



Avifauna discard packages and bone damage resulting from human consumption processes



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ABSTRACT

Few actualistic studies of the patterns resulting from human preparation and consumption of birds inform interpretations of archeological avifauna assemblages. This study focuses on developing new and adding to existing interpretive models. We examine differences in bone modifications produced by a culturally homogeneous group of eaters consuming medium-sized birds cooked using three cross-culturally common methods. We use the analytical concept of discard packages to capture variability in how groups of skeletal elements might be deposited into the archeological record. We also examine chop/cut marks, burn marks, and chew marks as these are variables that archeologists frequently use to identify and interpret anthropogenic avifaunal assemblages. We find that the creation of discard packages appears to be culturally motivated and varies little within our group of eaters, but the degree to which the associated elements are disaggregated during consumption is highly variable and depends on individual preference. Additionally, we find that while the presence and locations of chop marks are consistent across cooking methods and individual consumption preferences, the presence and locations of cut marks, burn marks, and chew marks are affected by cooking methods, individual preferences, or both.

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1. Introduction

1.1. Purpose of the study

Bird bones are common in archeological sites and understanding the causes of patterns present in archeological avifauna is critical because patterns of skeletal part representation and bone modification signal different human interactions with birds. Ratios of bird bones in the archeological record typically vary from the natural occurrence of skeletal elements in whole birds. The cause of these differences is difficult to interpret (Weisler and Gargett, 1993). Many previous approaches to this problem focus on taphonomic issues, addressing differential preservation due to bone density, but differences in bone density have not been sufficient to explain all the observed variation (Bickart, 1984; Bovy, 2002, 2012; Ericson, 1987; Livingston, 1989; Weisler and Gargett, 1993). The possible impacts of human hunting, processing, and consumption behaviors on skeletal part representation are often the subject of speculation in these studies, but few actualistic studies of bird consumption documenting these processes and their results have been undertaken (Laroulandie, 2001, 2005b; Serjeantson, 2009).

The present study builds on previous work by providing an actualistic analysis of avifaunal skeletal element damage and disaggregation resulting from consumption after three different cooking processes. The goals of the study are to identify patterns in damage to

bones and disaggregation into animal unit packages. We cooked six avian specimens (chicken, *Gallus* spp.) using three cooking methods, ate them, and defleshed the skeletal remains using a dermestid colony. Then, we analyzed the skeletal remains using a uniform set of variables. Our study provides insight into how preparing, cooking, and consuming processes damage bones and impact the formation of discard packages.

1.2. Limited interpretive models available

We have few models for understanding the complex social mechanisms by which bird bones were deposited. Descriptions of avifaunal preparation and consumption infrequently are included in ethnographic or historic texts. A search of the eHRAF World Cultures database (search terms “bird”, “cooking”, and “Food Consumption”) resulted in only 34 references to preparing birds for consumption. The disposal of bird remains also is little mentioned in ethnographic and archeological literature outside of disposal related to religious practices (exceptions Andrews, 1980; Gotfredsen, 1996). Generally, bird bones as archeological artifacts have been less studied than mammal bones, the result being taphonomic studies of bird bones are limited in scope and number (Bickart, 1984; Bovy, 2012; Ericson, 1987; Livingston, 1989; Serjeantson, 2009; Weisler and Gargett, 1993).

1.3. Previous actualistic studies

We know only of two previous actualistic studies of bird consumption. Weisler and Gargett (1993) conducted an actualistic study to

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determine whether observed patterns of bird bone modification from nine archeological sites in west Moloka'i, Hawai'ian Islands were the result of human predation. They steamed and roasted nine galliform birds: four quail, two partridges, two squabs, and a pheasant. They then ate the birds, chewed the epiphyses off half the long bones, and snapped the other half through the midshaft using bare hands. Overall, their experimental specimens strongly resembled the archeological materials that prompted the study, though they acknowledged that natural processes might also produce similar modifications.

Laroulandie (2001, 2005a, 2005b) focused on understanding modified bird bone from Paleolithic sites in France. She butchered, cooked, and defleshed ten gray partridges as proxies for all medium-sized birds. She butchered the carcasses using unretouched flint flakes, disarticulating the raw birds primarily by cutting through their joints with the flakes. She twisted and overextended some of the joints, in particular the joint between the humerus and the radius/ulna. She cooked the individual carcass segments on hot rocks by a fire, defleshed the cooked meat from the bones using flint flakes, and ate some of the meat off the bones with her teeth. She recorded the resulting cut, burn, and chew marks.

1.4. Descriptive study

Our study is intended to be descriptive and to contribute to model building, rather than serve as a hypothetico-deductive test. Inspired by the repeated observation that archeological bird bones often vary from the natural occurrence of skeletal elements, we wondered if consumption patterns might produce sets of skeletal elements that are frequently discarded together. Additionally, following Serjeantson (2009:138), we suspected that different cooking techniques would have different effects on muscle and connective tissue, resulting in more or less "attached" elements. For example, Serjeantson (2009) indicates that stewing animals leaves flesh tender and more likely to disarticulate easily. Particular cooking practices might affect the makeup of discard packages, because skeletal elements that disaggregate easily may be discarded separately, while skeletal elements that do not disaggregate easily may be discarded as a group.

The two previous actualistic studies set an important foundation for this type of work while leaving many avenues open for further research (Laroulandie, 2005b: 174). Our study contributes additional, complementary data in important ways. We are not trying to replicate the bone modifications seen in a particular assemblage, but instead are attempting to capture the range of variation that may be produced within a group of eaters. Both previous actualistic studies were inspired by the characteristics of particular archeological assemblages, which the authors then tried to reproduce. We started from the assumption that a range of eating practices and resulting bone modifications could occur even within a culturally fairly homogenous group. We avoided making assumptions about how we should eat or how bones would likely be modified, allowing eaters to follow personal inclinations.

The patterns identified in a cooking and consumption context should be distinct from those resulting from skinning for down (Esser, 2010) or symbolic/ritual use (Serjeantson, 1997), for example. We were influenced by Storey et al.'s (2008) suggestion that for chickens, bird preparation, consumption, and disposal strategies impact their survivorship and subsequent identifiability. We took the position that this is true for all birds, though we chose to use chickens as proxies for medium-sized birds. The impacts of depositional and post-depositional processes are beyond the scope of this study.

2. Materials and methods

2.1. Chickens as proxies for medium-sized avifauna

We used chickens as proxies for all medium-sized birds, as Laroulandie (2001) similarly employed gray partridges. The study is

intended to provide useful information about cooking and consumption impacts on bird bone in general, although the impacts of cooking techniques on chicken bone and the disarticulation patterns recorded here may be of particular use in regions where the use of chickens is the focus (as in Storey et al., 2008).

We used free range, pastured chickens in the study as they were the most appropriate option available. Our experience gained from using and producing skeletal reference collections indicated that the bones of factory-farmed chickens are poor analogs of prehistoric avifauna; they have greater porosity and are less ossified than free-range chicken bones. The chickens used in this study were purchased from a local cooperative market. They were whole, cleaned carcasses missing skulls, cervical vertebrae, and lower limb bones below the tibiotarsus. The lack of internal organs may not accurately reflect all possible cultural practices of cooking birds, but we judged it unlikely to alter the effects of cooking and consumption practices on the formation of discard packages, which is the focus of this study. The lack of lower limb and foot bones does mean that the ways in which these bones disaggregate during cooking and consumption cannot be addressed by this study.

2.2. Cooking techniques

We selected cooking techniques that represent three cross-culturally widespread cooking methods. Using eHRAF and traditional literature search methods, we learned that boiling, roasting, and grilling both whole and parted carcasses were and are commonly used techniques for cooking birds. The technique of preparing avifauna by boiling has not significantly changed over time and varies little across cultures (Aresty, 1964; Bayard, 1991; Bohannon and Bohannon, 1958; de Bry, 1972; Fletcher, 1911; Hollander, 2010; Irimoto, 1981; Kaufman, 2006; La Barre, 1948; Lin and Pan, 1947; Messing, 1985; Musters, 1872; Reichel-Dolmatoff, 1971; Reynolds, 1968; Sass, 1975; Stöeffler, 1969; Vennum, 1988; Wagley, 1941). Dry or oven roasting (Batdorf, 1990; Byock, 1999; di Messisbugo, 1960; Fletcher, 1911; Gifford, 1965; Gusinde and Schütze, 1937; Kniffen, 1939; Lin and Pan, 1947; Musters, 1872, 1873; Sass, 1975; Thoms, 2009; Wallace and Hoebel, 1952; Wagley, 1941) and open fire grilling (Basden and Willis, 1966; Breton et al., 1955; de Bry, 1972; di Messisbugo, 1960; Irimoto, 1981) are two other common preparation techniques. Across cultural contexts, birds and other smaller fauna are cooked whole or are "hewn" into portions prior to cooking (as in Medieval cookery as presented in Basden and Willis, 1966; Bohannon and Bohannon, 1958; Sass, 1975).

2.3. Variables

The primary purpose of this study was to identify potential discard packages of avian skeletal elements that might consistently be produced during preparation and consumption processes. We also recorded three common types of bone modification that are central to the interpretation of bird remains by zooarchaeologists: burning, cut and chop marks, and chewing marks.

2.3.1. Skeletal part representation/disaggregation

Our study complements past works by approaching the problem of differential representation of avifauna elements from the beginning of the process. We analyzed our post-consumption chicken bones to learn what "packages" of skeletal elements with what types of damage were present. In this we followed Bovy (2002, 2012), who posited that human processes are more likely than taphonomic processes to cause the patterns of skeletal disaggregation present at archeological sites. She suggested that other explanations like differential selection by humans, scavenging by animals, processing techniques, or consumption practices should be used to interpret avifauna skeletal part patterns (Bovy, 2002; Bovy, 2012). Other studies that approach the problem of differential representation in the archeological record also ask what cultural and taphonomic processes could account for the observed

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