua aborigines. The Spanish came from a state-level agricultural society but did not successfully transfer their subsistence base because of deficiencies in the new environment, which had been selected for military advantages. They were forced to rely on imported food and what they could control of the natives' production. The Timucua were a tribe-level people who supple-

mented the natural products of their environment with part-time horticulture.

MATERIALS AND METHODS

Archeological procedures

The spring and summer excavations of 1976 at the de Leon site were carried out according to standard archeological procedures which will be detailed in Singleton (1977). For purposes of zooarcheological analysis it should be noted that the field specimens examined in this study consisted of the vertebrate faunal material recovered by water-screening (through 1/4 inch mesh hardware cloth) the contents of natural and arbitrary levels and cultural features.

Previous zooarcheological analysis carried out by Johnson (1976) defined the faunal sample from a well and well pit at the de Leon site. This feature is believed to post-date the early First Spanish Period and will not be considered here.

The nature of the sample

The 17th century contexts available for study included 38 separate proveniences (field specimens), seven of which were designated features. Analysis began with the features, at the request of the excavator, and a total of 13 proveniences were examined (see Table 1). Due to the irregular shape of most proveniences fill volumes could not be estimated. The nature of backyard deposition in St. Augustine would probably make such estimates meaningless, except for descriptive purposes.

TABLE 1

SA 26-1 provenience analyzed winter 1977 by Loucks and Smith.

FS	NAME	EXCAVATION UNIT	DATUMS	DESCRIPTION
16	Feature 3	106N 106E	clay: T 2.07 B 2.11 oyster: T 2.11 B 2.63	Thin layer of light gray clay overlying heavy concentration of whole oystershell, bone, ceramics. Approx. 1m x 1m.
25	Area E	106 N 106E	T 2.22 B 2.31	Heavy concentration of bone and oyster shell. Dark gray sand in SE quadrant.
33	Area O	106N 106E	T 2.25 B 2.49	Orange and gray mottled soil, adjacent to NE edge of Fea. 4, approx. SE quadrant.
36	Pit Q	Test Pit A	T 2.92 B 3.08	Dark gray shell-flecked soil in NE quadrant. Circular shape.
50	Level 6	106N 106E	T 2.39 B 2.52	75 to 90 cm.
53	Feature 7	106N 103E	T 2.12 B 2.85	Brown soil with heavy concentration of whole shell.
58	Area D	106N 103E	T 2.28 B 2.48	Dark gray crushed shell flecked soil believed to underlie Feature 6.
60	Feature 6	106N 103E	T 2.20 B 2.47	Dark gray sandy soil with heavy concentration of shell and bone.
76	Feature 10	106N 103E	T 2,31 B 2.65	Gray-brown shell-flecked soil extending along N and W sides of quad. in the leached zone matrix.
103	Pit E	103N 91E	T 2.30 B 2.45	Dark gray coquina-flecked brown mottled soil.
105	Feature 15	103N 91E	T 2.30 B 2.49	Semi-circular pit with dark gray charcoal and shell-flecked soil. Possible firepit.

TABLE 1 continued.

132	Zone II Level II	103N 103E	T 2.24 B 2.42	-
142	Feature 23	103N 103E	T 2.62 B 2.76	Light brown whole shell flecked sand along NE corner of square.

Because the procedure for naming proveniences was not clear, and proveniences varied widely in the amount of faunal material included, no statements can be made about the representativeness of the analyzed sample. It must simply be regarded as a portion of the excavated sample, which is, in turn, a sample (of unknown representativeness) of the material deposited at the site extant in 1976.

Zooarcheological identification

Faunal identification was carried out using the collections of the zooarcheology laboratory at the Florida State Museum. Elements and fragments were identified to the lowest taxon which could confidently be assigned, with frequent reference to the known specimens. Materials representing the class Chondrichthyes were identified by H. Stephen Hale according to procedures he is currently developing (1977). For each taxon in each provenience the material was described, the minimum number of individuals was determined (Ziegler 1973:25), butchering marks and charring were noted, and the total weight of the identified remains was recorded. This information is on file in the zooarcheology lab under FSM numbers 26-1-001 to 26-1-132 and 26-1-200 to 26-1-60. Unidentified material was at least weighed, and where possible, information as to element, butchering, ect. was also noted.

Geographical model

While zooarcheologists have developed many methods for quantitative description of faunal species utilized by human

populations, description of geographical features of a reconstructed prehistoric or historic environment usually does not progress beyond simple listing of habitats available for exploitation. "Availability" is not usually defined nor are areal extents or potential productivities of the various environmental zones presented. The model defined below is a preliminary attempt to quantify the geographical variables of an archeological environment.

The significance of a spatial approach depends upon the assumption that, other factors being equivalent, a population will situate itself so that expenditure of subsistence activity energy in traversing distances between the home base and resource location is minimized. Obviously minimizing travel costs is a complex proposition: a long trip for a dependable resource might be a better investment than the numerous short trips that might be required to secure an elusive one; the value of a resource may be culturally defined or altered; or different segments of a population may forage in different directions or at different times from the same home base. Higgs and Vita-Finzi have pointed out that "it is misleading to associate an archeological site with a single uniform environment. Sites are commonly located at the junction of very different habitats the integration of whose resources results in a viable economy (1972:28). Because sites are thus biased, Vita-Finzi and Higgs (1970) developed the technique of catchment analysis.

Catchment analysis (the area from which a stream draws

water is its catchment) defines the service area of a site and establishes the potential for exploitation of this area in a broad sense. The size of the catchment will depend on the prevailing technology of the group and its shape will be influenced by topography and the nature of the local resource distribution (ibid 1972:28).

As a starting point, Higgs and Vita-Finzi define two broad classes of prehistoric societies: mobile economies and sedentary economies. They define a site catchment as the area habitually exploited from a single site plus the terrain covered in occasional forays to obtain raw materials for tools and other uses (ibid: 30). They suggest that 5km is a realistic estimate for the radius of sedentary exploitation and 10km for a mobile economy. Beyond these distances the decline in net return for effort expended is severe.

This basic concept was applied to the St. Augustine area in order to define "availability" of environmental resources. The Timucua have been described as semi-sedentary and the Spanish immigrants, a predominantly military population involved in exploration and conquest, can certainly be regarded as mobile. Environmental zones within a 10km radius of the approximate center of St. Augustine were therefore defined as available for colonial exploitation (see Figure 1).

Using a natural vegatation map (Davis 1967) and the 1943 edition of the USGS St. Augustine quadrangle, 15 minute series (because recent jetty construction had radically altered the

contours of St. Augustine inlet, more recent maps were undesireable), the 10 km circle was stratified into the following zones:

A. Atlantic Ocean

B. Beach and Dunes

C. Saltmarsh

D. Lagoons and Tidal Creeks

E. Pine Flatwoods and Swamp

F. Historic St. Augustine Town

These zones were modeled after the sections of the Coastal Plain Sector defined by Larson (1970:13-34). The areal extent in hectares of each zone was then calculated.

The zones constructed for the St. Augustine catchment were assumed to have significance for the interpretation of the faunal sample because they represented distinct habitats with unique floral and faunal complexes. Floral complexes, topography, and physiographic features were used to define the zones; faunal species were then assigned to zones on the basis of reported behavior from various sources.

RESULTS

Geographical results

The six zones constructed for the catchment area are summarized in Table 2 and briefly characterized below. A more extensive discussion of the southeastern coastal plain in relation to human use potential is in Larson (1970).

TABLE 2

Summary of geographical analysis.

ZONE		% CATCHMENT AREA	HECTARES
A	Atlantic Ocean	32.8	10,299
B	Beach and Dunes	4.4	1,381
C	Saltmarsh	11.6	3,642
D	Lagoons and Tidal Creeks	5.6	1,758
E	Pine Flatwoods and Swamp	44.2	13,878
F	Historic St. Augustine Town	1.3	408

10km radius circle has area of 31,400 hectares.

Zone A. 10,299 hectares. The portion of the catchment area covered by the Atlantic Ocean is treated as a single zone because the offshore waters deepen only gradually for a considerable distance seaward (Larson 1970:14). At a distance of two kilometers off St. Augustine Inlet the water is approximately ten meters deep. No floral species are native to this zone.

Zone B. 1,381 hectares. The beach and dunes are considered together because similar agents act to limit botanical resources: wind, salt spray and excessive drainage (Taylor et al. 1920:34-35). Thus xerophytic, salt-tolerant grasses such as sea oats are found in the foredune area and larger species, saw palmetto, spanish bayonet, prickly pear, and scrub oak are found in the more protected backdunes (Larson 1970:16-17). No botanical species are found below the mean high tide line.

Zone C. 3,642 hectares. The salt marshes are protected from the open sea by barrier islands and line the shores of the lagoon system. They are low-lying areas, subject to innundation at high tide. The dominant floral form is cord-grass.

Zone D. 1,758 hectares. Lagoons and tidal creeks. The Lagoons and tidal creeks are properly part of the saltmarsh system, but the aquatic and terrestrial components are separate in this analysis to emphasize the distinction between their respective faunal complexes.

Zone E. 13,878 hectares. The pine flatwoods and swamps comprise the largest single zone of the catchment area. These swamps are above the reach of the tide but drain into the creeks

of the saltmarsh; they are believed to be relict lagoons and marshes. It is clear, from examination of the St. Augustine quadrangle, that the series of parallel low ridges and sloughs which run in a slightly northwesterly-southeasterly direction, are remanent old beaches (Larson 1970:26; Taylor et al. 1920:5). There are no extensive areas of elevated, drained land in this zone, rather, the terrain presents marked changes in vegetation across short distances: pine/palmetto/wiregrass to hardwood hammocks to cypress ponds to bay tree swamps.

Zone F. 408 hectares. The narrow peninsula occupied by historic St. Augustine was the only zone of the catchment area which underwent significant cultural alteration during the 16th and 17th centuries. It was the only relatively well-drained land in the vicinity and by the end of the First Spanish Period virtually every available lot was occupied by city and garden plots: in 1764 the total area under cultivation was 305 hectares (Cumbaa 1975:115).

Zooarcheological results

Only specimens identified to at least the genus level were included in the catchment analysis. Table 3 summarizes the data collected for all eligible taxa in all thirteen proveniences. Zone assignment, discussed below, is also included in this table.

The point of applying catchment analysis to a zooarcheological sample is to reveal realized resource utilization; a thourough accounting of the potential faunal resources of the

TABLE 3

Results of faunal identification for all proveniences.

CLASS	GENUS	SPECIES	MNI	OSSEOUS WT.	ZONE
Chondrichthyes	Carcharhinus	milberti	6	3.03	D
	Carcharhinus	leucus	3	1.20	D
	Galeocerdo	sp.	1	.30	D
	Sphyrna	zygaena	2	1.10	D
	Sphyrna	morkorran	1	.70	D
Osteichthyes	Ictalurus	sp.	5	4.26	E
	Arius	felis	25	43.83	D
	Bagre'	marinus	4	4.80	D
	Centropomus	sp.	1	2.80	D
	Archosargus	probatocephalus	12	22.56	D
	Cynoscion	sp.	4	1.08	D
	Micropogon	sp.	6	3.75	D
	Pogonis	cromis	8	10.60	D
	Menticirrhus	sp.	1	.60	D
	Paralichthyes	sp.	1	.45	A
	Sciaenops	ocellata	9	16.80	D
	Sciaenops	sp.	1	28.20	D
	Mugil	cephalus	42	27.92	D
Amphibia	Rana	sp.	1	.50	F
	Bufo	sp.	3	.63	F
Reptilia	Agkistrodon	piscivorus	1	1.37	E
	Natrix	sp.	1	.10	E
	Malaclemmys	terrapin	2	3.15	C
	Gopherus	polyphemus	7	76.10	E
Aves	Gallus	gallus	9	53.80	F
	Meleagris	gallopavo	1	14.30	E
Mammalia	Odocoileus	virginianus	3	161.60	E
	Silvilagus	sp.	6	17.85	E
	Sus	scrofa	5	396.70	F
	Felis	catus	1	3.40	F

southeastern coastal plain has been provided by Larson (1970). Thus only identified species are included in the descriptions below.

Chondrichthyes. At least thirteen individuals represented by a total osseous weight of 6.33 grams composed this group. While sharks are usually considered marine animals, several species of Carcharhinus regularly enter estuaries, where the young are born, and may be found far upstream(Green 1968:293; Larson 1970:148). Carcharhinus leucas, the bull shark, and C. milberti, the sand bar shark, have been assigned to the lagoon and tidal creek zone, D. Galeocerdo sp. (cf. G. cuvier, the tiger or leopard shark) is a larger animal, frequently encountered in the open sea but also is known to regularly enter estuaries (Larson 1970:145). Since this behavior would have brought it within range of aboriginal technology and the presumably limited Spanish fishing capabilities, it was assigned to Zone D. The hammerhead sharks, Sphyrna zygaena and S. morkarran, are identified as "coastal" fishes (Dahlberg 1975: 23),but since both specimens are small, they may be presumed to have been captured while frequenting Zone D also.

All the elasmobranch remains were small vertebrae. They were likely to have been taken aboriginally by spearing in shallow water or in the nets of Indians or Spaniards. An additional technique suggested by Larson is impoundment in tidal lagoons which would also explain selection for small individuals.

Osteichthyes. Boney fish remains were the most numerous faunal type present at SA26-1 and yielded the largest number of identified species.

At least 42 individuals were identified as Mugil cephalus, the striped mullet, which is common in tidal pools and estuaries (Dahlberg 1975:76). The mullet is said to be impossible to take by hook and line (Larson 1970:165) which would indicate active netting or trapping in order to secure such numbers.

The second most common catch in colonial St. Augustine was catfish, with three species identified. Arius felis, the sea catfish, is a lagoon species, as is Bagre marinus, the gafftopsail catfish (Larson 1970:166-167). Ictalurus sp. (cf. I. catus, white catfish) is an inhabitant of freshwater creeks and rivers which occasionally goes into the brackish waters of estuaries (Dahlberg 1975:42). Because it is the only freshwater fish identified, and because the freshwater of tidal creeks originates in the flatwoods swamps, this species has been assigned to Zone E. All the Siluriformes can be taken on hook and line as well as by trap or net.

Archosargus probatocephalus, the sheepshead, is common inshore and prefers the vicinity of reef-like sunken debris; it will enter brackish and freshwater and the young are frequently found in the high marsh (ibid:74). It is most commonly taken by hook and line but could probably have been attracted by basket traps because of its reefing habit (Larson 1970:166).

Centropomus sp. (cf. C. undecimalis, the only species in

southeastern waters), the snook, is a shallow water fish which prefers sandy shores and lagoons and will travel up rivers. It was placed in Zone D.

Several species of the Sciaenidae were identified. Cynoscion sp. (cf. C. nebulosus, the spotted seatrout) is partial to grassy bottoms; it feeds along the edge of the marsh, moving with the tide, and retreats to deeper waters at low tide (Larson 1970:171). Other Sciaenids sharing the lagoon habitat at St. Augustine were Micropogon sp. (cf. M. undulatus) the Atlantic croaker, Pogonias cromis, or black drum, Sciaenops ocellata, red drum, and Menticirrhus sp. (cf. M. littoralis) the Gulf kingfish. A total of at least 29 individuals from this family places it third in terms of fishes represented at the site.

The only representative of the order Pleuronectiformes was a single individual of the flounder genus, Paralichthyes sp. Four species of flounder are found along the Atlantic coast in this area and, while the young are sometimes found in the lower reaches of the tidal lagoons, the adults are offshore marine fishes, Zone A (Dahlberg 1975:95).

Amphibia. Two amphibians were identified to the genus level, Rana sp., a frog, and Bufo sp., a toad. Because species identification would be required to define their individual habitats, and because they are suspected of being fortuitous inclusions in the midden, they will arbitrarily be assigned to Zone F, the town.

Reptilia. Two kinds of snakes and two turtles were

identified. Agkistrodon piscivorus, the cottonmouth moccasin, and Natrix sp., a water snake, both prefer aquatic habitats. No references were found to their presence in saltmarsh, so they are presumed to have come from Zone E, the Pine Flatwoods and Swamp.

Malaclemmys terrapin, the diamondback terrapin, is a resident of brackish waters, living in coastal marshes, tidal flats, estuaries, and the lagoons behind barrier beaches (Ernst and Barbour 1972:105). It spends days basking and prowling in the marshes and at night lies buried in the mud (ibid:105). This reptile has long been a staple in the diet of the residents of the sea islands; it can be collected by hand or probed for in the mud with a pole (Carr 1952:162-177). The diamondback utilizes the lagoons and creeks but is predominantly localized in the saltmarsh, Zone C.

Gopherus polyphemus, the gopher tortoise, is a terrestrial turtle preferring well-drained, sandy soils in ecotonal areas where it can dig its characteristic burrows and graze on grass and leaves (Carr 1952:332-340; Ernst and Barbour 1972:200-206). While the Flatwoods and Swamp zone would provide the ecotonal situation, it is also possible that these animals were attracted to cultivated fields and were collected during horticultural activities. Their natural provenience, however, will be considered Zone E.

Aves. Two kinds of birds were utilized by the occupants of SA 26-1: Gallus gallus, the domestic chicken, and Meleagris

the mission environment (Cumbaa 1975:103). Specific details of pig-keeping in St.Augustine are not included in the documents, but Cumbaa mentions the Old World practice of driving the pigs several miles in the fall to groves where they could feed on acorn mast (ibid:29). In colonial St. Augustine, however, a valuable pig would more likely have been kept penned in the back yard in town and the acorns brought to him.

One domestic cat, Felis catus, appeared among the mammals at SA 26-1. One cannot eliminate the possibility that this animal contributed to a meal: in hard times many of the residents of St. Augustine were reduced to eating cats, dogs, rats, and horses (ibid:120). In any case, its provenience is the town, Zone F.

Results of Zone/Species correlation

The assignment of species to zones is recorded in Table 4. It is immediately apparent that there was differential habitat utilization: the Beach and Dunes zone yielded no species while the Lagoon and Tidal Creek zone yielded more than twice as many as any other zone.

This distribution is further summarized in Table 5. It is seen that the zone of least areal extent (F) yielded the largest total osseous weight. In an attempt to standardize the results for comparison, three indexes were constructed. These simply relate the area of a zone to a parameter of the faunal sample from it:

gallopavo, the turkey. Chickens were among the domestic species introduced by the Spaniards and were quickly adopted by the Indians. They were probably allowed to range freely about the town and provided a reserve food supply against times of stress, as suggested by Cumbaa (1975:178-180). They are assigned to Zone F, the city.

Turkeys, on the other hand, are native to North America, and while not domesticated in the southeast (as in the southwest), they were an important staple in the aboriginal diet (Hudson 1976: 280, 290). They were quickly adopted by the Europeans, who were familiar with other large domestic fowl, but, for lack of references to domestic turkeys in St. Augustine, this may be regarded as a wild specimen and relegated to Zone E.

Mammalia. Four mammals, two wild and two domestic, were identified. Odocoileus virginianus, the white-tailed deer, and Silvilagus sp. (cf. S. floridanus, the cotton-tail), both from Zone E, were important aboriginal resources (Hudson 1976:274-281). Interestingly, their European counterparts, a wild rabbit, two species of wild hares, and three species of wild deer, were pursued by the Spanish in their own country when hunting supplemented the diet (Cumbaa 1975:29). Both the deer and the rabbit may have been attracted by cultivated fields, especially newly germinated corn, but deer were probably more commonly hunted far inland on the edges of mesic hammocks and rabbits were likely to have been taken in traps or snares (ibid:185).

Sus scrofa, the domestic pig, was another animal introduced by the Spanish and adopted by the Indians, at least while in

TABLE 4

Species by Zone for all proveniences.

ZONE	GENUS	SPECIES	MNI *	OSSEOUS WT. (-)
A	Paralichthyes	sp.	1	.45
B	none			
C	Malaclemmys	terrapin	2	3.15
D	Carcharhinus	milberti	6	3.03
	Carcharhinus	leucus	3	1.20
	Galeocerdo	sp.	1	.30
	Sphyrna	zygaena	2	1.10
	Sphyrna	morkorran	1	.70
	Arius	felis	25	43.83
	Bagre	marinus	4	4.80
	Centropomus	sp.	1	2.80
	Archosargus	probatocephalus	12	22.56
	Cynoscion	sp.	4	1.08
	Micropogon	sp.	6	3.75
	Pogonias	cromis	8	10.06
	Menticirrhus	sp.	1	.60
	Scianops	ocellata	9	16.80
	Scianops	sp.	1	28.20
	Mugil	cephalus	42	27.92
E	Ictalurus	sp.	5	4.26
	Agkistrodon	piscivorus	1	1.37
	Natrix	sp.	1	.10
	Gopherus	polyphemus	7	76.10
	Meleagris	gallopavo	1	14.30
	Odocoileus	virginianus	3	161.60
	Silvilagus	sp.	6	17.85
F	Sus	scrofa	5	396.70
	Felis	catus	1	3.40
	Rana	sp.	1	.50
	Bufo	sp.	3	.63

TABLE 5

Summary by zones and Indices.

ZONE	NUMBER SPECIES	TOTAL MNI	TOTAL WEIGHT	AREA %	VARIETY	DENSITY	PRODUCTIVITY
A	1	1	.45	32.8	0.97	0.97	0.44
B	-	-	-	4.4	-	-	-
C	1	2	3.15	11.6	2.70	5.50	8.60
D	15	126	169.27	5.6	85.00	720.00	960.00
E	7	24	275.58	44.2	5.00	17.00	200.00
F	4	10	401.23	1.3	98.00	25.00	9800.00

$$\text{Variety} = \frac{\text{Total Number of Species}}{\text{Area of Zone in hectares}} \times 10^4$$

$$\text{Density} = \frac{\text{Total MNI}}{\text{Area of Zone in hectares}} \times 10^4$$

$$\text{Productivity} = \frac{\text{Total Osseous Weight}}{\text{Area of Zone in hectares}} \times 10^4$$

Interpretation of Indices

Zone A, the Atlantic Ocean, shows low faunal variety, density and productivity. Obviously the realized zone resources come nowhere near the potentials of the ocean, but it does not necessarily follow that the indices present an inaccurate picture of colonial ocean use. Assuming that the archeological sample is representative of year-round patterns (seasonality is not a factor), then what is reflected may be the technological level of the culture. Harvesting the ocean without fossil-fuel powered vessels and equipment requires either a highly specialized technology or an advantageous location or both. The Timucua had no sea-worthy vessels and the Spaniards were occupied with other activities. Thus the ocean resources, although available within the St. Augustine catchment area, may have been largely beyond the technological reach of the 16th and 17th century population.

No faunal specimens representative of the Beach and Dune Zone were identified. In part this may be explained by the

nature of the sample. Beach denizens such as mollusks and crustaceans may have been eliminated from the sample before it was turned over to the zooarcheologist. In general, however, Larson's assessment of the Beach and Dune zone (his coastal strand) as a barren habitat is reflected. He finds no evidence for aboriginal occupation and hypothesizes only limited, specialized utilization, such as seasonal exploitation of nesting sea turtles.

The saltmarsh just barely registers on all indices due to the presence of the diamondback terrapin in the sample. While the saltmarsh is the beginning of the food-chain for a considerable number of marine, estuarine and terrestrial animals, few of its inhabitants are of sufficient size to be used by humans. The ubiquitous oyster, Crassiostrea virginica, may be considered a marsh dweller, and was certainly readily available in large numbers, but in definiton of the sample by the excavators it was eliminated from consideration.

The Lagoon and Tidal Creek zone rates high on all three indices. A large number of species in two vertebrate classes are reflected in the variety index. The high density is a result of the biomass enrichment initiated in the saltmarshes which are thus an integral part of the lagoon system. High productivity may reflect:

1) Availability. More than 40 linear kilometers of tidal creek and lagoon are found within the St. Augustine catchment.

2) Technology. The Timucua could partake of the lagoon resources by dip net, cast net, seine, fish weirs, natural impoundment, hook and line, spear, bow and arrow, basket traps, fish poison, and probably even clubbing. To these strategies the Spanish could have added superior boats, a variety of nets, metal hooks, and preservation by salting. The shallow, protected lagoon waters were probably accessible and productive year-round.

The Pine Flatwoods and Swamp Zone was described as being the most botanically diverse portion of the catchment. Perhaps the four vertebrate classes represented are a faunal correlate of the general ecological diversity. Productivity is relatively high, mostly due to the presence of deer remains. Because the flatwoods and swamp is not crosscut by a river near St. Augustine, as it is elsewhere on the coast, limited access to the inland zone may have restricted exploitation. It is highly probable that most of the Zone E species present at SA 26-1 were the result of aboriginal hunting activities. Most ethnohistorical sources agree that the Spanish resorted to hunting only when their preferred beef and mutton reserves were exhausted (Cumbaa 1975). The results of hunting with the arcabuz were said to be "miserable" (Arnade 1959:37). More research will be needed to define the exchange relationship between Timucua hunters and their clients.

Finally, the most striking characteristic of Zone F, the

colonial town, is its high productivity. Assuming a representative sample, this quantum leap in productivity underscores the most obvious difference in the subsistence strategies of the two major population components - the possession of domesticated animals by the Spanish. Without this cultural trait, it would have been impossible to maintain as large a population in as small an area as that represented by the colonial town. Two other traits, related to state-level organization, probably contributed to the stability and sedentism of the colony in spite of the inauspicious location. First, the Spaniards were able to call upon the resources of the mother country, the situado, which was, in turn, a product of coercive taxation. Second, the colonists themselves were able to persuade and/or coerce the Timucua into giving up a portion of their food resources.

CONCLUSIONS

This study has been an attempt to look at a very complex situation using a simple model. Numerous problems with the data base - adequacy and representativeness of the sample, reliability of the zooarcheological identification, skewing of the results due to methodological conventions, and lack of ethnohistoric documentation, to name a few - have been ignored in order that spatial aspects of faunal use might be abstracted and examined.

Focusing on spatial relationships does not result in conclusive statements, rather, this approach serves to generate

hypotheses and raise questions about implicit assumptions of traditional archeological interpretation.

The catchment area technique provides a systematic approach to assessment of prehistoric environment potential. The traditional alternative has been to summarize an ecological study which was originally done without reference to human use potentials, the technological level of the population, factors in the social environment which may have limited resource utilization, and cultural traditions which may have defined the perceived potentials of the environment.

The attempt to actually quantify the environmental zones met with only limited success due to the complexity of the coastal ecosystem and the large number of assumptions neccessary in order to segregate zones and fauna. Nothing is more impressive, on close examination of an ecosystem, than the interconnectivity of the whole.

On this basis, one might question the ususal rather fragmented procedure of archeological sample collection and analysis. Faunal material, often with certain classes arbitrarily deleted in the field, is turned over to the zooarcheologist without any accompanying background information or specific questions to be considered. The zooarcheologist can either do the documentary research and formulate hypotheses (which may be unrelated to the excavators' interests) or simply make up a species list and let the excavators interpret it. Obviously, both these alternatives are unsatisfactory. Active interdisciplinary co-operation

is the answer. In the absence of other devices for acheiveing this, I would suggest an application form for submission of faunal samples to the zooarcheological laboratory. On this form the excavator would be required to outline site history, excavation procedures, information about material culture and technology of the population, sources of environmental data, specific hypotheses about the culture which are being examined, and any other questions deemed important. With this information at hand, duplication of research effort would be eliminated and important problems promptly addressed.

One aspect of coastal plain archeology which has not received adequate attention and might be amenable to quantitative geograpical analysis is the possible prehistoric function of the intercoastal waterway and beach strand as a highway for migration and trade. The high productivity of the lagoon system suggested by this zooarcheological analysis would expalin how a highly mobile group could operate in this zone without permanent home bases or agriculture. The function of the beach as a highway in historic times is well documented. Between 1593 and 1602 over 500 survivors of shipwrecks on the Florida east coast made their way to the only European settlement, St. Augustine, simply by hitting the beach and walking (Arnade 1959). They did suffer however, from hunger due to the scarcity of resources in the Beach and Dune zone.

Finally, the catchment area model was found to be useful for defining "availability" - not that the 10km line may be

considered a barrier to wider-ranging exploitation - but because it forces the archeologist to regard the environment from the site occupants' point of view, in terms of the costs of bringing home the bacon.

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