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Domestic Stock Age Profiles and Herd Management Practices: Ethnoarchaeological Implications from Maasai Settlements in Southern Kenya

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ABSTRACT: Age profiles of domestic stock from East African late Holocene archaeological sites have been used to make inferences regarding the advent and development of early pastoral economies ca 5000 to 2000 years ago. This ethnoarchaeological study among contemporary pastoral Maasai of southern Kenya was undertaken to examine the basis of these inferences in particular, and the interpretations that have been made regarding prehistoric herd management practices generally. Age profiles at the Pastoral Neolithic sites and those of contemporary Maasai settlements appear to be very similar. This supports the hypothesis that modes of subsistence and herd management practices at the prehistoric sites may have been closely similar to modern ones. Results also show that natural factors of mortality, rather than intentional culling contributed significantly to faunal accumulation on the Maasai settlements studied. I suggest that the reconstruction of prehistoric herd management on the basis of age profiles should consider the role of natural causes of mortality, and the possibility that intentional strategies of culling may play a more limited role in the formation of the zooarchaeological record than previously suggested.

KEY WORDS: AGE PROFILES, PASTORAL NEOLITHIC, ETHNOARCHAEOLOGY, EAST AFRICA

RESUMEN: Los perfiles de edad del ganado doméstico de yacimientos arqueológicos del Holoceno final en Africa oriental han sido utilizados para realizar inferencias concernientes a la llegada y desarrollo de las primeras economías pastorales hace ahora entre 5000-2000 años. Este estudio etnoarqueológico entre los pastoralistas Masai contemporáneos del sur de Kenia se llevó a cabo para examinar la validez de estas inferencias y las interpretaciones a las que han dado lugar en lo relativo al manejo de manadas prehistóricas en general. Los perfiles de edad en los yacimientos neolíticos de pastores y los contemporáneos asentamientos masais parecen ser muy similares. Esto apoya la hipótesis de que los modos de subsistencia y práctica pecuarias en los yacimientos prehistóricos pudieron haber sido muy parecidos a los actuales. Los resultados también evidencian los agentes naturales de mortandad, más que el sacrificio intencionado de reses, contribuyen de modo significativo a generar los acúmulos faunísticos en los asentamientos masais estudiados. Se sugiere que la reconstrucción del manejo prehistórico de cabañas basada en perfiles de edad debería tener presente el papel desempeñado por los agentes de mortandad natural y la posibilidad de que las prácticas pecuarias intencionadas referentes al sacrificio puedan desempeñar un papel más secundario en la génesis del registro arqueozoológico de lo que hasta ahora se supone.

PALABRAS CLAVE: PERFILES DE EDAD, ETNOARQUEOLOGÍA, ECONOMÍA PASTORAL, NEOLÍTICO, AFRICAORIENTAL

BACKGROUND

Age distributions in faunal samples from archaeological sites have been widely used as the basis for inferences about prehistoric herd management and pastoral economies. In the Near East, for instance, age profiles have been used to identify incipient domestication of animals. A, and a shift from a random age distribution to a greater proportion of young and near-mature animals has often been used to suggest a change from hunting to domestication (e.g., Bökonyi, 1969; Ducos, 1978; Hesse, 1982). Age profiles have also formed the basis of inferences regarding specialized patterns in prehistoric animal husbandry (Payne, 1973; Hesse, 1982; Davis, 1984). It has been suggested that flocks managed for meat can be distinguished from those managed for milk on the basis of the proportions of immature to mature, and male to female slaughtered (Payne, 1973). Such patterns of economic decision-making are thought to be reflected in archaeological faunas from many regions of the world.

In sub-Saharan Africa, the advent and development of pastoral economies involved the introduction of animal species domesticated in northern Africa and the Near East, and the southward spread of these domesticates along with human population movements (Smith, 1992; Marshall, 1994). Information on the age distributions in domestic stock have been used to detect ecological aspects of the spread of pastoral economies and, interactions between contemporaneous hunter-gatherers and pastoralists, as well as to provide insights into the development and structure of complex Iron Age societies.

In East Africa, age profiles have been used to address interpretive difficulties associated with the advent and development of pastoral economies ca. 3000 to 2000 BP. Gifford-González (Gifford-Gonzalez, 1984), Marshall (1990) and Marshall and & Stewart (1995) note that faunal samples from the late Holocene sites are made up predominantly of sub-adults and adult cattle and sheep and goats (see below for age category descriptions used in this paper). This is in contrast to the expectations, based on ethnographic literature, since these are the ke age classes for milk production and herd growth, and are thus hardly slaughtered (Dahl and & Hjort, 1976). Marshall (1990) and Gifford-González (1984) discuss a range of hypotheses and factors to explain the differences, including sampling and taphonomic biases, as well as the possibility that the Neolithic herd management practices differed from those of contemporary pastoralists in the region.

In Southern Africa, cattle age structures from early Iron Age sites have been used as indicators of environmental stresses in the in-migrating herds (Mason *et al*., 1983; Plug and & Voigt, 1985). These herds showed a predominance of young animals, and Plug and Voigt and Plug have suggested that in a community just moving into the area and settling down, an active culling program is unlikely. The high mortality among young animals at these sites, they argue, is related to inhibiting environmental factors. such as drought and extremes of seasonality.

Age profiles of the domestic stock have also been the basis for inferences about social stratification and relations of power among later Iron Age communities in central and southern Africa. Immature animals dominate the faunal assemblages from sites associated with the elite groups in Great Zimbabwe and other regions, whereas mature animals appear in non-elite settlements (Sinclair, 1984). Such profiles have been interpreted as indicating the control of surplus resources by elite members of the society.

These examples show that in Africa, as in Western Asia and other regions, age profiles of domestic herds can be a powerful tool for understanding a wide range of issues. Other aspects of the zooarchaeological record, such as the taxonomic composition, body part representation and bone modification have been extensively studied in ethnographic contexts but very little research has been conducted to examine how age profiles are produced and patterned in ethnoarchaeological contexts. My ethnoarchaeological study of the factors affecting the formation of archaeological faunal assemblages on modern pastoral Maasai settlements in Southern Kenya was undertaken to test some of the current hypotheses regarding the meaning of age profiles generally, and more specifically those of the late Holocene in East Africa.

DATA COLLECTION AND ANALYSIS

This study was conducted in 1989 among the pastoral Maasai of Kuku Plain in Southern Kenya. At the time, the Kuku Plain Maasai were practicing a relatively traditional mode of subsistence, relying heavily on cattle and small stock herds for their subsistence. My study involved the collection of data from the modern Maasai settlements (*enkang*) on the structure of living herds and on their mortality patterns over the study period. In addition, data on age profiles were obtained from the analysis of dental material from the settlements used by three family homesteads. These three *enkang* were selected because of their location away from the urban and market centers in the area indicated that they were, and therefore considered to be relatively less integrated in the modern market oriented subsistence systems.

Data on the structure and composition of living herds were collected through interviews with elders (who were also the stock-owners) and, as well as school going youths from each family who were familiar with the history of the herds. Data on the size of the stock, species, sex and age composition were gathered and entered into obtained and filled in prepared data sheets. The age categories were defined as *Neonate* (calves, lambs, and kids), *Juvenile* (older than neonate and younger than breeding age), *Adult* (breeding age to a maximum limit of 5 offspring in breeding life span), and *Aged* (more than 5 offspring in a breeding life-span/stopped breeding due to old age) (the subadult category previously mentioned in connection with faunal studies and that we do not consider here can be loosely taken to refer to animals either very close to maturity or fully mature that have not bred). These categories were explained to my local experts. I also counted the animals myself, with the help of the youths and a research assistant, a local Maasai student at the University of Nairobi. The counting was done as the animals returned from grazing and entered the homesteads.

Data on mortality was collected through interviews with the elders/stock owners and the youths familiar with the history of the herd. At each of the three homesteads, the local experts were asked to list state in whichthe different ways the animals had been dispensed with. This includes "export" (through sale, gifts, loans or bride wealth), slaughtered for domestic consumption, or death (from diseases, drought or predation by wild animals). In each category, I asked the experts how many animals, and of which age and sex had been dispensed with or lost over the past one and a half years, from approximately January 1988 to June 1989. I considered my period of study to be a 'normal' period and not characterized by extremes of droaught or diseases.

Data on faunal patterning were collected from the three homesteads as well as the three individual meat-eating sites (*orpejet*) used by the three homesteads. In addition to the *enkang* and *orpejet*, one home encampment used by Maasai youth initiates (*Manyatta*) and its special meat eating site (*orpuli*), and one enclosed area reserved for sick or weak animals (*olopololi)* were also studied. Each of these sites was mapped and a surface collection was made of all the faunal remains. The dental specimens were analyzed using tooth eruption sequences and wear stages. I used codes with descriptions of different wear stages following the methods developed by Deniz & Payne (1982) and modified for East Africa by Gifford-González (1984) and Marshall (1990).

Thus, three categories of data were eventually gathered: the structure and composition of the living herds, obtained through interviews and by counting animals in the three *enkang* settlements; age profiles of recent mortality from natural factors and culling of the live herd; and age profiles in faunal assemblages collected from the 3 *enkang* and associated *orpejet*, 1 *manyatta* and associated *orpuli*, and the *olopololi*. These data were then compared with those observed at Pastoral Neolithic sites in central and Southwestern Kenya.

RESULTS

The results of the faunal census of the three Kuku Plain Maasai settlements and meat eating sites are presented in three categories: a) structure and composition of the living herds b) age composition of recent mortality, and c) faunal age distribution estimated from dental samples.

a) A*ge structure of living herds*

The age structure of living cattle and small stock herds in the Kuku Plain is dominated by juvenile and adult animals (Table 1). Aged animals were least represented. The proportion of adult cows was greater than that of males by 64%. This pattern reflects the relative economic and subsistence importance of different age and sex classes. In many traditional pastoral systems of East Africa, the larger number of adult animals is a result of maximization of the proportion of breeding animals, especially milk cows. If animals are raised for market or meat consumption, juveniles may

	TOTAL	%	Cattle	%	Sheep	%	Goats	%
Neonate	**48**	**10.1**	10	*05.4*	15	*10.8*	23	*15.0*
Juvenile	**186**	**39.4**	59	*32.2*	62	*44.9*	65	*43.0*
Adult	**212**	**44.9**	104	*58.8*	55	*39.8*	53	*35.0*
Aged	**26**	**5.5**	10	*05.4*	6	*04.3*	10	*07.0*
Total	**472**	**100.0**	183	*100.0*	138	*100.0*	151	*100.0*

TABLE 1

Kuku Plain: Age Composition of living herds in three households.

dominate the living herd as a result of many fewer animals being retained into adulthood or old age. The age structure of Kuku Plain herds, therefore, agrees with our expectation of a pastoral subsistence economy that is oriented towards the optimisation of herd growth and milk production.

b) *Mortality profiles in living Maasai herds*

According to the herders, a total of 195 animals died during the 1988/1990-study period (Tables 2 and 3). Twenty-two percent of total mortality represented animals intentionally slaughtered for food. The rest of the animals died of natural causes.

Enkang 1	**TOTAL**		**NEONATE**		**JUVENILE**		**ADULT**		**AGED**	
		%		%		%		%		%
slaughter	3	*10*	0	*0*	2	*67*	1	*33*	0	*0*
disease	15	*45*	6	*40*	6	*40*	2	*13*	1	*7*
drought	15	*45*	7	*47*	2	*13*	5	*33*	1	*7*
Total	**33**	***100***	**13**	***39***	**10**	***30***	**8**	***24***	**2**	***6***
Enkang 2	**TOTAL**		**NEONATE**		**JUVENILE**		**ADULT**		**AGED**	
		%		%		%		%		%
slaughter	1	*8*	0	*0*	0	*0*	1	*100*	0	*0*
disease	4	*33*	0	*0*	4	*100*	0	*0*	0	*0*
drought	7	*58*	3	*43*	0	*0*	2	*29*	2	*29*
Total	**12**	***100***	**3**	***25***	**4**	***33***	**3**	***25***	**2**	***17***
Enkang 3	**TOTAL**		**NEONATE**		**JUVENILE**		**ADULT**		**AGED**	
	%	%	%	%	%					
slaughter	4	*18*	0	*0*	1	*25*	3	*75*	0	*0*
disease	4	*18*	0	*0*	2	*50*	0	*0*	2	*20*
drought	14	*64*	7	*50*	0	*0*	0	*0*	0	*0*
Total	**22**	***100***	**7**	***32***	**3**	***14***	**10**	***45***	**2**	***50***
GRAND	**TOTAL**		**NEONATE**		**JUVENILE**		**ADULT**		**AGED**	
	%	%	%	%	%					
SLAUGHTER	8	*10*	0	*0*	3	*33*	5	*67*	0	*0*
DISEASE	23	*34*	6	*26*	12	*52*	2	*9*	3	*13*
DROUGHT	36	*54*	17	*47*	2	*6*	14	*39*	3	*8*
TOTAL	**67**	***100***	**23**	***34***	**17**	***25***	**21**	***31***	**6**	***9***

TABLE 2

Kuku Plain Cattle: Herder Information on Age Mortality in Cattle.

Enkang 1	**TOTAL**		**NEONATE**		**JUVENILE**		**ADULT**		**AGED**	
		%		%		%		%		%
slaughter	17	*35*	0	*0*	3	*18*	14	*82*	0	*0*
disease	19	*40*	9	*47*	3	*16*	7	*37*	0	*0*
predation/accidents	0	*0*	0	*0*	0	*0*	0	*0*	0	*0*
drought	12	*25*	5	*42*	0	*0*	4	*33*	3	*25*
Total	**48**	***100***	**14**	***29***	**6**	***13***	**25**	***52***	**3**	***6***
Enkang 2	**TOTAL**		**NEONATE**		**JUVENILE**		**ADULT**		**AGED**	
		%		%		%		%		%
slaughter	7	*39*	0	*0*	1	*14*	5	*71*	1	*14*
disease	10	*55*	7	*70*	0	*0*	3	*30*	0	*0*
predation/accidents	1	*5*	0	*0*	1	*100*	0	*0*	0	*0*
drought	0	*0*	0	*0*	0	*0*	0	*0*	0	*0*
Total	**18**	***100***	**7**	***39***	**2**	***1***	**8**	***44***	**1**	***6***
Enkang 3	**TOTAL**		**NEONATE**		**JUVENILE**		**ADULT**		**AGED**	
		%		%		%		%		%
slaughter	10	*16*	0	*0*	9	*90*	0	*0*	1	*10*
disease	7	*11*	0	*0*	0	*0*	3	*43*	4	*57*
predation/accidents	3	*5*	1	*33*	1	*33*	1	*33*	0	*0*
drought	42	*6*	12	*29*	11	*29*	16	*38*	3	*7*
Total	**62**	***100***	**13**	***21***	**21**	***34***	**20**	***32***	**8**	***13***
GRAND	**TOTAL**		**NEONATE**		**JUVENILE**		**ADULT**		**AGED**	
		%		%		%		%		%
SLAUGHTER	34	*26*	0	*0*	13	*38*	19	*56*	2	*6*
DISEASE	36	*28*	16	*44*	3	*8*	13	*36*	4	*11*
PRED/ACCIDENTS	4	*3*	1	*25*	2	*50*	1	*25*	0	*0*
DROUGHT	54	*42*	17	*32*	11	*20*	20	*37*	6	*11*
TOTAL	**128**	***100***	**34**	***26.6***	**29**	***23***	**53**	***41***	**12**	***9***

TABLE 3

Kuku Plain Herder Information on Age Mortality in Sheep/goats.

Animals that died from diseases comprised 46% (n=90), those that did from drought/starvation 30% (n=59), and from predation/accidentsmade up 2% (n=4). Patterns did not differ substantially between households and species. Very few animals were intentionally slaughtered for food. Non-intentional factors (disease, drought, accidents, and predation by wild animals) were the overriding causes of mortality in both cattle (88%) and sheep/goats (74%). Most of the animals died from starvation caused by droaught (54% of cattle, 42% of sheep/goats), and from disease (34% of cattle, 26% of sheep/goats). These two causes of mortality are closely related, and informants were sometimes not clear on which of the two factors was the cause of death. Some animals that were reported to have died from drought may have died from diseases during the dry seasons.

When intentional slaughter is considered separately and correlated with actual herd sizes over the study period, 4.3% of the cattle and 11.8% of the small stock were intentionally culled. These figures agree very well with the 8% off-take ratio quoted by Dahl & Hjort (1976). As noted by Dahl and Hjort, and as well on the Kuku Plain, a larger proportion of small stock than cattle is common among local pastoralists.

With regard to sex, the number of males that were intentionally slaughtered is higher than that of females for both cattle (87% male: 13% female) and sheep/goats (68% male: 32% female). These proportions are expected in a subsistence strategy that maximizes the number of female cattle in order to enhance milk production and herd growth. Only 22% of all mortality is, however, due to slaughter. The vast majority of animals (78%) die of natural causes. These animals are predominantly female because female animals dominate the living herds. Sixty-two percent (62%) of the slaughtered cattle were adults, and 38% were juveniles. No aged cattle were slaughtered. These animals were usually sold or given out as gifts. I noted similar patterns for small stock, but with relatively higher proportions of natural mortality affecting neonates.

c) *The faunal record of Maasai settlements*

A total of 110 (NISP=157) Minimum Number of Individuals (MNI) or 157 identified specimens (NISP) ofin cattle were estimated. In sheep/goats an MNI of 60 was estimated from 89 specimens (Tables 4 and 5). Surprisingly, a much smaller proportion of the small stock versus the large stock was represented in the faunal record. The general ethnographic literature, as well as stockholder information that I obtained on mortality patterns, suggests that small stock, rather than cattle are the main source of meat for African pastoralists. They constitute a larger proportion of living herds and contribute a greater proportion of both intentional and natural mortality. According to Dahl & Hjort (1976), 11% of the sheep and goat and 4% of the cattle herd may be culled annually while maintaining growth. Cattle are relied on for milk production and bulls are only slaughtered in ceremonies or given as gifts.

I attribute the predominance of cattle in the Kuku Plain faunal record to taphonomic factors and to recovery and sampling procedures. A significant proportion of the small stock is usually consumed at meat-eating areas (Mbae, 1990; personal observation). These sites are located outside the fenced compounds, and therefore easily accessible to scavenging animals. In addition, herders pointed out that in contrast to cattle, sheep and goat are never eaten when they die from diseases. The dead animals are either buried or discarded away from habitation areas, and usually eaten by scavenging wild animals. Taphonomic factors can, thus, account for the less than expected proportion between cattle and sheep/goats in the Kuku Plain data.

Atotal of 110 individuals (MNI) were estimated from 157 cattle mandibles, with the age distribution

	TOTAL		**NEONATE**		**JUVENILE**		**ADULT**		**AGED**	
	NISP	MNI		%		%		%		%
Enkang 1	10	8	0	*0*	4	*50*	4	*50*	0	*0*
Enkang 2	35	24	0	*0*	7	*29*	15	*63*	2	*8*
Enkang 3	35	25	0	*0*	18	*72*	6	*24*	1	*4*
Manyatta	47	31	0	*0*	5	*16*	20	*64*	6	*19*
Olopololi	30	22	1	*4*	15	*68*	3	*14*	3	*14*
Total	**157**	**110**	**1**	***0.9***	**49**	***45***	**48**	***43***	**12**	***11***

TABLE 4

Kuku Plain Faunal Age Distribution in Cattle.

	TOTAL		**NEONATE**		**JUVENILE**		**ADULT**		**AGED**	
	NISP	MNI		%		%		%		%
Enkang 1	39	25	0	*0*	9	*36*	15	*60*	1	*4*
Enkang 2	12	10	0	*0*	5	*50*	5	*50*	0	*0*
Enkang 3	23	16	0	*0*	8	*50*	2	*12*	6	*6*
Manyatta	14	8	0	*0*	2	*25*	4	*50*	2	*25*
Olopololi	1	1	0	*0*	1	*0*	0	*0*	0	*0*
Total	**89**	**60**	**0**	***0***	**25**	***42***	**26**	***43***	**9**	***15***

TABLE 5

Kuku Plain: Faunal Age Distribution in Sheep/Goats.

as follows: neonate 1 (1%), juvenile 49 (45%), adult 48 (44%), and aged 12 (11%). The juvenile class comprised 42% (n=25) of the small stock, adults 43% (n=26), and the aged animals 15% (n=9). With the exception of neonate animals, there is a fairly close similarity between the Kuku Plain informant data and the archeological record. The different sites are also quite similar to each other, suggesting that sampling biases are not great. Neonates in both cattle and small stock, however, appear to be archaeologically under-represented. This probably is due to taphonomic factors. Unlike prime and sub-adult cattle, which when they die or are ailing are usually consumed for food, neonate animals are not usually consumed. When they die, one would expect their carcasses to be discarded away from habitation areas, and not to form part of archaeologically recoverable samples. Neonate faunal remains are also more fragile and susceptible to post-discard destruction processes than are the bones of older animals. Faunal assemblages from Kuku Plain, therefore, reflect both behavioral reality and taphonomic expectations fairly well.

COMPARISON OF KUKU PLAIN AND PASTORAL NEOLITHIC AGE MORTALITYPROFILES

Data on the taxonomic and age distribution at four pastoral Neolithic sites is presented in Table 6. Three sites, Ngamuriak, Gogo Falls and Prolonged Drift, were selected for comparison with the Kuku Plain data because they are located in fairly similar habitats of wooded or bushy savanna. The sites are also of the same time period, ca. 3500 to 1500 bp, associated with the advent of pastoralism in the region, and analyzed by Marshall (1990) and Gifford-González (1984) using similar methods to those used in the Kuku Plains study.

Cattle age distributions at the Pastoral Neolithic sites are dominated by juvenile and adult age categories. This pattern is similar to both living herds and faunal assemblages from the Kuku Plain, as well as herder information on mortality patterns. The Neolithic pattern differs, however, from contemporary herder information on overall mortality in the cattle herds at the Kuku Plain (Tables 7 and 8). Neolithic age profiles include significant numbers of neonate animals that are not present in the Kuku Plains faunal or archaeological assemblages. One possible explanation is that the Kuku Plain pastoralists do not frequently cull young animals as early pastoralists may have done. An alternative explanation is that, unlike early pastoralist's, Kuku Plain pastoralists discard dead neonate animals away from habitation areas where they are eaten by dogs or wild carnivores.

The ethnographic literature suggests that traditional pastoral systems such as those of the Maasai are largely oriented towards milk production and herd growth in the context of fluctuating cycles of drought and disease (Dahl and & Hjort, 1976). Reproductive prime-age adult animals are, therefore, rarelyhardly slaughtered. Cattle meat is

	TOTAL	NEONATE		JUVENILE		ADULT		AGED	
Ngamuriak			%		%		%		%
Cattle	26	4	*15*	6	*23*	14	*54*	2	*8*
Sheep/goats	69	8	*11*	18	*26*	39	*56*	4	*6*
Gogo Falls									
Cattle	10	1	*10*	2	*20*	5	*50*	2	*20*
Sheep/goats	17	0	*0*	9	*53*	8	*47*	0	*0*
Prolonged Drift									
Cattle	22	1	5	5	*23*	10	*45*	6	*27*
Sheep/goats	5	0	*0*	2	*40*	3	*60*	0	*0*
Mean Distributions									
Cattle	58	6	*10*	13	*22*	29	*50*	10	*17*
Sheep/goats	91	8	*9*	29	*32*	50	*55*	4	*4*

TABLE 6

Pastoral Neolithic Faunal Age Distribution from Central and Southwestern Kenya (Gifford *et al*., 1980; Marshall, 1986).

	Kuku Plain Age Mortaly Distribution in Living Herds		Kuku Plain Faunal Age Distribution	Plastoral Neolithic (Ngamuriak)
	Slaughter	Natural Mortaly		
Neonate	0	39	1	15
Juvenile	33	24	45	23
Adult	67	27	43	54
Aged	0	10	10	8

TABLE 7

Comparison of Kuku Plain and Pastoral Neolithic Age Mortality(%) in Cattle.

	Kuku Plain Age Mortaly Distribution in Living Herds		Kuku Plain Faunal Age Distribution	Plastoral Neolithic (Ngamuriak)
	Slaughter	Natural Mortaly		
Neonate	0	36	0	11
Juvenile	38	17	42	26
Adult	56	36	43	56
Aged	6	11	15	6

TABLE 8

Comparison of Kuku Plain and Pastoral Neolithic Age Mortality (%) in Sheep/goats.

largely contributed to the pastoral diet through natural mortality, ailing, or aged animals. Young bullocks may also be targeted for slaughter to reduce competition for fodder, and to maximize female productivity. The archaeological implications of this pattern are that many more aged individuals, and much fewer prime-adult animals will dominate the faunal age distribution. Marshall (1990) used this data to argue that the lack of neonates and the dominance of juvenile and prime adult individuals at Ngamuriak suggest a subsistence base comparable to that of well-off contemporary pastoralists, who can afford to slaughter prime age animals without endangering herd growth and herd production.

Marshall's interpretation is not well supported by data from the Kuku Plain settlements studied. Neither the herder information on slaughtering patterns nor the fauna from the Kuku Plains support this interpretation, as the Kuku Plains Maasai households studied were average rather than wealthy. In these settlements herders did not cull very young animals during the study period, and just as has been recorded at Ngamuriak and Prolonged Drift, slaughtered juvenile and adult animals instead. More importantly, however, intentional culling constituted only 10% of cattle mortality on the Kuku plain. Natural mortality dominated age profiles overwhelmingly. It is likely then, that age distributions at Ngamuriak and other archaeological sites reflect natural mortality more than they do culling, and are thus strongly related to the interaction of natural mortality with the structure of living herds.

It appears that the predominance of animals in their reproductive stage in pastoral Neolithic assemblages reflects, as it does today, a subsistence basis oriented toward the maximization of reproductive/milk-producing animals in the herd. When natural factors of mortality hit the herd (as they do more often than intentional culling practices do), the reproductive/prime-adult animals are the most severely affected. In addition, the Kuku plains faunal data suggest that, as a result of preservation biases, neonate mortality resulting from drought and disease is not well represented archaeologically.

NATURALMORTALITYVS. KILL-OFF PATTERNS

The Kuku Plain study shows that natural mortality plays a much more significant role in herd management practices than hitherto anticipated. At the Maasai settlements studied, 88% of cattle, and 74% of sheep/goat mortality resulted from natural causes. Gifford-González (1998) has noted that disease was a major handicap affecting early pastoral economies in East Africa. Animal diseases have also been noted as a common phenomenon among contemporary pastoralists. The pastoral Maasai settlements studied have also been affected by both disease and drought in recent history. Thus, although the animals are eaten in some instances, it appears that culling or intentional slaughter is not an important contributor to the meat resource. Herds are mainly managed for milk and herd growth because a high rate of natural mortality is anticipated. The implication of these patterns requires that we look at herd management strategies in East Africa more in relation to natural mortality than to strategic kill-off patterns. This is in contrast to the assumption in much of the anthropological literature that a productively viable herd of stable growth can be sustained only by culling undesired animals. This has significant implications for age mortality-based interpretations regarding prehistoric herd management practices in general.

Because a large proportion of the total mortality on the Maasai settlements studied was sustained through non-intentional slaughter, the inferences that we can draw from archaeological distributions regarding human selective strategies are limited. Among the pastoral Maasai studied and similar groups in the region, and as reported elsewhere (e.g., Cribb, 1987), mortality patterns are variable through time. Considering that a significant proportion of mortality results from natural causes, the profiles that result may not provide a meaningful basis for inferring a specified kill-off strategy that would indicate specific subsistence or herd management goals.

Where possible, distinguishing between male and female animals by morphological or metrical means, may in turn be useful in separating intentional culling from natural mortality. Thus, it would be expected that a male dominated mortality profile would reflect culling, whereas heavy female mortality might be indicative of natural mortality generally (Hesse, 1982). I recognize, however, that bones are heavily processed on African sites and that it is very rare for specimens to be complete enough to allow such differentiation. In the absence of new analyses, it is perhaps safer for archaeologists to assume that natural mortality is the dominant process accounting for archaeological faunal assemblages, and to assume that neonate age classes are absent for taphonomic reasons.

CONCLUSION

A close similarity in faunal age distribution between modern pastoral Maasai settlements and the East African Pastoral Neolithic suggests similar modes of subsistence and herd management practices. Differences in the relative under-representation of some age classes may partly be attributed to taphonomic and sampling factors. However, culling has probablyve played a much more limited role in the production of the age profiles than is commonly assumed. These results have implications for precise interpretations of faunas from Pastoral Neolithic sites in East Africa, and for discussions of the status of prehistoric pastoral settlements in general. They may also be important for interpretations of domestication and pastoral specialization in the Near East and other areas. Herd management practices in small scale societies of sub-Saharan Africa and Asia, for instance, are surprisingly similar cross-culturally and are oriented towards herd growth (Dahl and & Hjort, 1976; Cribb, 1987). Culling has been considered an important component of such practices, yet there is limitedttle literature on how intentional *versus* natural mortality may shape archaeological faunal records. Studies of this kind are needed to address the role of natural mortality in herd management practices, and the implications these might have for archaeological faunal patterning.

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