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Cover Page Footnote

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FROM PORK TO MUTTON: A ZOOARCHAEOLOGICAL PERSPECTIVE ON COLONIAL NEW AMSTERDAM AND EARLY NEW YORK CITY

Haskel J. Greenfield

This article analyzes the zooarchaeological remains from historical deposits to increase our understanding of the relationship between diet and ethnicity in early colonial New York City. Excavations at the Broad Financial Plaza recovered faunal remains documenting approximately two centuries of historical occupation (middle 17th to the middle of the 19th century), a sequence rivaled by few other early colonial North American localities. Several trends are apparent in the data. Relative frequencies of pig remains declined while mutton and cattle increased correspondingly as New Amsterdam became the British colony of New York and as the Dutch residents on the block were replaced by inhabitants with British surnames. Wild animals such as deer decreased rapidly with the urbanization of Manhattan island during the British administration. Also, Old World rats appeared in the earliest levels, implying they were part of New York life from the earliest colonial periods.

Cet article analyse les vestiges zoo-archéologiques provenant de gisements historiques afin de permettre de mieux comprendre les rapports entre le régime alimentaire et l'ethnicité dans le New York colonial ancien. Les fouilles de la Broad Financial Plaza ont permis de récupérer des restes fauniques provenant d'environ deux siècles d'occupation historique (du milieu du XVIIe siècle au milieu du XIXe), séquence avec laquelle rivalisent peu d'autres localités coloniales nord-américaines. Il se dégage plusieurs tendances des données recueillies. La fréquence relative des restes de porc diminue tandis que le mouton et les bovins augmentent de façon correspondante au fur et à mesure que New Amsterdam devient la colonie britannique de New York et que les habitants hollandais sont remplacés par des gens à nom de famille anglais. Les animaux sauvages comme le chevreuil diminuent rapidement avec l'urbanisation de Manhattan durant l'administration britannique. En outre, le rat de l'Ancien Monde est présent dans les couches les plus anciennes, ce qui indique qu'il fait partie de la vie new-yorkaise dès les premières temps coloniaux.

Introduction

In socio-economically and ethnically heterogeneous urban societies, diet can play an important role in the recognition and perpetuation of socio-economic status and/or ethnic affiliation (cf. Deagan 1983: 151; Schuyler 1980). The analysis of zooarchaeological remains has recently been recognized as an important vehicle for studying ethnic affiliation and socio-economic status in early historical societies (e.g., Crabtree 1989a; Crader 1984; Guilday 1970; Jolley 1987; Lyman 1977; Pendery 1984; Langenwalter 1980; Reitz and Cumbaa 1983; Reitz and Honerkamp 1983; Reitz and Scarry 1985; Schulz and Gust 1983). Since the population of colonial New Amsterdam/New York City was a complex mix of ethnic groups that was politically, socially, and economically dominated by first the Dutch and later the British, analysis of dietary remains could play an important role in differentiating Dutch from British households in early New Amsterdam

and New York City. Through the analysis of animal bones recovered during recent excavations at the Broad Financial Plaza site in lower Manhattan, New York City (FIG. 1), the distribution of animal remains over time are examined to increase our understanding of the changing environment and ethnic mix, and cultural patterns of food consumption in colonial New Amsterdam/New York City.

Background

New Amsterdam was the center of Dutch colonization in the New World during the early 17th century. The first historical inhabitants of New Amsterdam received land grants from the Dutch West Indies Company. The Broad Financial Plaza site is located at the intersection of Pearl and Whitehall Streets. Occupation of the site spans the time from the earliest Dutch settlement in New Amsterdam (1625-1664) through the British conquest and

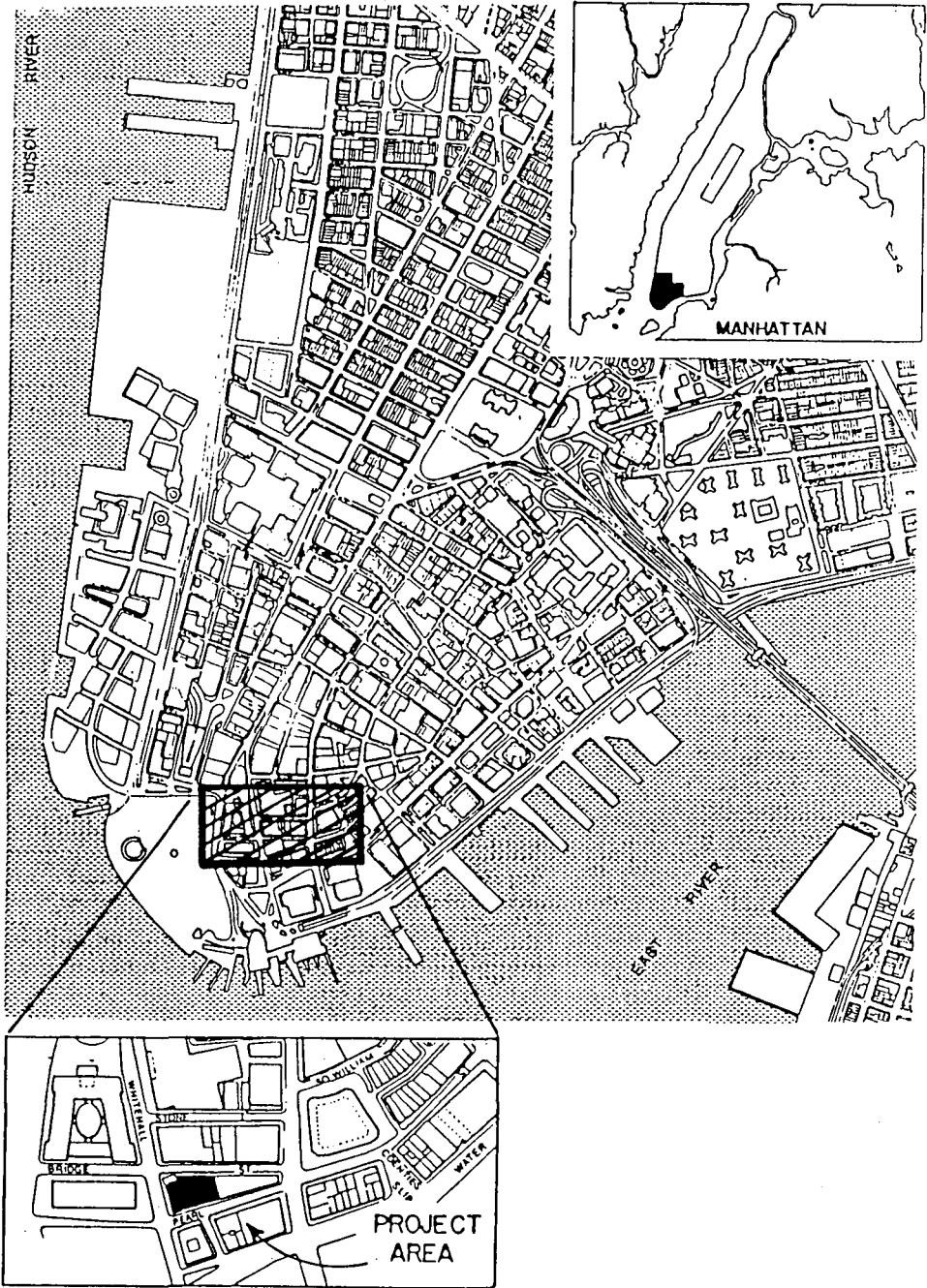


Figure 1. Map of lower Manhattan with inset showing location of the Broad Financial Plaza site.

colonial period (1664–1780), the early Federal period (1781–1850) and into the mid-20th century, when structures on the site were demolished and the area covered with asphalt for parking. The excavations documented three and a quarter centuries of occupation. Units with datable faunal remains were recovered only from deposits with *termini post quem* (TPQ) of ca. 1640–1844, still yielding a sequence rivaled by few other North American historical sites.

The site is on natural land and fronted onto the East River prior to land-filling operations which extended the waterfront out into the East River. Throughout its history of occupation, the site was characterized by a mix of residential and commercial activity. The property was originally owned and operated by the Dutch West Indies Company. During the seventeenth century, the site contained Dutch West Indies warehouses, the first church in the New York area, the first doctor's office, one of the first taverns, and the first British customs house. The site also housed the private residences of several historically-known individuals. The block lay adjacent to Fort Amsterdam, the primary market and fortified area of New Amsterdam. In the past, as today, the Broad Financial Plaza site was prime real estate, and played a vital role in the social and economic life of colonial New Amsterdam and New York City (Grossman 1985b: 27).

The deposits uncovered during the Broad Financial Plaza excavations span some of the earliest historical urban occupations in the New World. The faunal sample derived from the earliest historical European occupational phases of the city and continues for nearly two centuries (TPQ 1640–1844). This period begins when the area was used for a mixture of commercial and residential activities and ends with the shift toward specialized industrial activities. The early dating and long temporal span of the site allow us to monitor changes over time as the village and town of New Amsterdam grew to become the city of New York and as the Dutch transferred power to the British. As such, it provides an important comparison for the few other 17th- and 18th-century *urban* New World samples (e.g., Bostwick 1980; Reitz and Cumbaa 1983).

Even though large faunal samples were recovered during the course of the various lower

Manhattan excavations, only two (the 175 Water Street and Broad Financial Plaza projects) final reports on their zooarchaeological remains have been issued (Biddick 1982; Greenfield 1985). The 175 Water Street site is on landfill, with deposits limited to the 18th and 19th centuries. However, the analysis may have mixed temporally distinct units. To date, only the Broad Financial Plaza site has yielded an earlier historical faunal assemblage, the analysis of which is ready for publication. As such, it can contribute to our understanding of diet, ethnicity, land use, and discard behavior in early colonial life.

The Problem

The analysis explores the following issues:

1. What animals were exploited, and how were they exploited from the 17th to the 19th centuries in early historical New Amsterdam/New York City?
2. What are the major agents of attrition modifying the recovered bone sample?
3. Are there ethnic or class preferences for certain species, especially given the changing political-economic relationships that New York experienced throughout its early history?

Each of these questions will be explored in turn, beginning with the latter.

Analytical Methods

Each bone was identified to the species or next highest taxonomic level (genus, size-class). Problematic specimens were identified with the aid of the extensive comparative collection at the American Museum of Natural History and a variety of osteological atlases (e.g., Boessneck 1969; Gilbert 1980; Olson 1979, 1980; Schmid 1972; Sisson and Grossman 1953). Each fragment was coded for a number of variables including element, certainty of identification, domestication, side, sex, age, butchering, gnawing, burning, fusion, element part, and articulation with other elements.

The non-diagnostic ovicaprine remains were coded as sheep/goat. No goat remains

were identified among the Broad Financial Plaza fauna and goats were absent from virtually all the faunal assemblages in lower Manhattan sites. Since the sheep and sheep/goat remains were relatively few, they were combined for the purposes of the ensuing discussion.

No bones were measured since butchering and fragmentation destroyed most of the measurable points. The few preserved bone ends were not measured since they were from immature animals. Measurement of young or immature specimens is difficult since many of the points to be measured are not sufficiently developed for accurate measurement. A similar situation appears to have existed at 175 Water Street (Biddick 1982: 539).

Vertebrae and ribs were not analyzed in the same detail as other body elements. Fragmentation and butchering activities destroyed many of the diagnostic criteria that would allow separation of elements between closely-related species (e.g., sheep, goat, and deer). Initially, they were classified according to size-classes (small, medium, large mammals). Upon completion of the medium and large mammal samples, only one large mammal species (cattle) and three medium mammals (sheep, deer, and pigs) were identified to the species level. The dearth of horse and other large mammals point to cattle as the source for all or most of the vertebrae and ribs in the large mammal size classes. Most of the medium mammal vertebrae and ribs were probably from sheep and pigs, since only a few deer elements were recovered. However, vertebrae and ribs were not included in cattle, sheep, and pig bone counts.

Age profiles for cattle, sheep, and pigs were constructed on the basis of epiphyseal fusion and tooth eruption and wear data (cf. Grant 1975; Payne 1973; Silver 1969; Wilson et al. 1982).

Quantification of species percentages was kept to a minimum because the most popular techniques for calculating species' proportions are widely recognized as biased (Minimum Numbers of Individuals/MNI, Number of Individual Specimens/NISP, Adjusted Frequency/AF). MNI, in particular, is plagued by the way the sample is divided into subsamples for inter-deposit analysis (Grayson 1984: 29). AF has not been widely used for North American historical samples, limiting

comparability of samples. NISP calculations are plagued by other problems, such as specimen interdependence, which can be somewhat accounted for by not double-counting articulations (Grayson 1984). Recent simulation studies have shown that NISP is a more sensitive indicator of species abundance than MNI with small samples (Gilbert et al. 1982), an important consideration in this study. The published raw data (Greenfield 1985) can be re-analyzed when and if biases in MNI and AF are resolved. As a result, a version of NISP was used for this analysis. Each bone or fragment identified to a specific taxon was counted separately. Fragmented bones that could be refitted or articulated with other bones were counted only once, as if they were a single bone. This limits the potentiality of frequency inflation through the presence of whole or partial skeletons. Articulations were rarely encountered among the mammalian remains. They were most frequent among rodents. The data were coded into a computer-compatible format and entered into the Broad Financial Plaza computer data banks. All data were sorted using D-BaseIII, with the aid of an IBM XT.

Stratigraphic Context

Only faunal remains from temporally unmixed deposits were included in the analysis, with the exception of one deposit to be discussed below. Temporally-stratigraphically related deposits were grouped together by the excavators to form a *Strata Group* when there is a clearly related set of activity foci in use at the site during a specific time span. For example, Strata Groups IA and IB represent temporally sequential sets of the same deposit, related to the construction and subsequent use of particular structures (Roberts 1985).

Five major temporally-ordered groups of deposits or Strata Groups were identified by the excavators and used in the analysis of the faunal remains. Strata Group IA (1650) came from the walls and cobble floor of Heerman's post-1650 warehouse. Strata Group IC (1650) was the original surface upon which the warehouse was constructed. Strata Group IIA (1640) comprised the mid 17th-century builder's trenches for the earliest privy/cistern features. Strata Group ID (1680) is a "series of secondary construction or destruction debris deposits"

(Grossman 1985b: 4). Strata Group IIB (1680) is made up of the late 17th-century builder's trenches and fills of three early double-barrelled wooden privies or cisterns. Strata Group VB (1680) is the mid- to late-17th-century floor and wall elements from Building B that overlaid and cut into Heerman's warehouse. Strata Group III (1720) represents early 18th-century deposits in a small stone rectangular outbuilding. Strata Group IVB (1844) is the late 18th-early 19th-century fill of an oval brick structure. In sum, there are four chronologically differentiated deposits upon which the ensuing discussion will be based: a mid-17th-century set (TPQ 1640-1650: IA, IC, IIA), a late 17th-century set (TPQ 1680: ID, IIB, VB), an early 18th-century set (TPQ 1720: III), and a late 18th-early 19th-century (1840: IVB). Strata Group VI is a temporally mixed multi-component deposit. It is a 19th-century cap of sand and silt overlying the 17th- and 18th-century remains (Grossman 1985b: 4, 14; Roberts 1985). It is included in the analyses of 17th-19th-century age distributions to enlarge the sample size, since age data from all strata groups are combined without regard for temporal/stratigraphic sub-divisions (TAB. 1).

Taphonomic Considerations

Depositional Context

Few, if any, of the deposits were from *in situ* domestic activities. Most were the result of rapid filling from destruction/construction activities. These were quickly filled in by debris as surrounding structures were destroyed and the area leveled for new construction. Only Strata Group IIB may have derived from *in situ* domestic components (i.e., backyard privies). The privy deposits contained faunal material similar to that found at 175 Water Street (Biddick 1982). With the exception of Strata Group IIB, there is a substantial uniformity in the type of deposits among the many strata groups reducing depositional variability as a significant source of bias in the analysis.

Bone Recovery and Treatment

The sample was excavated and recovered by both hand troweling and sieving. Wet-siev-

ing was the primary means of recovery, but dry-sieving was used in the upper levels. Most organic remains were somewhat degraded because of fluctuations in the water table. Bones were separated on-site from heavier artifacts and transported in separate plastic bags to the field laboratory, where they were dried slowly in a shaded area. Special care was taken during drying since excavation took place in mid-winter (during the 1983-1984 winter) and many of the bones were water saturated and frozen. As a result of slow drying procedures, chemical consolidation or stabilization was not necessary.

Weathering

The bone assemblage was relatively well-preserved. Very few bones exhibited signs of lengthy exposure to the elements. The excavators concluded that most of the deposits were the result of rapid or single phases of deposition. Otherwise, fewer of the immature remains would have been found, or present only in an extremely fragmentary state—common consequences of long-term exposure to the elements (cf. Gifford 1981).

Burning

The species identification rate among the burnt bones was extremely low (92.7% were unidentifiable even to the genus). All were in secondary or tertiary deposits—not deposited where they had been burned. Fifty one fragments of burnt bone were found. The temporally most heterogeneous Strata Group (VI) contained the highest relative frequency of burnt bone (6.7%). Only two burnt specimens were identifiable to the species or genus—a sheep metacarpus and astragalus, respectively in Strata Groups VI and IVB. No cattle, pig, deer or other mammalian remains were identified as burnt. The other burnt remains consisted of ribs (N = 4) or bone scrap (N = 16) identifiable to a size class or classified as unidentifiable mammalian bone fragments (N = 27). A single exception may have been a burnt large mammal (bovine?) lumbar vertebra (TAB. 2). Only one bone fragment was both burnt and butchered. A second fragment was gnawed by a rodent after being burnt.

Table 1. Age distribution of fragments for most common domestic mammals.

Age	Strata Group						Total	%
	IA,IIA	ID	IIB	III	IVB	VI		
<i>Sheep:</i>								
Unknown	2	-	-	3	1	1	7	-
Newborn/Foetal	-	-	-	-	1	-	1	1.6
Infantile (<3 months)	-	-	-	-	1	-	1	1.6
Juvenile (3-12 months)	2	-	8	8	3	5	26	42.6
Juvenile/Subadult	-	-	-	-	-	-	-	-
Subadult (1-3 years)	-	-	5	2	3	2	12	19.7
Subadult/Adult	1	2	6	5	2	1	22	-
Adult	2	1	4	9	4	1	21	34.4
Total	7	3	23	27	15	15	90	-
<i>Cattle:</i>								
Unknown	-	1	1	-	-	-	2	-
Newborn/Foetal	-	-	1	-	-	-	1	1.5
Infantile (<3 months)	-	-	1	4	1	-	6	9.5
Juvenile (3-12 months)	-	1	-	8	4	1	14	22.2
Juvenile/Subadult	-	-	-	-	-	-	-	-
Subadult (1-3 years)	1	3	7	5	3	-	19	30.1
Subadult/Adult	8	2	20	20	5	10	65	-
Adult	3	1	4	9	2	4	23	36.3
Total	12	8	34	46	15	15	130	-
<i>Pig:</i>								
Unknown	-	-	1	-	-	-	1	-
Newborn/Foetal	1	-	2	-	2	-	5	8.3
Infantile (<3 months)	-	-	4	-	1	-	5	8.3
Juvenile (3-12 months)	3	-	12	9	1	6	31	51.6
Juvenile/Subadult	-	-	-	-	-	2	2	3.3
Subadult (1-3 years)	3	1	4	2	1	2	13	21.7
Subadult/Adult	2	3	4	4	4	3	20	-
Adult	-	1	3	-	-	-	4	6.7
Total	9	5	30	15	9	13	81	-

Gnawing

Gnawing can alter the original bone distribution, since gnawed bone is consumed and eroded more quickly than ungnawed bone. Gnawing acts to destroy the outer hard layer (periosteum), exposing the softer spongy cancellous layers. Bone disintegrates much quicker without its protective surface. Sixteen pieces of mammalian bone showed gnawing marks (11 rodent; 5 canid/suid). Two of the gnawed bones were also butchered and one was burnt. More canid/suid gnaw marks were found on the ends of bone than on long bone shafts: 3 bone ends and

2 long bone shaft fragments. Rodent gnaw marks were found mostly on bone shafts—3 bone ends and 8 shaft fragments (TAB. 3). The differential distribution in the location of gnawing marks is linked to the mouth size of the different genera. Rodents have smaller mouths making it more difficult for them to attain a proper hold on large bone ends. In contrast, canids and suids can more easily grip it. While canids and suids will select bones with lower density (Binford and Bertram 1977; Greenfield 1988b), rats are less discriminating. All of the major species were affected. Strata Group VI contained the largest number of canid/suid-

Table 2. Distribution of burnt bone.

TPQ		1640	1640	1680	1720	1844	1650-1800
		Strata Group					
Species	Element	IA	IIA	IIB	III	IVB	VI
Sheep	Metacarpus	-	-	-	-	-	1
	Astragalus	-	-	-	-	1	-
Small Mammal	Scapula	-	-	-	-	-	1
	Rib	-	-	-	-	-	1
Medium Mammal	Rib	-	-	2	1	-	2
	Scrap	1	2	1	1	-	7
Large Mammal	Lumbar vert.	-	-	-	-	-	1
	Scrap	-	1	1	1	-	1
Unknown	Scrap	1	1	11	4	2	10
Totals		2	4	15	7	3	24

Table 3. Gnawed bone frequency by Strata Group and type of gnaw mark.

TPQ			1640	1680	1720	1650-1800
			Strata Group			
Species	Element	Type of Mark*	IA	IIB	III	VI
Sheep	Metacarpus	A	-	1	-	-
	Metacarpus	B	-	-	-	1
	Ilium	B	-	-	-	1
Sheep/goat	Tibia	A	-	1	-	-
Cattle	Humerus	A	-	-	1	-
	Ulna	B	1	-	-	-
	Ilium	B	-	-	-	1
Pig	Humerus	A	-	1	-	-
	Tibia	A	-	1	-	-
Dog	Phalanx 1	B	-	-	-	1
Medium Mammal	Lumbar vert.	B	-	-	-	2
	Rib	A	-	-	-	1
Unknown	Scrap	A	-	1	-	-
	Scrap	B	-	-	-	2
Total			1	5	1	9

*A = canid/suid; B = rodent.

gnawed bones (N = 9) and Strata Group IIB contained the second largest quantity (N = 5). Both strata groups contain deposits of a vastly different nature. The former is a group of disturbed components, while the latter include some of our best preserved faunal deposits—a series of privy deposits.

Canid/suid gnaw marks were found on a sheep metacarpus and tibia from Strata Group IIB and rodent chew marks were found on a sheep tibia and ilium in Strata Group VI. Three cattle bones were chewed: a rodent-chewed ulna in Strata Group IA, a rodent-chewed ilium in Strata Group VI, and a canid/suid-chewed humerus in Strata Group III. A pig humerus and tibia in Strata Group IIB were chewed by canids or suids.

Interesting implications can be drawn from the canid/suid-gnawed bone distributions. First, the presence of canid/suid-chewed bones in the privy deposits from Strata Group IIB imply that some or all of the privy fill may have been filled with material previously deposited elsewhere. Second, they demonstrate the presence of canids or suid (whose gnaw-marks cannot yet be discriminated) as attritional agents. Third, even though only a few bones show obvious gnaw marks, this does not mean that only a small proportion of the original assemblage was modified by gnawing. Observations of modern canid- and suid-gnawing on bones has shown that attrition is not equal among all size-classes of species or bone elements or that the relative effect of gnawing upon an assemblage is reflected by the frequency of gnaw-marks. For example, domestic suids may consume 90% of medium-sized mammal bones (sheep and pigs), but only 10% of large-sized mammals (cattle—Greenfield 1988b). Payne and Munson (1985) found that among squirrel-sized animals (and by implication all animals with smaller and softer bones, such as bird or fish), only 22% of the MNIs from the original assemblage survived consumption by dogs. Therefore, the relative frequencies of the medium- and small-size animals may be under-represented. How this affects our ultimate interpretation of the data will be discussed later.

The presence of a rodent-gnawed bone in Strata Group IA (1640) post-dates by a century the earliest evidence for rat infestation of settlements along the North American coast (1564–1565; e.g., Wing 1963: 52). If the single specimen was gnawed by a rat, as opposed to an

indigenous rodent, such as a squirrel, and is not intrusive, rats were probably pests since the arrival of the first Europeans in New Amsterdam. The large number of rat bones in 1680 deposits and the presence of a bone chewed by rodents in even earlier deposits (1640) implies rats were an integral part of New Amsterdam life from the initial colonization.

In sum, the deposits include both privies and destruction layer debris allowing insight into the varying nature of assemblages from different types of deposits. Those from privies were the best preserved. Weathering was not very extensive, but rodents and canids/suids may have been more than minor attritional agents. Implications from the distribution of other artifactual categories are that these deposits probably originated from local household food debris ending up as fill in privies and construction/destruction deposits.

Results

A total of 5471 bone fragments was recovered during the excavations. Most fragments were from mammals (56.9%; N = 3116), with smaller contributions from birds (23.2%; N = 1268), fish (19.7%; N = 1081), and reptiles (00.09%; N = 5). Fish scales are not included in the above counts. A total of 1906 mammal (or 61.2% of the mammalian total), 616 bird (48.6%), and 994 fish (91.9%) remains came from temporally homogeneous deposits. The mammal remains were selected by the excavator for detailed faunal analysis, while only species frequency lists were compiled for the bird and fish remains (the bird and fish remains were studied by other analysts). Of the mammal remains, 438 pieces (23.6%) were identified to a genus or species. Although this is a relatively small sample of remains, it is worth considering because it is the only sample from this time and place and can act as a guide for future research. Since the mammalian remains were the only class of remains studied by the author, only their remains will be discussed here.

Slightly more than half (50.7%) of the mammalian collection was composed of unidentifiable bone fragments (TAB. 4). A smaller percentage was identifiable only to size class (25.6%). The smallest percentage was identifiable to species or genus (23.6%). When rat re-

Table 4. Rate of identifiability of all mammalian remains.

TPQ	1640				1680				1720	1844	Total All
Strata Group	IA	IC	IIA	Sbtl.	ID	VB	IIB	Sbtl.	III	IV	Periods
Species											
N	14	0	20	34	20	1	117	138	135	129	438
%	19.2	0.0	18.3	18.5	20.0	25.0	36.8	30.8	29.8	27.8	23.6
Size-Class											
N	24	0	25	49	44	3	102	149	105	70	475
%	32.9	0.0	22.9	26.6	36.6	75.0	32.1	33.3	23.2	15.3	25.6
Unidentified											
N	35	2	64	101	52	0	109	161	212	257	941
%	42.9	100.0	58.7	54.9	43.3	0.0	34.3	35.9	46.9	57.4	50.7

mains (*Rattus* sp.) are not included, only 18.2% of the total sample is identifiable to species or genus. This is a common fraction for sieved collections. The proportion of identified species varies widely between strata groups. The source of most of this variation is depositional integrity and type of deposit. The less disturbed and more enclosed the deposit, the more identifiable are the bones. The privies in Strata Group IIB had the highest percentage of species identifications (36.8%). There is a short temporal trend in the rate of identifiability. The rate of identifiability increases from a mean value of 18.5% for the 1640 deposits to 30.8% in the 1680 deposits and varies around that value for all subsequent deposits. This cannot solely be attributable to the lesser length of time the later remains spent in the ground, but also probably represents the smaller sample size from the earliest deposits.

The proportion of domestic mammal bones from the potential mammalian food assemblage (PMFA) increases over time from a low of 84.8% domestic in the 1640 sample to a high of 94.5% in the 1680 sample, thereafter decreasing only slightly (TAB. 5). Wild mammalian remains are more common in the earliest levels, but by 1680 wild mammalian remains are much less frequent in the sample, possibly reflecting the increased urbanization of the environment and the declining exploitation or availability

of wild mammals in and around the city.

The bone remains of several species were identified to the species or genus level (TAB. 6). The most common potential food species are cattle (40.2% of bone remains from mammalian food species), sheep (27.9%), pig (25.1%), deer (3.4%), hare/rabbit (3.1%), and beaver (0.3%). Reptiles (turtles) and non-food species, including dogs, cats and rats, were also identified. In the following section, the remains of the major food species (sheep, cattle, pig, and deer) will be discussed separately. In this way, changes in the exploitation pattern of individual species may be presented.

Domestic Sheep (*Ovis aries*)

Approximately half of the ovicaprine specimens were identified as domestic sheep. The rest were not species-specific or had lost their diagnostic characteristics (cf. Boessneck 1969). Throughout the temporal sequence, sheep remains increase in relative frequency. In 1640 deposits, sheep bones are 21.2% of the mammalian food assemblage (excluding rodents). By 1680, they had increased to 23.8%, and by 1720 they represent 28.7%. Sheep remains continue to increase in frequency during the latest deposits (TPQ 1844), when they represent 35.7% of the assemblage.

Table 5. Frequencies of domestic versus wild mammal food species. Excludes rats, dogs, cats, and non-mammalian species; includes only potential mammalian food species (PMFA).

TPQ Strata Group	1640				ID	1680			1720 III	1844 IVB	Total All Periods
	IA	IC	IIA	Sbtl.		VB	IIB	Sbtl.			
Domestic											
N	11	0	17	28	16	0	87	103	88	42	261
%	78.6	0.0	85.0	84.8	88.8	0.0	96.7	94.5	93.6	92.9	92.8
Wild											
N	3	0	3	5	2	1	3	6	6	3	20
%	21.4	0.0	15.0	15.1	11.1	100.0	3.3	5.5	6.4	7.1	7.1

Table 6. Mammal and reptile taxon frequency by stratum and TPQ group, corrected for articulations and mendable fragments.

TPQ Strata Group	1640				1680				1720 III	1844 IVB	1650- 1800	
	IA	IC	IIA	Total	ID	VB	IIB	Total			VI	Total
<i>Bos taurus</i>	4	-	8	12	8	-	34	42	46	15	15	130
<i>Ovis aries/Capra hircus</i>	3	-	4	7	3	-	23	26	27	15	15	90
<i>Sus scrofa</i>	4	-	5	9	5	-	30	35	15	9	13	81
<i>Odocoileus virginianus</i>	2	-	2	4	2	1	1	4	1	-	2	11
<i>Sylvilagus Lepus sp</i>	-	-	-	-	-	-	2	2	5	3	-	10
<i>Castor canadensis</i>	1	-	-	1	-	-	-	-	-	-	-	1
<i>Canis familiaris</i>	-	-	-	-	-	-	2	2	5*	2	1	10
<i>Felis cattus</i>	-	-	-	-	-	-	1	1	-	-	-	1
<i>Emydidae (family)</i>	-	-	1	1	-	-	1	1	1	1	1	5
<i>Rattus</i>	-	-	-	-	1	-	21	22	1	75	1	99
Small Artiodactyl	-	-	-	-	1	-	1	2	-	-	5	7
Mammals												
small	1	-	-	1	-	-	2	2	20	3	7	33
medium	21	-	17	38	31	1	78	110	44	51	68	311
large	2	-	8	10	12	2	21	35	41	16	22	124
Unidentified	35	2	64	101	52	-	109	161	212	261	206	941
Total	73	2	109	184	115	4	326	445	418	451	356	1854†

Notes: * - plus one small carnivore bone; † - total all periods with articulations - 1911.

Because the sample sizes for the age groups from the various strata groups are too small for any one phase, all of the strata groups were combined in the following analysis (TAB. 1). Since the data from each of the strata groups were aggregated, the data from Strata Group VI was also included because it contained remains that temporally paralleled the entire range of the more temporally restricted strata groups. There are very few specimens from newborn and infant animals (3.2%). Bones of subadults are found in greater numbers (19.7%), but are still less common than those from adults (29.5%). The remains of juveniles are the most common age group (42.6%). A common assumption is that low frequencies of immature (newborn-subadult) specimens is a function of differential attrition due to their fragility. However, the presence of relatively large numbers of bones from immature animals (42.6%) does not necessarily indicate that differential attrition by age was not a significant problem. In fact, as argued in the previous section and in the conclusion, there was significant differential attrition of the more fragile bones of younger animals. Mortality or harvest age distributions with large numbers of immature individuals points to the exploitation of sheep in urban areas for their primary products, such as meat (cf. Greenfield 1988a; Payne 1973). In such a situation, a relatively large number of older male lambs (newborn-juvenile) are culled for meat, while relatively fewer subadults are chosen for slaughter. Fewer females are slaughtered young since they are necessary for reproduction. Most females are slaughtered as adults, i.e., when they are beyond reproductive usefulness.

Domestic Cattle (*Bos taurus*)

Domestic cattle remains are present in nearly every strata group, throughout representing the most common food species in the assemblage. In 1640, their remains represent 36.4% of the food assemblage, increase to 38.5% in 1680, continue to increase to 48.9% in 1720, and finally drop to 35.7% in the 1844 deposits. Cattle bone frequencies increase initially along with those of sheep between 1640 and 1720, but thereafter plummet to values equal to pigs (1844). The post-1720 decrease in cattle remains seems to be related to the corresponding

increases in sheep and pig remains, and may be related to a variety of factors, which will be considered below.

The aggregate harvest profile does not seem to be very similar to that of sheep. Adult bones are most common (36.3%), while those of subadults (30.1%), juveniles (22.2%) and infants (11.0%) follow in decreasing frequency. But, the cattle and sheep profiles are both similar in that the majority of remains come from individuals that were slaughtered prior to adulthood (cattle: 63.7%; sheep: 65.5%). But only half of the immature cattle remains were from individuals slaughtered for veal (< 1 year: 33.2%), while more than two-thirds (69.5) of the sheep bone remains were from individuals slaughtered at less than one year of age. The relative frequency of immature cattle bones may be underrepresented somewhat, since such bone is more affected by various attritional processes (e.g., exposure, cooking, etc.) than are mature bones (i.e., those already fused). The proportion of immature individuals, therefore, would have to be slightly increased to approximate the original death assemblage. Such an age distribution is reminiscent of harvest profiles generated by herd management strategies emphasizing meat production (Greenfield 1988a; Payne 1973).

Similar attritional processes also affect the distribution of remains from large- and medium-sized mammals because of the effects of differential bone size and density upon bone fragmentation and subsequent identifiability. The bones of larger animals tend to break up into more fragments than those of smaller animals. In general, the bone fragments from large species are less easy to identify to the species than are those from smaller species because of the differential fragmentation rates. Thus, fragmentation not only decreases the size of a bone, but also tends to skew the identification rate of species in favor of smaller species. But, large-mammal bones are less susceptible than medium-mammal bone to attrition from gnawing. If the former is the case, relatively larger ratios of unidentifiable-identifiable large (N = 124:130; 48.8:51.2%) than medium (N = 311:192; 61.8:38.2%) mammal bones would be expected to be found. Since this is not the case and there is evidence gnawing, cattle are probably underrepresented, and would have to be slightly increased to approximate the original death

assemblage.

Domestic Pig (*Sus scrofa dom.*)

Domestic pigs are present throughout the sequence, but the relative frequency of their remains decreases following significant changes in the city's socio-political landscape. In 1640, the remains of pigs ranked second in frequency (27.3%) among the mammalian food animals. Pig remains increase in 1680 deposits (32.1%), but drop to third place (15.9%) in 1720 becoming less than half of their former value in the assemblage. They regain some of their lost significance in the 1844 deposits (21.4%). At the same time, cattle and sheep remains take up much of the slack.

The pig age distributions can provide an independent test of the above interpretations of the cattle and sheep exploitation patterns because pigs are usually produced only for their primary products. They are the most specialized of the domestic species discussed here, with no secondary use other than as scavengers (cf. Greenfield 1988a, 1988b). As a result, the pig harvest profile should resemble that of exploitation strategies designed to maximize primary production. The age distribution shows that the vast majority of pig remains were from immature individuals (TAB. 1). The largest group were remains were from juveniles (51.6%). Piglet remains, under six months of age, were second in frequency (16.6%), followed by those from subadults (21.7%) and adults (6.7%). Half of the adult remains came from loose teeth, while the other half were hind limb parts (femur and fibula). Subadults and juveniles age classes were well represented remains from all body parts. Pork production and consumption emphasized individuals under a year of age. Immature individuals could be preferentially culled because of the prolific reproductive and growth rates of pigs. Younger animals were more highly desired by consumers and probably tended to generate higher profits for breeders.

White-Tailed Deer (*Odocoileus virginianus*)

White-tailed deer are present in the early deposits of the sample (TAB. 6). While no deer were found at the 19th-century 175 Water

Street (Biddick 1982), they are present in the 1640 deposits from the Broad Financial Plaza (12.1% of the PMFA). Subsequently, they experience a dramatic decline to approximately 3.7% of food animal remains in 1680. The decline continues in the 1720 deposits (1.1%). By the final deposits (1844), deer remains have completely disappeared from the assemblage (FIG. 2). The decline and disappearance of deer is directly associated with the urbanization of lower Manhattan, deforestation in the surrounding region as open farmland replaced forests, and over-predation. Early settlers relied upon wild game, but less and less over time.

A wide distribution of body parts was found, including cranial, vertebral, forelimb, hindlimb and podial elements. There is no evidence for the use of antler for tools or selection of only certain body parts to be brought to the city from kill sites. Most of the ageable specimens were from adults (N = 4), while the rest were from subadults (N = 1). Four specimens could be aged only as indeterminate sub-adult/adult.

Discussion

The faunal assemblage from the Broad Financial Plaza excavations provides insight into the use and importance of both wild and domestic animals during the early colonial history of New Amsterdam/New York City. The distribution of species and their relative importance show dramatic shifts over time, which when coupled with an understanding of the taphonomic history of the site and assemblage, tell us a great deal about animal exploitation strategies, the changing environment, and shifts in socio-economic behavior.

Wild Animals

The wild bone assemblage illustrates some of the significant economic and ecological changes accompanying the colonization and urbanization of lower Manhattan. Over time, mammalian wild species remains undergo a decline in the potential mammalian food assemblage (hereafter referred as PMFA) from 15.1% in 1640 to 5.5% in 1680, thereafter slightly increasing to 6.4% in 1720 and 7.1% in 1844 deposits. But this is probably not an accurate re

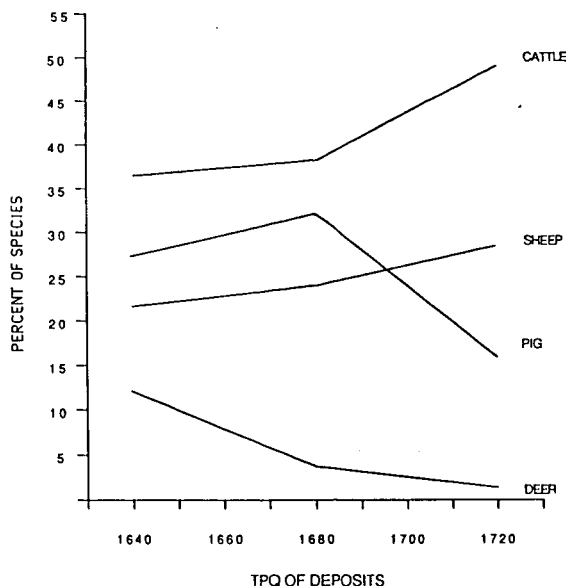


Figure 2. Relative frequencies of potential mammalian food species (NISP) over time (cattle, sheep, pig, deer, rabbit, and beaver). Frequencies are calculated on the basis of the totals of only these species.

flection of the overall importance of wild species to the urban economy. The waters, wetlands, and markets of New York were well-known for their abundance and diversity of small wild mammals, reptiles, fish, and fowl. Each were probably significant components of the diet. Recognition of the role of the attritional agents that modified the mammalian assemblage considered above forces us to realize that similar agents must have modified the assemblage of smaller wild species as well. They are even more fragile and subject to greater attrition than are medium- and large-sized mammals (Payne and Munson 1985), and it unlikely that they are represented in their original abundance and diversity.

The growing dependence of urban populations upon domestic species is better reflected by the decreasing importance of deer over time (FIG. 2). Deer decline from 12.1% of the PMFA in 1640, to 3.7% in 1680. By 1720, deer constitute only 1.1% of the PMFA remains and disappear soon afterwards. The decline and disappearance of deer is directly associated with the urbanization of the region and the disappearance of extensive forests near the city. This change is synchronous with the major political shifts

in the region—the British have taken over the colonial administration. Early settlers relied upon wild game to a greater extent than later colonists. The British administration (in contrast to the Dutch) opened up the rest of Manhattan island for development. The result was deforestation and field enclosure, with consequent deleterious effects upon deer populations. As time progressed, local deer populations crashed and never recovered from habitat loss and over-hunting.

It is also interesting to see that there is a contrast between literary and archaeological sources of information on class and diet. The image of early frontiers is that there was a strong reliance upon wild resources during the early periods. As the areas become more developed, these resources become less fundamental to subsistence but remain important for two of the socio-economic classes—the very poor who need to supplement their meagre domestic resources and the wealthy who continue to hunt and consume wild foods as status markers, such as venison and trophies. The Broad Financial Plaza was a relatively high status block in the city of New Amsterdam during its early history reflecting at least the upper end of the socio-

economic diversity of the city (where civic leaders such as Cornelius van Tienhoven and his family resided; Grossman 1985b: 7; Stokes 1915, vol. 1: 266). From this, it is possible to conclude that there is little archaeological evidence for the use of wild game in the later periods by high status households living on this block in lower Manhattan. However, it is difficult to make similar conclusions for lower status households given the dearth of published materials from other areas of the city.

It is remarkable that even with the small sample size of deer, the decline in deer bones from the Broad Financial Plaza site dramatically parallels the documentary sources for deer distributions and population densities during the colonial period. This is another indication of the magnitude of ecological changes taking place around the city. The faunal remains indicate dropping utilization, and possibly availability, of deer beginning by the latter half of the 17th century. Late 17th-century documents from New England show that significant deer populations were restricted to north of the 44th parallel and away from major urban centers. The first closed deer hunting season (3 years) in Massachusetts was enforced by the end of the 17th century (Cronon 1983: 101). The mid-17th-century decline in deer remains at the Broad Financial Plaza may indicate that deer population decimation may have taken place earlier in New York (Grossman 1985b: 22). Even though Massachusetts began legislating closed deer hunting seasons by the end of the 17th century, New York state was noticeably tardy. It was not until late in the second half of the 18th century that New York State joined Massachusetts, Connecticut and other neighboring states to legislate annual closed deer hunting seasons. These were designed to enable deer populations to recover and grow so that they could be exploited once again for subsistence and sport purposes (Huey 1979: 47–50).

Domestic Animals

Although cattle remains are the most common mammalian species throughout the sequence, a consideration of attritional agents makes it unlikely that they continuously dominated the assemblage. Cattle bones are relatively denser and more likely to survive and be identified than any of the other major mam-

malian taxa (sheep, pig, and deer; see, e.g., Binford and Bertram 1977). All of these taxa with the exception of deer show evidence of gnawing. As a result, it is likely that sheep and pig remains were more common in the original death assemblage than in the recovered sample, and that the relative proportions of cattle remains were probably lower—possibly as much as 50%, based on attritional studies (e.g., Binford and Bertram 1977; Greenfield 1988b; Payne and Munson 1985). At the same time, the bones of pigs tend to be slightly softer and lower in specific density and therefore more subject to attrition than even sheep, indicating that the relative proportions of pigs may have been even larger. Deer, whose bone is among the densest and relatively easy to identify in such assemblages, were probably less subject to such attritional forces. In sum, the absolute dominance of cattle remains may not be a true reflection of their relative frequency in the original death assemblage nor of their importance in the early colonial economy, since the proportions of sheep and pig remains probably have to be substantially increased to account for bone attrition. The relative sheep:pig relative bone proportions may also have to be corrected, but to a much smaller extent. Therefore, while the proportions of cattle, sheep, and pig remains are probably highly skewed and possibly meaningless, the sheep versus pig values are probably a much more accurate reflection of their changing proportions. The significance of this conclusion will be discussed below.

Consideration of attritional agents also makes it likely that the youngest age classes among the domestic food species suffered the severest attrition. These are the age classes most likely to be consumed by dogs, pigs, etc. This realization in conjunction with the relatively high percentages of young individuals in all of the domestic animal harvest profiles indicate that cattle, sheep, and pigs were raised for their primary and not secondary products. These animals were slaughtered relatively early in life for the urban meat market and not later as would be expected if they had already exceeded their expected usefulness for secondary products. More data will be needed before temporal trends can be observed.

Cattle remains (NISP) continuously increase in frequency from 1640 to 1720, but decrease to less than 1640 levels by 1844. Both pig and cattle NISP increase slightly between 1640 and

Table 7. Meat weights of cattle (450 pounds), sheep (50 pounds), and pigs (122 pounds), based upon Bowen's (1975: 20) calculation for dressed averaged-sized individuals.

TPQ	Sheep		Cattle		Pig	
	#	%	#	%	#	%
1640	350	5.1	5,400	78.9	1,098	16.0
1680	1,300	5.3	18,900	77.2	4,270	17.5
1720	1,350	5.6	20,700	86.7	1,830	7.7
1840	750	8.7	6,750	78.5	1,098	12.8

1680. But, pig remains then decrease precipitously in 1720 (moving down to third place), and slightly recover in 1844 deposits. In contrast, sheep NISP show a continuous increase over time, beginning in third place and moving up to second place (FIG. 2). All domestic animals remains exhibit slight increases in frequency from 1640 to 1680. Cattle bones continue to increase in frequency, along with those of sheep (1640-1720), but thereafter plummet as pig bone frequencies rebound. The changing proportions of the three major domestic species will be the subject of the rest of the discussion. The observed decrease in pig remains takes place whether we use NISP or other measures such as meat weight. For example, following Bowen (1975: 20), the dressed weight of adult cattle, sheep, and pigs were calculated for each of the identified specimens (TAB. 7). The major difference between NISP and meat weight calculations are that sheep proportions experience only a slight increase in 1720 deposits. But, pigs decrease by 44% between 1680 and 1720 deposits. Cattle make up the loss experienced by pigs. Changes in the proportions of cattle, sheep, and pig bones seem to be related to a variety of factors including anthropogenic changes in the environment, and the ethnicity and socio-economic status of the blocks occupants, all of which will be considered below.

How can the shift in cattle, sheep, and pig bone frequencies be explained? The magnitude of the decline in pig and increase in sheep remains can be explained as a function of simple random variation over time between deposits due to small sample size (cf. Grayson 1984). Unfortunately, it is difficult to judge if this is the case, and more importantly this line of ar-

gument closes off any discussion about the information that may be gleaned from even small data sets. Simply saying that the data sets are too small and more need to be collected is counter-productive, since even trends in small data sets may be used to structure future research. Also it is unlikely that new excavations will take place in this area in the near future. If the frequency data are not accepted as a direct function of simple random variation, could they be evidence that the conditions for animal husbandry in New York changed over this span of time? These numbers, while small, in conjunction with the information from historical sources suggest that conditions were changing. As will be discussed below, the changing relative frequencies of the remains of the major domestic species reflects a combination of changing environment and shifts in the ethnic composition of the urban population.

Changing Environment

The continued decline of deer bones in the PMFA throughout the sequence (FIG. 2) probably reflects the anthropogenic changes in the environment of Manhattan island and the surrounding countryside. The initial colonists encountered a mixed-oak forest environment on Manhattan island, with little open ground. As the island was colonized, the forests were cut down for fuel and building materials, creating a more open and "civilized" environment. This had two consequences for this discussion. First, it reduced the potential environment for wild and domestic forest-preferring species (i.e., deer and pigs). Second, it created more favorable conditions for the increased production of

domestic grazers, such as sheep and cattle.

The relatively high percentage of pig NISP in the 1640–1680 deposits is not surprising considering the surrounding environment and the need of the early colonists to quickly establish a reproductively viable herd of domestic stock upon arrival. Pigs mature quickly, multiply rapidly and are unselective foragers, making them ideal animals for colonizers (cf. Crabtree 1989: 210) who have transportation (such as ships) to move animals over great distances but who are able to invest little in their care upon arrival. As the oak forests were cut down, there would be proportionately less mast naturally available for pig forage. With decreasing natural forage for pigs, more effort would need to be invested in feeding pigs. By the late 17th century, the colonists could not simply turn pigs loose in the forests, as was a common pattern in many rural areas in Europe and colonial North America (cf. Cummings 1967: 15–16; Grigson 1982). As the forests disappeared, they were replaced by open meadows and environments more optimal for cattle and sheep grazing. As cattle and sheep populations become large and viable, the pressures on the initial colonists decreased and pig husbandry became proportionately less important. The early emphasis upon pigs was, in part, a survival strategy of the early colonists. The survival of names such as Sheep Meadow in Central Park are a reflection of the later importance of ungulate grazing areas on Manhattan island. Therefore, the increase in cattle and sheep bone frequencies in the 1640–1720 deposits was probably, in part, due to anthropogenic changes in the environment.

In addition, there were other pressures on pig husbandry. By the end of the 18th century (1780s), pigs were no longer allowed to freely roam city streets. They had become such a serious health hazard and impediment to the flow of traffic through the city streets that a new set of city ordinances was passed prohibiting lax husbandry practices within city limits. Any pig found freely wandering on city streets became the property of the finder (Pomerantz 1938: 270). The problem of freely wandering pigs was noted in earlier documents. In response to the new legislation, pig production increasingly shifted to the surrounding rural communities. Moving pig production to the countryside beyond Manhattan involves transporting them. Pigs do not move well on the hoof over great

distances since they lose weight and condition easily, although they are known to have been driven over the Appalachians. Pigs often require the use of carts and a good road system to be transported to far-off marketplaces for sale and butchering. Since freshly butchered meat goes bad very quickly (within a day during the summer—cf. Cummings 1967), most pork was shipped salted or smoked and deboned, making them archaeologically less visible (Derven 1984). Cattle and sheep can be more easily driven to distant markets.

The decline in pig bone relative frequencies stands in contrast to their pronounced presence in the documentary record. Pigs were important to the economies of both colonial New York and New England. However, there were increasing numbers of complaints by residents to authorities concerning free-roaming pig stocks. A plethora of 17th-century New England and New York documents reveal British attempts to restrict free-roaming domestic pigs from urban areas. Initially, legislation was passed limiting pigs to areas 8 miles or more from town centers. Soon afterwards, fencing and enclosure acts were passed to ensure that pigs could no longer wander about. When these proved insufficient to control pig movements, pigs were moved to isolated areas such as peninsulas and islands. The Dutch administration of New Amsterdam instituted a similar series of policies in the decade before the arrival of the British (Cronon 1983: 134–137; Grossman 1985b: 25; Stokes 1915: 61). A 1639 map shows Roosevelt Island in the East River as Hog Island. Grossman (1985b: 25) postulates that Roosevelt Island may have functioned as an offshore holding area for the difficult-to-control pig populations. By 1657, enclosure laws were enacted (Cronon 1983: 134–137; Grossman 1985b: 25; Stokes 1915: 61).

Although the zooarchaeological data indicate a decline in pig remains during the latter phases of occupation, pigs remained a vital part of the urban environment into the 19th century. From the documentary record we can see that pigs continued to roam the streets of New York City through the 18th and early 19th century, even with legislation enjoining their removal from the city (Pomerantz 1938). They served not only as a source of food, but also as recyclers of waste. City inhabitants habitually threw garbage out onto the streets, which was then scavenged by freely-roaming pigs

(Earle 1903: 124-125). Pigs also destroyed clam and oyster shellfish-gathering sites (Cronon 1983: 137), affecting not only the environment, but also the food base of native populations (Grossman 1985b: 25).

Another explanation for the decline in pig frequencies in our deposits may be shifting loci for pig production. If this is the case, the shift in pig frequencies should be synchronous with the new legislation banning pigs from the city streets. However this is not the case. The decline in pig bone frequencies shows up approximately 70 years prior to the enactment of the pig ordinances of the 1780s. A second variable may be the shift in the dietary preferences of the city's occupants towards beef and mutton. The decline in pig bone frequencies may be attributable to these processes and are discussed below.

Diet and Ethnicity: A Hypothesis

Pig, sheep, and cattle bone remains also yield evidence for shifts in cultural preferences and exploitation between the 17th and 19th centuries. It is hypothesized that the shift in the proportions of these European-introduced species is consistent with the changing ethnic mix of the inhabitants of the site. During the earliest period of Dutch presence in New Amsterdam (1640), pig remains (26.5% of the PMFA) are more abundant than sheep (20.6% of the PMFA). This relationship is maintained through the early British administration of New Amsterdam. In the 1680 deposits, pig bones (32.1% of the PMFA) are still more common than those of sheep (23.8%). By 1720, the relationship has been reversed, with sheep remains more common (27%) than pigs in the PMFA (15%). In this period, percentages of pig remains are half of what they were in 1640. The trend toward increasing frequencies of sheep remains in the PMFA over time is obvious whether measures such as NISP or meat weights are used. At the same time, the relative frequency of cattle remains continuously climbs. Could the declining relative frequency of pigs, and increasing frequencies of mutton and cattle faunal remains from this block reflect shifts in the ethnic identity of its occupants?

In their model of the "English Barnyard Complex," Reitz and Honerkamp (1983: 6) propose that the faunal inventory from sites

should be mostly "swine remains, followed by sheep and a few aged cattle." However, they also note that a number of other "studies emphasize the importance of sheep rather than swine in 17th and 18th century [English] diets... (Ernle 1922; Maltby 1979; Rogers 1866-1902; Thirsk 1957; Fussell 1973b)" (Reitz and Honerkamp 1983: 6). Familiarity with some of the English data indicate that some of the difference in opinion may be traced to the fact that Reitz and Honerkamp's model derives from rural contexts while much of the post-medieval English faunal data derive from urban contexts (e.g., Davis 1987: 186; Maltby 1979; O'Connor 1982). While Reitz and Honerkamp's study of 17th-18th-century British colonial diet relies upon Anderson's (1971) model of English yeoman foodways, they actually use a model based upon English husbandmen's diet (Reitz and Honerkamp 1983: 6). However, an understanding of the position of yeoman in 17th-century England is necessary before such a model can be universally applied to all English socio-economic classes and its specific application to New York City data. First, the data Anderson presented and used by Reitz and Honerkamp are essentially concerned with rural food habits (Reitz and Honerkamp 1983: 5). Second, yeoman were basically a rural socio-economic group. A yeoman's lands were relatively extensive. Yeomen, however, were still at the lower end of the rural socio-economic hierarchy. They were found at the upper end of the lower free rural socio-economic groups, above the husbandmen and laborers. Third, Reitz and Honerkamp use a model based upon English husbandmen rather than yeoman in their study. Husbandmen were a lower rural socio-economic group than yeoman. Each had sufficient land to support himself. As a member of an even lower group, the laborer had only a few acres or a cottage and lived off his wages (Dyer 1989: 15). A model of English foodways built upon rural yeoman would necessarily be different than that for husbandmen and cannot be universally applied. Nor should data from English rural contexts necessarily be directly comparable to urban contexts in general or to New World urban contexts in particular. Hence, the *universal* application of Anderson's data or Reitz and Honerkamp's derivative of his model (1983: 5-6) should be avoided and justification provided for each individual case. Therefore, part of the parameters for defining English foodways may

be class, while others may be rural versus urban.

Rural yeoman and husbandman diets in England also differed. The model cited above from Reitz and Honerkamp (1983) aptly characterizes the husbandman's diet. Yeoman diets, however, probably differed. The yeoman's lands were relatively extensive and were often used for sheep-raising and wool-selling to pay taxes. Tax rolls of yeoman-class individuals clearly indicate the dominant role of sheep and wool in local economies (cf. Dyer 1989: 129–130), although they would not necessarily have been the major food species. Faunal studies of English village sites between the 12th and 16th centuries reveal a consistent pattern of beef as the dominant meat (e.g., Dyer 1989: 155–156; Grant 1984; Noddle 1975). In the more pastoral areas of the countryside, there were higher proportions of mutton and cattle in the diet than in other areas. Therefore, rural lower class diets varied regionally and according to their level of stratification (Dyer 1989: 151).

Studies of fauna from urban sites from post-medieval Britain, such as Exeter and Lincoln, tell us something about English urban lower-class diets. As the cities grew in size and complexity, their economic organization began to change. Their population was increasingly sustained by their surrounding hinterlands. Major cities, such as London, were dependent for their meat supply on a network that extended throughout England, Scotland, and Wales. In the absence of refrigerated and motorized transport, urban sites were supplied with livestock "on the hoof." Cattle and sheep raised in the countryside were driven into towns for slaughter (Davis 1987: 186). Faunal assemblages from post-medieval urban sites show a predominance of cattle bones, followed by substantial numbers of sheep bones. In the triad of major domestic food species, pigs come in a distant last. Sheep increased relative to cattle and pig during this time, probably less as a result of preference than of economic availability. It is also interesting to note that the average age of slaughter for sheep rose during this period to mostly mature individuals (Davis 1987: 186; Maltby 1979; O'Connor 1982). Although pig bones become relatively less frequent in urban sites, the animals may have still been a significant component of the urban diet. But the preference for young individuals (with soft and easily destroyed bones—contrary to

the more durable bones of older sheep) and ease with which pork is salted, pickled, and otherwise prepared for long-term storage and transport may make pigs less visible in the archaeological record of this period.

A special characteristic of the 15th-century aristocratic English diet was its emphasis upon meat and fish. Meat consumption estimates from 15th-century aristocratic households show the importance of beef. It was clearly the most important meat, often exceeding more than half of the total meat weight consumed. It was followed by pork and mutton, with their relative frequencies varying quite widely. In actual numbers of individuals, pork and mutton often were nearly the same. While cattle and sheep were generally consumed as full-grown individuals, pigs were more often slaughtered young—in their first or second year of life (Dyer 1989: 59–60). Regional and rural-urban variation in aristocratic English diet, and especially in the consumption of fresh beef, seems to have been relatively insignificant. They were prepared to pay the price (Dyer 1989: 67). Therefore, diet in late and post-medieval England varied between rural and urban populations and among socio-economic classes.

If the similarities between German and Dutch cuisines may be acknowledged, then studies of German or German-American populations may contribute to this issue. Lemon (1967) analyzes dietary preferences in a mid- to late-18th-century Pennsylvania population which was more than half German-American. He found a two-to-one ratio in favor of pork over beef. Pennsylvanians had little desire for mutton (1967: 62). Pork was an essential part of the Dutch diet in New Amsterdam from its earliest moments for both cultural and economic reasons. Pork was a specialty and was incorporated into numerous Dutch dishes. They enjoyed *oleykoek*, *speck inde kool*, pork and cabbage, fried pork and apples, and head cheese made of pigs feet and head served in cold slices (Cummings 1941: 11; Earle 1903: 144; Hershkowitz 1985: 7).

But pig was also an essential animal for frontier families. It grows and reproduces quickly, with little effort expended in maintenance. In this situation, Dutch cultural preferences dovetailed with the economic necessity of establishing a secure subsistence base quickly—a condition reminiscent of British colonial subsistence in 17th-century Chesapeake Bay set-

lements (cf. Miller 1984).

Even though both the British administration in New England and the Dutch administration in New Amsterdam were grappling with the problem of free-roaming pigs, the Dutch and British viewed pigs through very different sets of cultural filters. Pork is an essential ingredient of traditional Old World Dutch diets (Earle 1903: 143-144), while it is of much lesser significance to British dietary patterns. In contrast, mutton and beef dishes are a common component of British cookery from medieval times onwards (e.g., Crabtree 1989; Maltby 1979; and numerous references in Huey 1979). While Anderson (summarized in Reitz and Honerkamp 1983) suggests that pork was significantly more important in Old World British diets than mutton, Huey amply documents the contrary from a number of British and colonial sources and notes that the "British often despised pork for its lowness" (1979: 39). The ratio of pork and beef in the diet of affluent colonial New Englanders was nearly equal, while pork was more favored in German-American communities. Mutton was a luxury meat, since it was difficult to preserve (Cummings 1967: 16; Derven 1984: 56; Lemon 1967: 61ff.). This preference is seen even today in northern England and Scotland. In Scotland, for example, both pork and bacon are eaten to a far lesser extent than in any other part of Britain (Allen 1976: 143, 144). There is a higher preference for pork among Dutch/German than among British ethnic groups in the central and northeastern North America. It seems that mutton and cattle versus pork consumption may be linked to distinct ethnic food preferences. Pork dishes are central to the Dutch diet and sheep and cattle to the British diet in the Old World (cf. Earle 1903: 143-144; Grossman 1985b: 23, 27; Huey 1979).

Were these ethnic preferences retained in the British colonies of New England? Were there also class-related preferences, as existed in England? The answer seems to vary according to the history of settlement in different areas. Cattle remains are almost everywhere the most common faunal element of British and Dutch colonial sites. But, studies of English foodways on the southeastern coastal plain indicate that pig remains were far more common than sheep, whereas sheep represented a negligible component of the faunal remains (Reitz and Honerkamp 1983). In New England, the rela-

tive proportion of pigs and sheep in the diet was more complex. Derven (1984: 56) in her study of meat transactions from Deerfield, Massachusetts, found that the "overall proportions of meat transactions are approximately 36 percent beef, 44 percent pork, 12 percent lamb and mutton, and 8 percent veal." These figures, however, she notes, are probably skewed by the provisioning of the Line of Forts (Derven 1984: 55). Pork could be more easily and safely salted than mutton (cf. Derven 1984: 57; Wingerson 1984: 34), explaining its frequent mention in provisioning inventories from military installations (e.g., Guilday 1970). In contrast, Pendery (1984) argues that pigs played a less significant role in the diet of New Englanders than sheep or cattle. The difference in opinion may be understandable by reference to class. Mutton was a luxury meat in New England (Cummings 1941: 16; Derven 1984: 56). Cronon (1983: n. 14, 201) argued that pigs were favored by poorer New England colonists as a source of meat. This is supported by Pendery's (1984) comparative analysis of the fauna from lower and higher socio-economic status New England households. Proportionately more mutton and cattle remains were associated with high status households. Wealthier colonists could afford to raise and use cattle and sheep (Pendery 1984: 21). Young's (1987) comparative study of 17th-century upper and lower-income households in Queen Anne Square (Newport, Rhode Island) is also informative in that each of the ethnically-British household assemblages contain substantially larger quantities of sheep than pig bones. However, his comparison of upper and lower income households is thrown into question because the upper income assemblage dates from an earlier time period—a period in which the Newport economy was thriving—while the lower income assemblages date to after the mid-18th century British occupation—a period in which the Newport economy was in decline. Cressey et al.'s study (1984) of 19th-century households in Alexandria, Virginia, also demonstrated class differences in the distribution of faunal remains, with "a significantly higher frequency of pork bones discarded in the Lower Class Black sites . . . and a wider range of food species represented in Upper Middle Class sites including several wild species." The comparison of 18th-century probate inventories and faunal remains from Mott Farm, Rhode Island, is also enlightening

in this context. The probate inventories show 70% sheep, 20% cattle, and 10% pigs. The sheep on the farm were raised primarily for wool and only secondarily for consumption (when they were older). In contrast, the zooarchaeological sample shows a vastly different set of frequencies—26% sheep, 42% cattle, and 32% pigs (Bowen 1975: table 2). But the higher pig than sheep frequencies seem to remain a relative constant in rural and lower class urban contexts. Could the differences in New England dietary patterns be of a class nature? While the data may seem to indicate such a relationship in areas where traditional British diets were maintained by upper class families (cf. Pendery 1984), the data are still too few. As a result, more data reflecting a wider range of socio-economic position of households will be necessary to fully resolve this issue.

The New Amsterdam colonial administration was run by the Dutch during the time of the earliest deposits from the Broad Financial Plaza excavations and the area of excavation included one of the centers of Dutch decision-making. Even though New Amsterdam was characterized by a plethora of ethnic and linguistic groups, the power structure remained very much within the hands of the Dutch colonial authorities. With the shift of New Amsterdam to British authority, British immigration to the colony increases and the colony is increasingly integrated into the British economy. The decline in pig remains and rise of cattle and sheep bone frequencies in the Broad Financial Plaza fauna may reflect the substitution of a British- for a Dutch-based dietary pattern associated with the changing colonial administration. The continued emphasis upon pigs in the 1680 deposits may reflect conscious attempts on the part of the remaining high class Dutch to maintain their ethnic and class distinctiveness during the early part of the British administration. This behavior may have been a reflection of the tenuous British political control over the newly acquired colony. British control over the colony during this period was by no means assured, as evidenced by the brief retaking of the city for a year by the Dutch (1673–1674; Archdeacon 1976: 99). It is interesting to see the differing cultural associations between pork and sheep with British colonists in New England than in New Amsterdam. In more ethnically homogeneous New England, pork consumption may

have reflected economic status. In contrast, in more ethnically heterogeneous New Amsterdam, pork may have been a vector for marking ethnicity.

The shift in species proportions, if interpretable as changes in dietary patterns, possibly reflects the new British ethnic presence 'on the block'. Ownership of the house lots change from Dutch names to British names at this time. The documentary record reveals that individuals with British ethnic identities moved onto the block (e.g., Obadiah Hunt, Michael Harding; see Grossman 1985a: 18). Some of the historically-recognizable owners of residences and structures on the block were very prominent individuals. For example, Obadiah Hunt's tavern was the favorite gathering spot for provincial governors and city politicians (Hershkowitz 1985: 13).

Also, given the fact that Dutch remains an important linguistic and cultural pattern in New York for another two centuries (cf. Bachman 1969), it is difficult to conceive that the Dutch adopt a British dietary pattern soon after conquest. In fact, as the Dutch lost control of the colony and the British became the major power brokers, Dutch food preferences were not abandoned and British ones adopted by the Dutch inhabitants. Instead, the historical records allow us to see that Dutch cultural patterns survived well after the shift in the power structure of New York from a Dutch-centric to British-centric system. Language, food, and other markers become vectors for displaying and enhancing ethnicity among the upper class families of Dutch origin after conquest. We are seeing the replacement of one ethnic group by another in the formal power structure of the city.

Resistance to British power was expressed in a variety of ways. The association of mutton with British culture and power in the minds of the colonists is clearly reflected in political activities by the middle of the 18th century. As part of the growing colonial opposition to the British Stamp Act of 1765, various British products were boycotted. This included lamb and sheep meat (Wingerson 1984). "Leading citizens of New York and Boston, as well as Philadelphia, signed resolutions not to purchase or eat lamb, and to boycott any butcher who sought to counteract the resolutions" (Schlesinger 1966: 76).

Traditional pictures of the differences be-

tween colonial New Amsterdam and New York create the impression that the inhabitants of New Amsterdam were more ethnically homogeneous. However, recent research has shown the colony's ethnic composition to be a mosaic of European ethnicities (Cohen 1981: 44). This situation stands in strong contrast to contemporary British colonies in the New World where most of the immigrants came from the British Isles. In contrast, Holland was a refugium for all sorts of persecuted religious and ethnic groups from the early 16th century onwards and this diversity is reflected in its colonies. With our greater understanding of the ethnic make-up of the colonies, it is possible to see that Dutch cultural patterns during the days of the Dutch administration may have been used to reflect both ethnic and political-economic relations. During the British administration, in contrast, Dutch cultural patterns came to reflect ethnic identity and economic power and not political power which lay in the hands of the British. Although pigs and sheep were differentially consumed over time by the inhabitants of early New York, pigs were no longer as central to the diet as had been the case during the Dutch period. Nonetheless, it is interesting to see that Dutch cultural patterns remained in force for at least 40 years after the British took over the colony (Grossman 1985b: 30).

New Amsterdam's population was not restricted to peoples of only Dutch or British descent. Spanish, Portuguese, Jewish, and other groups were present from the beginning of the colony. However, with the shift of New Amsterdam from Dutch to British rule in 1664, colonists came increasingly from the British Isles. The new colonists brought with them different sets of dietary tastes and preferences. Non-British ethnic groups came to represent a lesser proportion of the city's population over time. Even though the ethnic composition of New Amsterdam began to change with the advent of a British administration in 1664, the analysis of a variety of non-faunal artifact categories shows that "Dutch cultural patterns were still highly visible in early British New York until at least the 1680's" (Grossman 1985b: 23). This is reflected in the changing relative proportions of ceramic and pipe origins between the 1640-1650 and 1720 TPQ deposits. Ceramics and clay pipes of British origin begin to replace those from Dutch factories in 1680 deposits. The replacement process was completed by the

early 18th century (Grossman 1985b: 17-21).

It is hypothesized that the increased emphasis upon more typically British goods in the 1720 deposits is possibly a reflection of the increased British immigration and cultural presence in the colony during this period. There is a change from a predominantly lowland Dutch/Germanic to Anglo-Saxon origin among the new colonists in the lower Manhattan colony. The occupants of this block were of Dutch descent in the mid-17th century and of British descent afterwards. The shift in proportion of pig and sheep remains in the PFMA following upon the heels of the British conquest of New Amsterdam occurs at a temporally significant point. Whether this represents a widespread geographic trend as the area becomes more urbanized or a localized shift from Dutch to British dietary behavior is difficult to predict given the dearth of published assemblages from the region.

Alternative hypotheses, however, must be tested before the ethnicity hypothesis can be considered supported. Several possibilities readily come to mind to explain the increasing frequencies of mutton and beef relative to pigs:

a. The draining and/or filling of swampy areas around the edge of lower Manhattan. The first serious attempts to drain swampy areas in lower Manhattan took place during the 1650s (Innes 1902). However, as Geismar (1987) amply documents, extensive filling operations continued to take place along the East River waterfront during much of the 18th century. The advent and continuation of filling/drainage operations in Lower Manhattan does correlate with the observed shifts in the frequencies of pig, sheep, or cattle.

b. New marketing patterns. There might have been a shift toward older animals with more durable bones as the result of the growth of the wool and milking industries as experienced in post-Medieval Britain (Maltby 1979). As a result, cattle and sheep, which were exploited for their secondary products, would become archaeologically more visible than pigs (cf. Greenfield 1988a; Payne 1973). However, the development of a sound domestic wool industry was not encouraged during the colonial period, only arising out of the Non-Importation

Movement which grew out of opposition to the Stamp Act of 1765 (Schlesinger 1966: 76). Also, a quick glance at the age distribution from the Broad Financial Plaza assemblage shows little significant change in age distribution over time.

Another marketing change would have been a shift in the loci of animal production away from the urban core. As New York City and its food demands grew, it developed a complex relationship between the urban core and the surrounding rural communities. Eventually, livestock husbandry in the surrounding rural communities became geared to the demands of the urban market. As Davis (1987: 186) has proposed for post-Medieval Britain, faunal data from urban sites may provide 'mirror-images' of the data from rural contexts. Those animals eaten at home were those not sent to market. The diet of farm families should, therefore, change as they became increasingly dependant upon demand from urban markets. However, few contemporary rural communities actively involved in livestock production for urban markets have been excavated in New York City's catchment—which would be an important direction for future research.

c. The low frequencies of caprines and relatively high frequencies of pigs in the 17th-century Chesapeake Bay area has been explained by Miller (1984: 232) as a function of the time necessary to care for them and protect them from predation. Pigs need much less care than sheep. This is true, as Young (1987: 74) notes, of a frontier situation, but it could also explain the rise in ovicaprine frequencies over time as the colonial outpost of New Amsterdam grew into the town and city of New York. The role of predators would have been reduced over time through habitat destruction. With deforestation of central and northern Manhattan under the British, vast areas of safe grazing would have appeared. Once again, samples from a larger variety of sources are necessary to place this assemblage within such a context.

Only future research may enable us to definitively untangle the web of economic and social relationships affecting the distributions of New York City faunal remains. This can only be achieved through the analysis of large number of faunal samples from a variety of controlled urban and rural deposits and a careful

consideration of their historical contexts.

Conclusion

This study represents an initial attempt to use zooarchaeological data to test some of our ideas about the complex socio-economic history of colonial New Amsterdam and New York. However, the presently-available data are too few to provide more than a tentative outline of patterns that must be tested with larger data sets that, one hopes, will become available in the near future. Larger data sets would eliminate the effects of stochastic variation resulting from small sample size. Unfortunately, there are no other presently available data sets in the literature that can be used to test the conclusions based upon changes in the relative frequencies of the major mammalian food species.

In conclusion, our understanding of the relationship between ethnicity, patterns of food consumption and disposal, and the changing environment in early historical New Amsterdam-New York can be increased through zooarchaeological studies. Faunal remains can be a sensitive indicator of changes in cultural behavior and should be accorded equal status in the hierarchy of significance when planning artifact recovery and analysis. They add yet another means by which we may increase our understanding of human activities.

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