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North American Historic Sites Zooarchaeology

ABSTRACT

The current status of historic sites zooarchaeology in North America is examined from an analytical and behavioral perspective. This review article emphasizes the weaknesses, strengths, and potential of the discipline.

Introduction

Zooarchaeology, defined as the identification and analysis of animal bones from archaeological sites (Grayson 1973:432), is the subject of this study. The paper will focus on North American zooarchaeology of Euro/Afro American historic sites. After a brief history of the science is presented, the study of historic sites faunal assemblages will be reviewed in the context of current methods and practices. The paper will then focus on various aspects of historic sites zooarchaeology, including historic documentation, dietary practices, husbandry practices, butchering, site interpretation, and the inference of cultural practices. An attempt has been made to review most published studies and selectively include a number of unpublished works.

Historical Background

Robinson (1978) has divided the science of zooarchaeology into three periods: the Formative Period (1870–1952), the Systemization Period (1953–1969), and the Integration Period (1969–present). The Formative Period was a time of development and experimentation, while the Systemization Period incorporated faunal studies into archaeological reports as appendices and focused on dietary factors, hunting patterns, and butchering practices. The Integration Period, a direct outgrowth of the "New Archaeology," was characterized by faunal reports that integrated faunal analysis into the main body of the report (e.g., Winters 1969; Munson et al. 1971). Reports during the Integration Period focus on faunal analysis as a tool in determining site seasonality and subsistence and are characterized by a greater emphasis on theory.

Although the history of faunal analysis goes back to the 1870s, its application to the field of historic sites archaeology has been more recent. The first North American Euro/Afro American historic sites faunal report was published by Parmalee in 1960. Thus, it can be asserted that North American historic sites zooarchaeology is only a 22 year old discipline.

Methods: Procedures and Problems

Since the publication of White's *American Antiquity* article in 1953, zooarchaeologists have been concerned with determining the actual number of faunal species represented at a site and at assessing their dietary significance. Basic to the reconstruction of the number of faunal species represented is the concept of Minimum Number of Individuals (White 1953), hereafter referred to as MNI. Although White is generally attributed with the origination of this concept, MNI was used in the analysis of faunal remains from archaeological sites in Russia during the 1880s and used by paleontologists for at least two decades prior to White's 1953 article (Casteel 1977:125).

White's calculation of MNI was based upon the greatest number of paired right and left elements from any given animal species. Since the publication of White's article, alternate methods have been proposed. Krantz (1968) maintains that MNI should be calculated by pairing off the right and left bones from the same species and adding all the remaining left and right elements. Bokonyi (1970:291) proposed that MNI should be calculated on the

basis of age and animal size. Although Krantz's and Bokonyi's methods of calculating MNI reflect a more realistic representation of the actual number of individuals represented at an archaeological site, application of their methods would be time consuming and impractical for most faunal assemblages.

There is a great deal of variation in the way MNI is calculated (Casteel 1977:125) and there is no agreement as to its proper calculation (Grayson 1973:433). Variations in the application of MNI will produce varying results that cannot be directly compared. This is particularly a problem when the majority of historic site zooarchaeologists do not indicate which MNI technique they have used. Recently, Casteel (1977) examined this problem and concluded that there is no best way to calculate MNI and that testing of new approaches should continue.

Modifications in application of the MNI method have been suggested. White (1953) applied his concept of MNI to the entire site while others have applied it to separate stratigraphic zones of the site (Flannery 1967; Perkins and Daley 1968). In their study, Perkins and Daley (1968) were able to document the differential exploitation of faunal resources through time at the same site. The separate calculation of MNI for different features and different historic occupations at the same site has been successful in determining differences in exploitative patterns (Cleland 1970) and seasonality (Shapiro 1979).

The MNI concept has recently been criticized because it cannot provide a valid measure of taxonomic abundance that is greater than ordinal in scale because the relationship between MNI and the actual number of individuals in faunal assemblage is never known (Grayson 1979:201). Thus, all that can be known is that the actual number of individuals lies somewhere between the MNI and the total number of elements identified for that species.

The calculation of MNI is a means to an end. The end result is to derive a meat yield calculation in order to determine the dietary significance of each faunal species in relation to one another. White (1953) proposed a standardized estimate for poundage of edible meat afforded by significant food animals. However, the weight of animals vary with seasonality, sex, and age (Smith 1974; Stewart and Stahl 1977), and there are discrepancies between White's proposed meat yield and the weight of several animal species (Stewart and Stahl 1977). Since White's figures do not include domestic species, historic sites archaeologists have had to rely upon well-documented comparative collections and use other sources to calculate meat yields (e.g., Bidwell and Falconer 1925). However, there is more variation in the meat yield for domestic animals than wild species. Historic documentation of the weight of different cattle acquired by the Continental Army ranged from 100 to 400 lbs. with one notable exception weighing 2270 lbs. (Olsen 1964:507).

A method, other than MNI, has been proposed for calculating the meat yield of animal species. This method assumes that the bone weight amounts to between 7 and 7.7% of the live weight of the animal (Reed 1963:214–15; Uerpmann 1973:310–11). However, the live weight calculation will be affected by mineralization, fragmentation, differential weathering, and differential representation of skeletal elements (Reed 1963:215). This method has not been used extensively by zooarchaeologists and has been applied to only two historic sites faunal studies (Cumbaa 1975; Otto 1975).

Recently, a slightly different technique for estimating meat yield from skeletal remains was devised. Animal biomass is calculated from bone weight through use of an allometric equation (Wing and Brown 1979:127). This technique has been used in two historic faunal studies (Reitz 1979; Honerkamp 1980). The advantage of the technique is that it yields a calculation that is based upon archaeological data (Honerkamp 1980:147). Disadvantages with the technique are that skeletal weight and

body weight are not directly proportional (Wing and Brown 1979:127) and the calculation is based upon constants that need to be continually refined (Honerkamp 1980:147).

Meat yield estimates are idealized figures that represent the maximum amount of meat available; they do not reflect the amount of meat consumed. As stated by Lyman (1979: 539), four left cow femurs may represent four cows but not 2,000 lbs. of meat. Lyman believes that the butchering unit, defined as the portion of the animal body that results from the act of butchering, is the proper analytic unit. The analytic unit, which is culturally derived, would more realistically reflect consumption. This recently defined approach has been applied to only one historic site, Fort Walla in southeastern Washington (Lyman 1979).

Historic Sites Faunal Methods

In many cases, the aforementioned methods and concepts have never been applied to historic faunal assemblages. Through examination of 39 historic sites faunal reports (Parmalee 1960, 1967, 1973; Olsen 1964; Brose 1967; Butsch 1970; Guilday 1970; Cleland 1970; Olsen and Penman 1972; Thurmond 1973; Ehrenhard 1973; Losey 1973; Stephenson 1974; Bowen 1975; Cumbaa 1975; Hanson and Hsu 1975; Honerkamp 1975, 1980; Otto 1975; Cardinal 1976; Olsen and Wilson 1976; Barber 1976; Breitburg 1976, 1979a, 1979b, 1980; Robinson 1977; Mudar 1978; Miller and Lewis 1978; Loucks 1979; Miller 1979; Reitz 1979; Schultz 1979; Sharpiro 1979; Lyman 1979; Bostwick 1980; Mainfort 1980; Polhemus 1980; Drucker 1981) it has been determined that the number of faunal elements was not quantified in 23% of the reports, MNI was not calculated in 36% of the reports, and meat yield was not calculated in 69% of the reports. The prevalent lag between practice and method and theory is illustrated in Table 1. Faunal reports that were contained in journals, conference bulletins, theses, or dissertations were more complete in their analysis than faunal studies contained in site reports. This is particularly evident in the calculation of meat yield, which was calculated 44% of the time in the conference and journal articles but was not calculated for any of the site reports.

There has been a consistent lack of concern for faunal studies by a number of historic sites archaeologists. Historic sites archaeologists in the mid 1970s stated "time did not permit us to make a thorough study of these remains (faunal) and as this was certainly not representative of a total population, it was felt that there was no need" (Hanson and Hsu 1975: 164) and "detailed identification and analysis of this quantity of bone would be a lengthy process and would not be of sufficient value to justify the time spent" (Stephenson 1974:326).

As indicated in Table 2, there has been a steady improvement in the methods used. Of the 26 reports examined during the period from 1975 to 1981, 84.6% contained quantification of the faunal elements, 73.1% the MNI,

TABLE 1
KINDS OF METHODS USED BY REPORT TYPE

	Sample size	Quantification of faunal elements	Calculation of MNI	Calculation of meat yield
Site reports	12	8 (66.6%)	6 (50%)	0
Journal, conference articles, M.A. theses, and Ph.D. dissertations	27	22 (81.5%)	19 (70.4%)	12 (44.4%)
Total	39	30 (76.9%)	25 (64.1%)	12 (30.8%)

TABLE 2
KINDS OF METHODS USED BY YEAR GROUPINGS

Year	Sample size	Quantification of faunal elements	Calculation of MNI	Calculation of meat yield
1960–1969	4	3 (75%)	1 (25%)	0
1970–1974	9	5 (55.5%)	5 (55.5%)	2 (22%)
1975–1981	26	22 (84.6%)	19 (73.1%)	10 (38.5%)
Total	39			

and 38.5% the meat yield. However, when it is considered that the aforementioned methods were outlined almost 30 years ago (White 1953) and are commonly accepted as the proper way to analyze faunal remains, an incredible discrepancy between what has been practiced and what has been considered acceptable exists.

Analytical Tools and Problems

Diversity and equitability indices are valuable analytical tools (cf., Cumbaa 1975; Reitz 1979). Diversity is a measure of the number of species exploited and equitability is a measure of the degree of dependence upon the utilized species (Reitz 1979:124). These measures have been used to determine that a St. Augustine site had a aboriginal procurement pattern (Cumbaa 1975:209). They have also been used to demonstrate that at St. Augustine and Frederica site inhabitants were reliant upon only a few taxa even though there was a large number of different species exploited (Reitz 1979:130).

There are a number of analytical problems that must be considered when a faunal assemblage is analyzed. These problems include sample size, recovery methods, preservation factors, and modification of the faunal assemblage by natural and cultural processes. These problems are usually not addressed by historic sites faunal analysts.

In order for zooarchaeologists to properly assess the faunal sample, they must know the recovery methods (Ziegler 1973:3). A study of a Neolithic and Bronze Age site in Northern Greece indicates that those remains recovered when material is unscreened will be heavily biased toward large mammals and older age class mammals (Payne 1974). Moreover, the larger elements of a skeleton are overrepresented, affecting inferences of butchering methods (Payne 1974:11). Most archaeological recovery techniques are biased against the recovery of smaller species of animals, particularly fish (Limp and Reidhead 1979). Correction values, derived from multiple mesh screening of sample units at Nevada sites, have been formulated to alleviate recovery biases (Thomas 1969) and techniques for measuring and correcting recovery biases by analyzing the fragmentation pattern of animal bones have been established (Watson 1972). However, neither technique has been applied to historic faunal assemblages.

Differential bone preservation will affect interpretations of historic faunal exploitation. Skeletal elements may be subject to differential preservation dependent upon their durability and the context of their deposition. The exceedingly high incidence of a small game animal (rabbit) recovered from an exceptionally well preserved feature, a privy, suggested to Robison (1977:200) that small game played not only a greater part in the Fort Southwest Point garrison diet but also at other forts with poor bone preservation. On the other hand, an analysis of !Kung Bushman faunal remains indicates that smaller animal bones preserve better because they are not extensively broken (Yellen 1977:319).

Another basic analytical problem that is often neglected is the differentiation of intrusive fauna from cultural fauna. A number of intrusive animals, including rodents, raptorial birds, and carnivores, in an archaeological

faunal assemblage may reflect natural processes (e.g., scavenging and natural deposition). Intrusive faunal remains can be identified as such if they were non-edible wild species, not butchered, skeletally complete, unbroken, or unburnt (Thomas 1971:368; Ziegler 1973:16). A study of the distribution pattern of non-edible wild species at Fort Michilimackinac has demonstrated that they tend to occur in cultural features that were potential shelters or natural traps (Butsch 1970:61). A statistical method, employing correlation coefficients, has been devised to quantify natural bone at a site (Thomas 1971); however, this method has not been used in any of the studies examined.

Natural processes may modify a faunal assemblage. The differential destruction of skeletal elements by attritional processes (e.g., dogs and other carnivores) has been examined by the study of archaeological assemblages and experimental replication (Binford and Bertram 1977). The probabilities of survival for a given anatomical part will vary with bone density, a factor that is dependent upon the age of the animal (Binford and Bertram 197:148). Thus, the age classes of a species in a faunal assemblage may be skewed by attritional processes.

Cultural processes can create analytical problems. Different food preparation techniques, cooking techniques, butchering, and disposal practices affect the faunal assemblage (Otto 1975:300; Honerkamp 1980:145). The differential distribution of elements and species at a site may be the result of food sharing and butchering practices (Loucks 1979: 230).

White (1953:391) emphasized the importance of distinguishing between the portion of the animal used for food and that used for utensils and clothing. The differential representation of skeletal elements at a site may reflect tool manufacture or use. The absence of ulnas at Fort Moultrie, South Carolina, suggested to Stephenson (1974:331) that these elements were used for awls or punches. The common historic practice of manufacturing bone discs and/or bone buttons from cow ribs and scapulas may skew the frequency of these elements. Consequently, the presence of bone artifacts and their manufacturing residue should be taken into consideration when the faunal remains are analyzed and interpreted.

Another analytical problem is created by variation in the number of identifiable skeletal elements. For example, pigs have twice as many identifiable foot bones as deer and sheep (Daley 1969:149). Thus, the differential number of identifiable bones for different species may skew the MNI and meat yield figures. Although a corrective technique, based upon the division of the archaeological sample of skeletal elements of each species by the number of identifiable skeletal elements for that species has been devised (Perkins 1964), this technique has not been used by historic sites faunal analysts.

Problems with analytical terms and their use are prevalent in faunal studies. The terminology and systems of abbreviations currently in use are poorly defined, redundant, ambigious, and unnecessarily cumbersome (Casteel and Grayson 1977:239). A uniform terminological approach through the use of terms already defined and by explicitly defining new terms is advocated by Casteel and Grayson to alleviate the problem.

The aforementioned analytical and terminological problems indicate that the scientific study of faunal remains is still in its infancy. Standardized methods for calculating MNI and meat yield need to be developed and additional corrective techniques for various problems need to be devised before valid inter-site comparisons can be made. Until this stage is attained, faunal analysts must recognize the limitations that these problems impose upon their data.

Role of Historic Documentation and Historical Studies

The potential for advances in the field of zooarchaeology is greater for historic faunal studies than prehistoric faunal studies. The

proper use of historic documents can resolve analytical problems. Often there are written records (e.g., military correspondence, probate inventories, diaries and daybooks of planters) that state the kind, number, and average weight of livestock animals; the nature of the meat supply (i.e., whether the supply was on the hoof, acquired by the butchering unit or preserved by salting, pickling or smoking); and the daily food allotments for soldiers and slaves. Although these forms of documentation have been recognized by historic sites archaeologists and applied to faunal studies (e.g., Olsen 1964; Parmalee 1966; Bowen 1975; Otto 1975; Olsen and Wilson 1976; Breitburg 1976), they have not been used to resolve analytical problems. These documentary items hold potential for establishing accurate meat yield calculations and determining whether the total meat yield or the butchering unit is the proper analytic tool.

One of the most valuable research tools available to historic sites archaeologists is historic documentation. The combined use of this research tool and zooarchaeological data can suggest the uses of animals. Discrepancies between the zooarchaeological data and probate inventories at the Mott Farm allowed the archaeologist to identify the animals used for food consumption versus those raised for market purposes, draft, and clothing (Bowen 1975).

Historic documentation provides a check on what is manifested archaeologically. At Fort Sumner, New Mexico, the historic documentation coincided so well with the faunal assemblage that all faunal remains were reflected in the historic documentation, including the remains of an officer's pet hawk (Olsen and Wilson 1976:16). Historic documentation can be used as a check on the real versus the ideal; written records often reflect what people should have done, not necessarily what happened. The historic documentation at Fort Ligonier suggests that hunting was officially forbidden; however, the faunal remains indicate that hunting was practiced (Guilday 1970). Discrepancies between the historic and archaeological record can lead to the development of alternate explanations. For example, since hunting was not encouraged at Fort Enterprise in the Northwest Territory (the commanding officer considered the cost of ammunition greater than the return), the presence of a small number of bird and mammal remains were interpreted as animals collected by the expedition naturalist (Losey 1973:141–42).

There are a number of historical studies on dietary practices (cf., Hilliard 1969, 1972; Anderson 1971). These studies are invaluable to historic site faunal studies, however, they have received limited usage. Inferences on status, butchering and dietary patterning can be derived from historical studies (cf., Otto 1975; Schultz 1979; Honerkamp 1980; Drucker 1981). The combined use of historical studies and historic faunal remains have emphasized the importance of beef in the diet of late 19th century settlers in the American West (Schultz 1979:57). Subsistence models, based upon an ethnohistorical study (Anderson 1971), and historical documentation have been formulated and tested with archaeological data (Cumbaa 1975; Reitz 1979; Honerkamp 1980). Anderson's (1971) model, based upon a synthesis of British foodways, was not applicable to Fort Frederica, a British colonial site in North America, because of its frontier location (Honerkamp 1980:280).

Faunal Analysis and Historic Settlement Types

There are 55 sites represented in the 39 faunal studies examined. Eighteen are military garrisons or encampments, 14 are fortified towns, 6 are plantations, 2 are hotels or inns, 2 are missions, 6 are lower-to-middle class rural residences, 5 are urban residences, 1 is a mining camp, and 1 is a jail. There is more known about the diet of military garrisons than about the diet of civilians. The irony is that so little is known about the most prevalent type of historic settlement—the lower-to-middle class residence.

Dietary patterning should vary with the settlement type. Plantations are specialized economies and military garrisons have regimented dietary practices (i.e., rations) and prescribed status distinctions. The military subsistence economies are more rigid and thus more predictable than the subsistence economies of the lower-to-middle class residences. Since socio-economic factors, ethnicity, and the local ecology should be more influential in the subsistence economies of the latter settlement type, a more varied adaptation should result.

Dietary patterning should also vary with the location of the settlement type. The composition of urban and rural faunal assemblages differs because of differential access to resources and commercial markets (Mudar 1978).

Dietary Practices, Preferences and Limitations

Most of these 55 historic sites reflect a dependence on domestic animal species. The three sites that suggest a greater reliance upon wild animal species are a 17th century Spanish mission (Loucks 1979:228), a 16th century St. Augustine site (Reitz 1979:136), and a 19th century fortified outpost (Losey 1973). The only site which suggests an equal exploitation of both wild and domestic species is an early Massachusetts colonial residence (Olsen and Penman 1972). Although the remains from all sites may be biased by sample size, a greater dependence on wild faunal species would be anticipated for these sites because of the type of adaptation. These sites reflect a short-term adaptation by an expeditionary force (Losey 1973) and early colonial adaptations (Olsen and Penman 1973; Loucks 1979; Reitz 1979).

The data suggests that cattle, pigs, and sheep were the mainstay of the diet for most of these sites. The exploitation of wild animals species was evident at most sites. The faunal remains of the American garrison at Fort Southwest Point, Tennessee (Robison 1977), and the faunal remains of the French occupants of Fort Michilimackinac, Michigan (Cleland 1970), reflect a greater exploitation of the natural environment when compared to British occupations of the same or neighboring sites. In the case of Fort Michilimackinac, differences in faunal exploitation were related to differences in site function; the French occupation was primarily a trading mission center while the British occupation was a military garrison (Cleland 1970). Robison (1977) attributed the greater exploitation of wild species at the American garrison of Fort Southwest Point in comparison to the British garrison at Fort Loudoun, Tennessee, to the prolonged seige of Fort Loudoun by hostile forces. However, this pattern just as likely reflects the American's greater familiarity with the land and their ability to more fully exploit it.

Although beef appears to be the staple supply of meat at a number of historic sites, pork is also important. The historic documentation and faunal remains at one site in central Tennessee suggest that pork was the staple supply of meat (Breitburg 1976). The dietary importance of pork relates to the economic feasibility of raising an animal with a short gestation period, a fast rate of maturation, and an ability to produce numerous offspring and consume practically anything (Bowen 1975: 20; Breitburg 1976:263). Its importance is emphasized by the number of cultural methods that have been devised to preserve pork (Breitburg 1976:263).

The consumption of invertebrate species of saltwater fauna (e.g., scallops, oysters, and clams) is evident at a few historic sites (Brose and Reed 1967:80; South 1974:225; Mudar 1978:351). Cumbaa (1975:138) maintains that shellfish were intensively exploited at one St. Augustine site; however, Reitz (1979:106) excluded shellfish from her analysis of St. Augustine sites because they were also used as a building material. The exploitation of aquatic freshwater mussels as a food resource

has been suggested by Parmalee (1973:82), however, others have discounted this possibility (Breitburg 1976:266).

In order to accurately reconstruct dietary practices, the faunal analyst must determine the nature of the meat supplies. If meat was acquired after it was butchered, boned, and salted elsewhere, no faunal remains would result. Consequently, any attempt at computing the amount of meat available would be nonsensical (Guilday 1970). If the supply of meat was acquired by the butchering unit, certain faunal elements would be overrepresented and butchering residue (e.g., skull and hoof elements) absent. Without these determinations, dietary practices may become confused with dietary preferences or dietary restrictions and limitations (*cf.*, Cumbaa 1975: 201; Loucks 1979:228).

The differential representation of skeletal elements may reflect dietary preferences or dietary limitations. At Fort Walla Walla, Washington, 65% of the bones of pigs were pigs feet, suggesting that pig knuckles or pigs feet were eaten (Lyman 1977:69). An analysis of the animals consumed by the Continental Army indicated that all cow elements were poor quality meat cuts that could only have been used as soup bones (Olsen 1964:508).

Cultural Inferences From Faunal Assemblages

Aspects of a culture's technological system can be inferred from faunal assemblages. The exploitation of a greater variety of fowl by Europeans at Fort Michilimackinac was related to the use of firearms (Cleland 1970:16). Most technological inferences used by historic sites faunal analysts are with fishing. The presence of turbot at Fort Michilimackinac indicates deep sea fishing (Cleland 1970). The presence of a greater species diversity of fish and turtle at the planter's kitchen at Cannon's Point Plantation suggests that slaves and overseers may have possessed inadequate fishing techniques (Otto 1975:336). The absence of netted fish species such as mullet suggests that nets were not used at Fort Frederica (Honerkamp 1980:286) while the presence of large species of fish from the Sciaenidae family suggests sophisticated fishing techniques (Honerkamp 1975:133).

Differences in dietary patterning may reflect ethnicity. A study of the faunal remains from early 19th century Detroit suggests that the consumption of mutton and saltwater mollusks was related to ethnicity (Mudar 1978: 368). On the other hand, ethnic differences between black slaves and white overseers were not evident in the faunal assemblages recovered from Cannon's Point Plantation (Otto 1975:356).

Differences in social and ideological systems are reflected in dietary practices. The presence of a greater number of fish remains during the French occupation at Fort Michilimackinac in comparison to the British occupation relates to religious dietary regulations: the French were Catholic and the British Protestant (Cleland 1970:16). Aspects of the social system are reflected as status distinctions by the presence of quality cuts of meat and a more diverse faunal assemblage, particularly at military sites (cf. Brose 1967:80; Losey 1973). A study of three western sites indicates that quality cuts of meat correspond with high socio-economic status (Schultz 1979:59). A study of three St. Augustine sites (Cumbaa 1975) and a study of socio-economic differences within a southern plantation have determined that quality cuts of meat and a more diverse faunal assemblage are correlated with social status (Otto 1975). A positive correlation between wild resource utilization and high socio-economic status was demonstrated at St. Augustine, Florida (Cumbaa 1975), and Cannon's Point Plantation, Georgia (Otto 1975:308). However, the high biomass contribution of wild animals at a St. Augustine site has been interpreted to a low socio-economic standing (Reitz 1979:138). A dietary pattern of

limited variety has been used to support the hypothesis that Fountainhead Plantation, South Carolina, was occupied by low socio-economic blacks (Drucker 1981:190). On the other hand, faunal diversity has been interpreted to dietary preferences (Butsch 1970: 62).

Political factors (i.e., alliances and wars) may affect the faunal resources that are exploited. The first Spanish period pattern of using immediately available resources at St. Augustine may relate to their relations with neighboring Indians and British colonies located to the north (Reitz 1979:149).

Differences in dietary practices can also reflect leisure time or sport. A high incidence of game animals at Drayton Hall Plantation, South Carolina, was hypothesized prior to the faunal analysis to be the result of leisure time (Miller and Lewis 1978:252). The presence of duck, grouse and passenger pigeon remains at Fort Stanwix, New York, was interpreted as hunting for sport (Hanson and Hsu 1975:164).

Food taboos are an important consideration. According to Simoons (1961), food avoidances relate to religious practices, hygiene, and man's familiarity with animals. Revolutionary War and Civil War accounts indicate that starving troops would not eat rats or cats (Martin 1962:83; Watkins 1962:96). The food taboos against domestic pets is considered to be so great that zooarchaeologists have offered alternate explanations for cut marks on cat elements. Reitz (1979: 141) suggests that the cut mark may actually be a plow mark and Otto (1975:356) suggests that the cat may have been cut up for fish bait.

Cultural preferences for the preparation of foods should be reflected in the faunal remains; however, faunal analysts rarely distinguish charred from uncharred bone. The presence of charred articular ends of bone suggest that the animals were prepared by open fire roasting and *the random burning of bone suggests* that the animal remains were deposited in hearths after they were consumed (Loucks 1979:273). The absence of burnt small mammal bones at Fort Moultrie was interpreted as the result of broiling or stewing meat (Stephenson 1974:331).

Husbandry Practices

Differences in the number of animals and their age classes reflect husbandry practices (Noodle 1974:248) which can be reconstructed by using the detailed age criteria established by Silver (1963). There is an optimal slaughter age when rapid growth rate has ceased and the meat output no longer increases relative to the food output (Uerpman 1973:315). However, variations in the age of pig slaughter were discerned at the Mott Farm, Massachusetts, (Bowen 1975:23), The Hermitage, Tennessee (Breitburg 1976:259), Pettus Plantation and Utopia Cottage, Virginia (Miller 1979:168–171). Miller (1979:171) suggests that variation in the age of slaughter may reflect whether the animals were penned or not. The wider age range of domestic mammals recovered from the planter's kitchen at Cannon's Point Plantation on Saint Simon Island, Georgia, suggests status differences (Otto 1975:334). Other unconsidered factors (e.g., supply and demand, local ecology, and type of adaptation) may also affect the age of slaughter.

The purposes for which the animals were raised are reflected by age and sex categories. At Drayton Hall Plantation, Virginia, male swine were over represented in the faunal assemblage because females were retained for breeding purposes (Miller and Lewis 1978: 256). Animals that were used for labor and purposes other than consumption can be recognized by age categories that extend beyond the optimal slaughter age. They can also be recognized on the basis of sex. Male animals tend to be used more often than females for labor purposes and only female animals would be retained for dairying.

The raising of animals for market purposes can be discerned by discrepancies between the faunal remains and the historic documentation (Bowen 1975:22; Breitburg 1976:263).

The differential representation of skeletal elements can be attributed to market practices. The high ratio of swine skull parts at Drayton Hall Plantation was interpreted to the raising of pork for market purposes (Miller and Lewis 1978:264) while the absence of chicken head and feet elements from urban residences in Detroit was attributed to the purchase of chickens from urban markets (Mudar 1978: 339).

Husbandry practices may also reflect aspects of the social system relating to status and recreation. The age of slaughter can be used as a means of assessing social status by assuming that different age categories reflect differences in the quality of meat (Miller 1979: 168). Evidence that cocks were raised for recreational activities (i.e., gaming purposes) at Fort Sumner, New Mexico, was suggested by the large size of their spur cores (Olsen and Wilson 1976:30).

Butchering Practices, Techniques, and Cultural Inferences

Butchering practices have received widespread attention among historic sites faunal analysts. Observations on butchering marks have been used to infer butchering methods, the types of butchering implements used, and the quality of the meat cuts. Although most faunal analysts use a descriptive approach, a more rigorous technical approach is advocated. Only one of the historic sites faunal studies examined contained a detailed quantitative study of the location, orientation, and frequency of the butchering marks (Lyman 1977). This study placed the butchering methods in an historical perspective that varied slightly from those recorded for the military in 1924 and present day practices (Lyman 1977:73).

Butchering practices reflect culturally prescribed patterns of consumption and distribution. The distribution pattern of meat and the degree of butchering among the !Kung Bushman is dependent upon the number of individuals among whom the meat must be shared (Yellen 1977:285). Although historic butchering practices differ from those of hunters and gatherers, they are known to vary with ethnicity and nationality. An American butchering pattern has been defined (Schultz 1979:58). Differences in the way French and Americans butcher their meat should be reflected in the archaeological record (Yellen 1977:329). Since many historic forts in Eastern North American have mixed occupations of different nationalities (e.g., Spanish, French, British and American), it is therefore theoretically possible to use this culturally distinct process to segregate mixed occupations at some sites.

Butchering patterns suggest what portions of the animal were consumed. A study of the butchering patterns of cattle from Fort Loudoun indicate that the entire animal, including the head, was eaten (Parmalee 1960: 28).

Butchering remains indicate the quality of the cut of meat. The butchering remains from the Netherland Inn, Tennessee, and the Custer Road Dump Site, Michigan, indicate that roasts and steaks were consumed (Brose 1967:78; Parmalee 1973:84). On an interpretative level, a decline in the military importance of Fort Mackinac in the 1880s was correlated with the decline in the quality of beef cuts (Brose 1967:80).

The use of different implements for butchering reflects temporal variation, status, and the cuts of meat desired. Temporal variation was noted at Fort Stanwix—not a single saw mark was found on 18th century bones while the 19th century bones were almost exclusively sawed (Hanson and Hsu 1975:165). Thus, the ability to discern the use of different butchering implements is a potential chronological aide at some sites. Different butchering implements may be used depending upon the cuts of meat desired and the difficulty involved with butchering the animal. For example, the differential use of saws and an ax/cleaver for butchering correlate with different skeletal

areas of the animals (Lyman 1977:67–69). The use of different butchering implements may also relate to status. At Cannon's Point Plantation the faunal remains from the planter's kitchen were carefully butchered by saw while the faunal remains from the slave and overseer cabins were butchered by axes and cleavers (Otto 1977:104).

Ecological Considerations

Only a few historic site faunal studies have considered ecological factors. Site catchment studies indicate that all the species exploited at St. Augustine, Frederica, and Baptizing Spring mission would have been found within a two mile radius of the sites (Loucks 1979:276; Reitz 1979:130). The available literature indicates that differences in British and French faunal assemblages reflect adaptations to local environmental factors (Reitz 1979:61). Differences in 18th century British exploitation of fish and birds at Frederica and St. Augustine have been related to environmental factors (Reitz 1979:156). Honerkamp (1980:288) has attributed the greater utilization of pig over cattle in early colonial Georgia to highly dispersed grazing and foraging lands.

Bones as a Food Resource

The bones themselves may be cracked for marrow and treated as a food resource. Shattered bone may also result from the use of bone as raw material in tool production (Uerpman 1973:310). The extensive crushing of bones at encampments of the Continental Army suggests that bone marrow was extracted and consumed (Olsen 1964:508). At another site, evidence suggests that starving men were attempting to extract residual bone grease (Losey 1973:141).

Role of Faunal Analysis in the Interpretation of Historic Sites

Faunal analysis can significantly contribute to more dependable and valid site interpretations (Miller 1979:174). The ratio of bone to artifacts is the primary variable for distinguishing an adjacent from a peripheral midden deposit (South 1977:182). The differential distribution of faunal remains at historic sites indicates where food was prepared, eaten, and discarded (Butsch 1970: Robison 1977:202). The differential horizontal distribution of different skeletal elements throughout a site suggests what areas of the site were used for the deposition of butchering refuse and kitchen refuse (Thurmond 1973:240; Stephenson 1974: 330; Lyman 1977:70). Differences in the horizontal density of faunal remains correlate with the occurrences of historic structures (Breitburg 1976:249) and can be used to interpret the function of structures (Miller and Lewis 1978: 264–65). The concentration of certain species of intrusive animals defines the function of certain structures (Breitburg 1979a:58) and correlates with the occurrence of certain feature types (Butsch 1970:61). Furthermore, faunal analysis has confirmed the function and cultural affiliation of features (Cardinal 1976).

The properly combined use of historic documentation and faunal analysis may provide more accurate interpretations of the socio-economic status of the site occupants. The proper use of both these research tools was instrumental in altering the interpretation of Utopia Cottage from a slave-quarters to a tenancy (Miller 1979). When historic documentation has been lacking, faunal remains have aided in interpreting socio-economic status (Drucker 1981:190).

Most prehistoric faunal studies are concerned with enhancing site interpretations by establishing the seasonality of occupation. Since most historic sites are assumed to have been occupied year around, site seasonality is usually neglected. However, Shapiro's (1979) ability to determine the seasonality of different features at Fort Michilimackinac challenged Cleland's (1970) previous interpretations of the site. Shapiro's data suggest that the exploitation of faunal resources by the French occupants of Fort Michilimackinac reflect adjustments to the seasonality of

natural resources similar to prehistoric adaptations to the region (cf., Cleland 1966).

New Directions

Since 1970, significant advances in the field of zooarchaeology have been made. These include the testing of hypotheses (Butsch 1970; Cleland 1970; Losey 1973; Cumbaa 1975; Miller and Lewis 1978; Mudar 1978; Loucks 1979; Miller 1979; Reitz 1979; Shapiro 1979) and the use of predictive models (Smith 1974) and computer systems (Brock 1974; Gifford and Crader 1977). The application of the comparative approach (Brock 1974:21; Noodle 1974:248) and the importance of deploying a faunal analyst in the field (Shapiro 1979:320) have been advocated. Most historic site faunal analysts have not made use of these approaches.

Differences between cultural systems have been the subject of a few recent historic faunal studies (Cleland 1970; Reitz 1979; Bostwick 1980). A comparison of British and French occupations at Fort Michilimackinac (Cleland 1970) and comparisons between British and Spanish occupations at St. Augustine (Bostwick 1980) have suggested differences in subsistence patterning between cultural systems. An inter-site comparative study between British and Spanish subsistence strategies has been conducted (Reitz 1979). Changes through time within the same cultural system have been examined by Honerkamp (1980) and Reitz (1979). In both studies, a shift from swine to cattle as a source of meat was apparent at both Spanish and British colonial sites in the Southeastern United States. Studies of the same cultural system have been conducted (Otto 1975; Cumbaa 1975; Reitz 1979) and differences between the faunal assemblages attributed to status distinctions and ecological factors. Also, a significant inter-disciplinary study, incorporating the disciplines of history, historical archaeology, cultural anthropology, and physical anthropology, has been conducted (Gibbs et. al. 1980).

Conclusions

The purpose of this paper has been to assess the potential applications of historic sites faunal studies. The potential applications are both numerous and varied. Historic sites faunal analysts can aid in advancing methods and analytical procedures through the combined use of historic and archaeological data. Additional applications include the interpretation and cultural identification of site occupations and the determination of various aspects of social and ideological systems.

In conclusion, historic sites faunal analysts should establish goals that are concerned primarily with the documentation and comparison of inter- and intra-site variability in subsistence practices. These comparisons should take into consideration the affects of settlement type, socio-economic status, temporal variation, and spacial variation, on inter- and intra-site variability.

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