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Caribou sharing and storage: refitting the Palangana site

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Abstract

The distribution of caribou at the Palangana site (XCL-00130), Alaska, is compared to two models of hunter–gatherer food sharing. Variance reduction and tolerated theft based on ethnographic observations and mathematical modeling are translated into residual archaeological faunal assemblages based on element frequencies and anatomical refitting. These models, applied to the Palangana caribou assemblage, indicate that food sharing occurred between the site occupants in a manner similar to tolerated theft. Food sharing behaviors are established through comparison of the faunal assemblages of two discrete households occupied contemporaneously. Analysis concludes that stored caribou were distributed among the households in response to consumer needs. © 2002 Elsevier Science (USA). All rights reserved.

The sharing of food resources is frequently cited as a fundamental characteristic of human behavior and the foundation of hunter–gatherer economies (Binford, 1981, 1985; Boyd and Richerson, 1988; Gowdy, 1998; Isaac, 1978; Isaac and Crader, 1981; Lee and Devore, 1968; Sahlins, 1972; Service, 1966; Vos and Zeggelink, 1996). “Sharing” an act that results in the distribution of goods from a provider to one or more recipients is alternatively seen as evidence of human altruism (Mauss, 1950; Service, 1966), a consequence of living in groups (Bell, 1995; Trivers, 1971), as part of a suite of procurement or risk reducing strategies (Blurton Jones, 1984; Smith, 1988; Winterhaldler, 1986), or a means of acquiring prestige and mating opportunities (Hawkes, 1990, 1991; Hill and Kaplan, 1988a,b). Recent ethnoarchaeological and ethnographic works among contemporary foraging societies have identified a variety of principles influencing both the contexts and the

extent to which the sharing of resources occurs (e.g., Binford, 1984; Cashdan, 1985; Hawkes, 1993; Kaplan and Hill, 1985; Kent, 1993a; Marshall, 1994; Minnegal, 1997). The purpose of this study is to determine the presence, extent, and nature of faunal resource sharing at the Palangana Site, Alaska (Binford, 1978, 1984). Ethnographic information enables faunal data to be related to the economic and social conditions at the time of occupation. After considering variation in sharing behaviors, a model is developed to recognize two major forms of sharing (variance reduction and tolerated theft) archaeologically. These models are then examined with the Palangana site faunal assemblage.

Sharing in living systems

The propensity of hunting and gathering peoples to share food resources has long been noted by anthropologists, but it has not, until recently, been shown that marked variability in the type

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and frequency of sharing behaviors exists within and between hunting and gathering groups (Blurton Jones, 1984; Hawkes, 1992; Kaplan and Hill, 1985; Kelly, 1995). This makes it difficult to explain food sharing solely as the direct result of an intrinsic morality of “good will” (Ingold, 1980) or strict obedience to an “egalitarian social order” (Endicott, 1988; Kent, 1993b). The sharing of goods, land, or information is a mechanism whereby participants reduce the risks inherent in foraging, especially hunting, or exploit the different procurement abilities of individuals and groups. When practiced, sharing exerts considerable influence on the social and economic relationships between participants, affecting the butchery process of carcasses (Gould, 1968; Marshall, 1993; Yellen, 1977), residential camp layout (Binford, 1991b; Fisher and Strickland, 1991; Whitelaw, 1989), and household faunal assemblage composition of residential units or households (Kent, 1993b; Marshall, 1993). Such effects vary among hunter–gatherer communities, depending on the frequency and context in which food resources are shared.

Though sharing has received much theoretical and ethnographic attention, it has relatively low archaeological visibility and its identification is neither simple nor straightforward (Enloe, 1991; Enloe and David, 1992; Henshaw, 1999, 1995; Rapson, 1990). Identifying its existence archaeologically is currently predicated on the ability to discern contemporaneous procurement and consumption units at the level of individuals, families, or residences. Where archaeologists have investigated sharing, they have done so by focusing on discrete features such as hearths (Enloe, 1991; Rapson, 1990) and residential structures (Henshaw, 1999, 1995; Zeder and Arter, 1996). Without contemporaneous features, sharing must be inferred from far less direct lines of evidence based on theoretical arguments and empirical ethnographic patterns such as reliance on big-game hunting, small group size, or high mobility.

If sharing is to be detected archaeologically, variability in living systems cannot be overlooked. Sharing is a context-dependent behavior, effectively distributing resources when and where necessary. Thus, we cannot seek evidence simply of sharing archaeologically but must also address different forms of sharing behavior. The categorization of past human groups simply as “sharers” versus “hoarders” would be a meaningless endeavor. Recognizing variability in sharing behaviors, however, raises two questions: why do

people share and can different kinds of sharing be seen archaeologically? Before addressing food sharing at the Palangana site, we must examine the variables that govern sharing in modern foraging communities and how different forms of sharing relate to the material record available to archaeologists.

Why Share?

Sharing can be expected to occur in relation to the relative costs and benefits resulting from the redistribution of goods. The old adage “it is better to give than receive” is not universally true, as sharing need not result in equal benefits to all parties involved, for all resources, in all seasons, or in all environmental, social, and cultural contexts. By redistributing resources, sharing effectively establishes and alters the social and economic relationships between providers and consumers (Blurton Jones, 1984, 1987; Hawkes, 1993, 1992; Kaplan and Hill, 1985; Wilson, 1998). For sharing to occur, a provider must relinquish some portion of their procured goods to others. What is gained in return, at a later time, may not be equal to the caloric or economic value of the goods that were initially exchanged. However, the directional flow of resources from giver to receiver has been shown to vary in predictable ways. Factors influencing the flow of such goods include kinship distance (Gargett and Hayden, 1991; Gould, 1968, 1980; Yellen, 1977), social obligations (Altman and Peterson, 1988; Bailey, 1991; Kaplan and Hill, 1985), and whether the resource is procured via individual or communal hunting (Bailey, 1991; Binford, 1978; Marshall, 1994). In general, sharing is most likely to occur between close kin and between people who have shared previously, either as a result of cooperative hunting endeavors or friendship.

A growing body of ethnographic research indicates that sharing occurs more frequently where there is a high degree of variance (e.g., daily, seasonally) in the amount of resources procured (Bailey, 1991; Winterhalder, 1986). Large animal carcasses are more frequently and widely distributed than easily obtained small animals or plants (Bunn et al., 1988; O’Connell et al., 1988, 1990; Yellen, 1991). In sum, the larger, rarer, and more unpredictable the targeted item, the more likely it will be shared. *Tolerated theft*, *variance reduction*, and *exchange* are three generalized models that seek to explain why sharing evolved and how it is maintained in foraging societies, and are based

primarily on the relationship between risk and package size. While all three model the alleviation of differences between acquisition and consumption, based on the perceived social and economic values of procured resources, each highlights a different aspect of the sharing process. Variance, based on the risk associated with procurement (i.e., the probability of not procuring targeted resources), results in an unequal distribution of “high-risk” resources between members of a group at any given time. Plant resources are generally considered low-risk items, whereas the procurement of animals, particularly large body size species, is associated with a greater risk. Package size refers to both the quantitative size of a resource (large versus small animals) as well as their inherent economic value. Large packages (whether in size or calories) are most frequently shared.

Through mathematical modeling, Winterhalder (1986) shows that one way to overcome the periodic shortfalls associated with high-risk foods is to share these resources among a cooperative group of providers. One hunter’s success can then be distributed to less successful hunters, creating a reciprocal, cooperative relationship through time that pools risk and minimizes the variance between individual return rates (Bailey, 1991; Kent, 1993a; Lee, 1979; Marshall, 1994). This is the *variance reduction* hypothesis. High-risk foods often come in large package sizes and this presents an immediate problem, as storage is frequently imperfect or impossible. When large resources or large amounts of resources are procured, without the possibility of storage, the concept of *tolerated theft* (the permissible stealing of resources) has been used to explain their distribution. Sharing is generally considered a reciprocal behavior wherein goods are received with the intent of repayment approximately in kind at some unspecified future date. Tolerated theft, on the other hand, assumes that once the “owner” of a resource has an adequate share, the remainder of the resource is of diminished value and not worth defending from the demands of others who are in need (Blurton Jones, 1984, 1987; Wilson, 1998; Winterhalder, 1996). It is only after initial satiation of the procurer is reached that redistribution through tolerated theft can occur. The inequality between the perceived value of the resource for the donor and the recipient drives the interaction.

A third model of sharing is *exchange* of qualitatively different goods such as trading meat for other foods, manufactured items, raw mate-

rials, labor, or social and reproductive benefits. The costs and benefits of exchange rest on the relative worth of the exchanged items. When intangible goods such as social prestige and respect are received in return for resource sharing, distribution is difficult to characterize in terms of hunting variance and package size. Hawkes (1990, 1991, 1992, 1993) suggests that in some foraging societies hunters who share do not incur *economic* benefits equal to the amount of goods they provide to others. In their study of the Ache, Kaplan and Hill (1985) (also Hill and Kaplan, 1988a,b) conclude that hunters share meat in exchange for increased reproductive opportunities.

Sharing in the archaeological record

Models of sharing behavior have been derived from studies of living communities and via mathematical modeling. Their application to the archaeological record remains untested. Since the sharing of food items, particularly animal products, can result in archaeologically identifiable residues (faunal remains), the different forms of sharing described above are potentially detectable provisioning strategies. How sharing contributes to faunal assemblage composition, such as element frequencies, species counts, and patterns of conjoining specimens, will ultimately determine the applicability of tolerated theft, variance reduction, and exchange to archaeological study. To determine what meat sharing would “look like” archaeologically, tolerated theft and variance reduction are translated from modeled human behaviors to residual faunal assemblages in archaeological contexts.

Modeling resource distribution

A simple model of resource distribution is developed here. Only variance reduction and tolerated theft distributions are examined, sharing as exchange is not. By dividing caribou “carcasses” into 11 butchery units, general distributive patterns between four hypothetical households can be discerned. Carcass segments are based on common forager dismemberment patterns for large ungulates (Binford, 1978; Bunn et al., 1988; Marshall, 1994), and for the sake of simplicity, represent large meat/marrow packages as opposed to individual faunal elements and their associated tissues. Each carcass is divided into 11 anatomical

portions (Fig. 1) that can be distributed among households. Each household is designated the role of either “provider” or “receiver” for each carcass. When a household provides a carcass it has the option to “share” it with other households. Both the variance reduction and tolerated theft distributions are based on 16 caribou carcasses but involve different number of providers and receivers in each case. For variance reduction, each household provides the same number of carcasses and receives an equal number of carcass segments, with all 16 caribou being shared among the four households. For tolerated theft, one household is designated the role of primary provider and the remaining households are mainly receivers. The providing household preferentially retains most of the carcass, distributing only low utility segments.

A variance reduction distribution of meat does not imply that each carcass procured is immediately partitioned and distributed in equal packages among group members. Rather, it refers to the accumulative effect of numerous procurement and distributive acts over time. Theoretically, reciprocal meat sharing over time, in a manner that reduces variance for all group members, should result in an archaeofaunal distributional pattern distinct from that resulting from tolerated theft. In the variance reduction model, households “provide” carcasses one at a time, not synchronously. Each caribou carcass secured by a household is divided into 11 units and all portions are then distributed sequentially among all four households. Household One provides the first carcass, then Households Two, Three, and Four,

and the process is repeated until all 16 caribou are distributed. Each household provides four carcasses and each household receives carcass segments from itself and the other three households. Binford (1984) suggests that sharing of this sort will result in similar faunal assemblages across households. As “hunters” or households contribute and distribute equal number of carcasses, their assemblages will over time become increasingly uniform, eliminating variance between them. For archaeological collections, this means that differences in the faunal assemblages (e.g., body part profiles) of different households or hunters deriving from variable hunting success will eventually “even out” if the site has an extended period of occupation (Binford, 1984, pp. 200–201) and if all of the faunal remains have an equal opportunity for preservation and recovery.

As modeled, the derived variance reduction assemblages do result in identical faunal inventories within each household (Table 1). All four households contain the same anatomical segments, and if translated into minimum number of elements (MNE), identical element frequencies. Given the occurrence of multiple sharing acts occurring over an extended period of time, skeletal element frequencies alone do not provide sufficient evidence to identify the presence of this behavior.

Tolerated theft should result in a markedly different relationship between households. To create a distributive pattern that is “unequal” in nature, each household must provide and receive carcass segments differentially. In modeling this scenario, Household One was made the primary

Carcass Segments Distributed

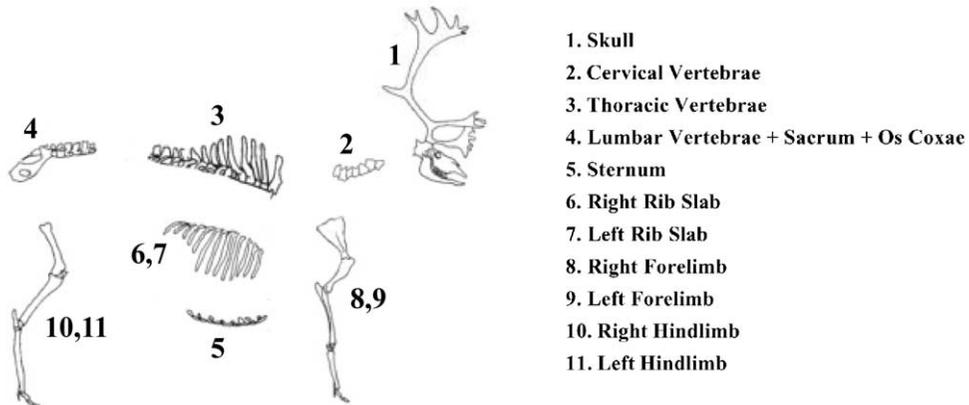


Fig. 1. Carcass segments distributed in the modeled assemblages.

Table 1
Distribution of carcass segments

Carcass portion		Household			
		1	2	3	4
<i>Variance reduction</i>					
1	Skull	4	4	4	4
2	Atlas + axis + cervicals	4	4	4	4
3	Thoracics	4	4	4	4
4	Lumbers + sacrum + os coxae	4	4	4	4
5	Sternum	4	4	4	4
6	Right rib slab	4	4	4	4
7	Left rib slab	4	4	4	4
8	Right forelimb	4	4	4	4
9	Left forelimb	4	4	4	4
10	Right hindlimb	4	4	4	4
11	Left hindlimb	4	4	4	4
<i>Tolerated theft</i>					
1	Skull	2	5	5	4
2	Atlas + axis + cervicals	2	4	5	5
3	Thoracics	5	5	4	2
4	Lumbers + sacrum + os coxae	5	5	5	1
5	Sternum	4	4	5	3
6	Right rib slab	5	5	4	2
7	Left rib slab	10	2	2	2
8	Right forelimb	10	2	2	2
9	Left forelimb	7	2	2	5
10	Right hindlimb	10	2	2	2
11	Left hindlimb	7	2	2	5

provider, contributing 10 caribou. Households Two, Three, and Four each contributed two carcasses. Rather than distributing carcass segments sequentially and evenly between households, high utility segments are retained by the “providing” household and only low utility segments are given to receivers. In eight cases, high marrow segments are kept, in the remaining eight high meat utility segments are kept while the remaining portions are made available to receivers. Designation of high versus low utility segments is based on Food Utility Indices (FUI) developed for caribou (Metcalf and Jones, 1988). Carcass portions (Fig. 1) kept by meat maximizing providers include segments 3, 4, 5, 6, 7, 8/9, and 10/11; marrow maximizing segments are designated as 6/7, 8/9, and 10/11. Unequal sharing of this sort is comparable to tolerated theft. As seen in Table 1, the carcass segments remaining at each household are unevenly distributed. Household One, designated as the primary provider, has the largest assemblage. High utility segments are most abundant at this household. Overall, receiving households have smaller assemblages with a greater frequency of low utility segments.

Sharing through meat exchange was not explicitly modeled, since its zooarchaeological patterning could potentially mimic the variance reduction and tolerated theft distributional patterns. Depending on the faunal resources exchanged, if one “household” repeatedly exchanged meat for non-tangible goods, a tolerated theft pattern could emerge. If, however, a “household” provided both faunal resources and exchanged them for other goods and services, an assemblage composition pattern similar to variance reduction could result. For these reasons, the archaeological signature of sharing via exchange is encompassed by the equal and non-equal distributional models and is not individually examined here.

Refitting faunal remains

Depending on the type of distribution that occurs (i.e., tolerated theft versus variance reduction), basic measures of assemblage composition (e.g., MNI, MNE) may not adequately reflect the movement of carcass segments. If refit patterns of faunal remains are added to the relationship

between households, distributional patterns may be clearer. Refitting skeletal elements of the same animal and/or fragments of individual skeletal elements provides a direct method of linking skeletal segments or fragmentary elements to individual carcasses or anatomical units across an archaeological site. Refitting of faunal assemblages includes two general types: *mechanical* refitting of fragmentary bones and *anatomical* refitting of paired elements—based on the identification of bilateral and intermembral skeletal segments (Rapson and Todd, 1992; Todd and Frison, 1992; Todd and Stanford, 1992). Anatomical refits are identified through a series of metric and non-metric attributes, which emphasizes bilateral symmetry between elements and the “tightness” of joint articulation. To date, refit criteria and methodology are restricted to limb

elements. Each carcass added to the modeled assemblages contains a predictable complement of bilateral and intermembral refits. As carcasses are distributed between providers and receivers, the number of inter- and inhousehold bilateral and intermembral refits increases. Such refits therefore “track” the movement of limb segments between households.

Refits between and within the set of four hypothetical households are shown in Figs. 2 and 3. Variance reduction results in an equal number of refits both within and between households (Fig. 2). Shared sequentially among an equal number of providers and receivers, refits between paired and articulated elements occur in equal numbers at all four households. In the tolerated theft model, refits are most common within, and conjoining to Household One, the primary provider (Fig. 3).

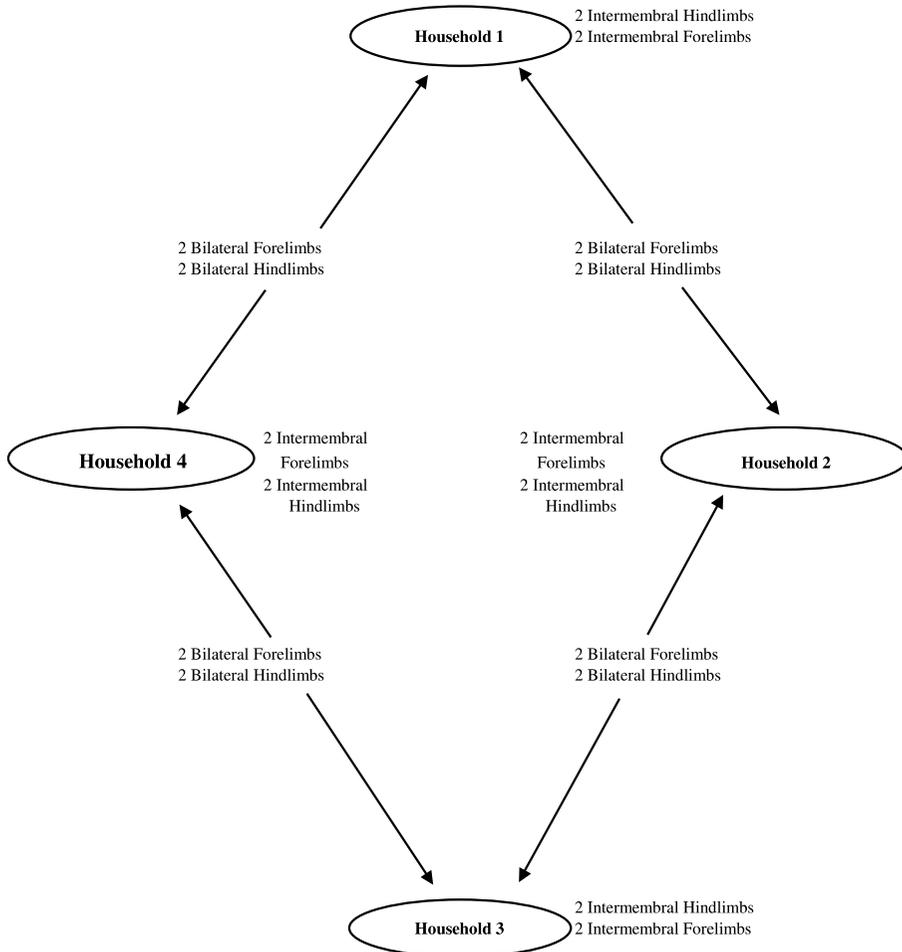


Fig. 2. Faunal refit pattern resulting from the variance reduction model.

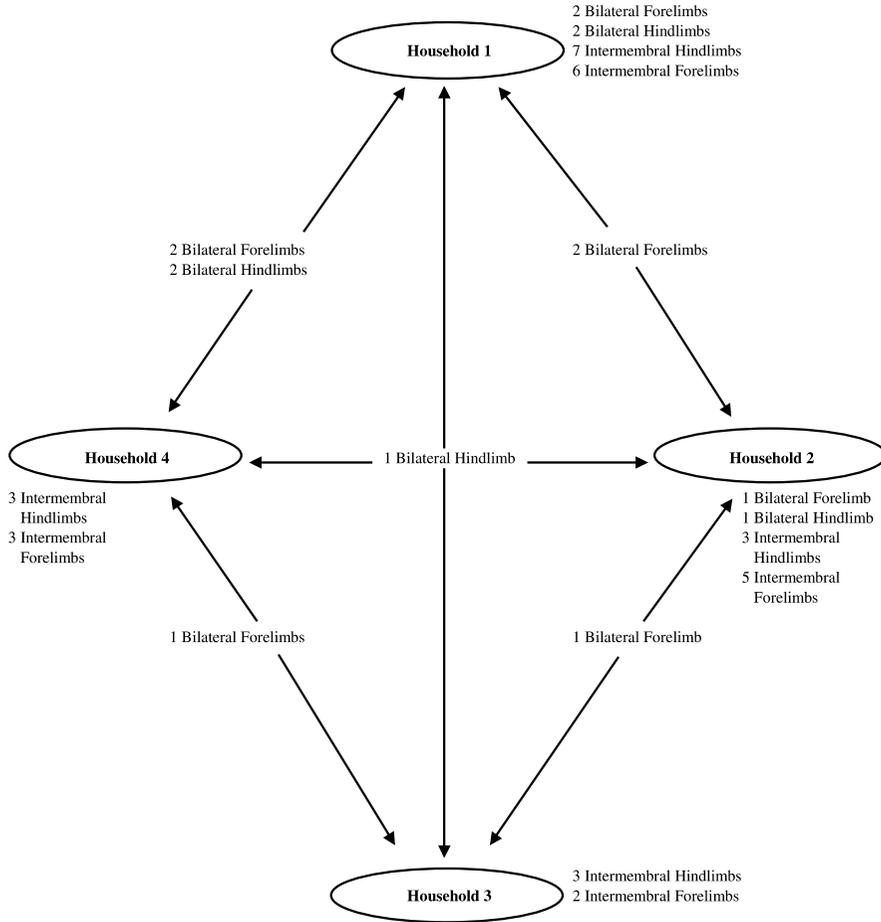


Fig. 3. Faunal refit pattern resulting from the tolerated theft model.

The more carcasses a household provides, the more segments it has to distribute to others, and consequently, the more anatomical refits are generated, linking it to other households, resulting in a preferential direction of movement. Refits within households outnumber those found conjoining households in the tolerated theft distribution.

The models of distribution presented here characterize two extreme patterns of sharing. As is the case with all models, they are an overly generalized portrayal of what can be a complex set of behaviors. It is unlikely that any human group would share resources exactly according to the variance reduction and tolerated theft distributional models outlined here. However, these models do indicate trends in the potential archaeological patterning, resulting from different kinds of resource sharing—ranging from homog-

enous to disparate faunal assemblages. Further, translating concepts such as tolerated theft and variance reduction into faunal assemblages requires a number of assumptions. As modeled here, it is assumed that all carcasses are butchered into the same anatomical segments, that all “households” participate as both providers and receivers, and that segments are distributed sequentially among households. The refits resulting from these models are dependent on the carcass segments distributed. If “butchered” and distributed in a different manner, such as dividing carcasses into smaller anatomical units, the resulting refit patterns would be dramatically altered. However, the general refitting relationship between givers and receivers would still hold. The patterns of assemblage composition and refits derived from the modeled faunal assemblages establish general parameters of how sharing could appear archaeo-

logically. Meat exchange was not modeled, as its archaeological patterning could potentially mimic either of the performed distributions. Depending on the faunal resources exchanged, if one “household” repeatedly exchanged meat for non-tangible goods, a tolerated theft pattern could emerge. If a “household” both provided faunal resources and exchanged them for other goods and services, an assemblage composition pattern similar to variance reduction could result. For these reasons, the archaeological signature of sharing via exchange is encompassed by the variance reduction and tolerated theft models. Before relating these models to the Palangana site assemblage, consideration of the archaeological context of the site in relation to sharing behaviors and the subsistence economy of the Nunamiut is needed.

The Palangana site

The Palangana site (Alaskan Heritage No. XCL-00130) is located in the central Brooks Range of interior Alaska (Fig. 4) and was occupied in the 1880s by four Nunamiut families (Binford, 1978). The Nunamiut are central Alaskan Eskimos who are generally characterized as

logistical arctic foragers, with a subsistence economy based on the hunting of caribou. The site was investigated during the late 1960s and early 1970s as part of Binford’s (1978, 1983) ethnoarchaeological project among the Nunamiut. Native informants provided oral accounts of the site’s purpose, duration of occupation, and general descriptions of the occupants. The excavated area (about 25% of the site) encompassed two household structures that have been identified by the Nunamiut as the residences of two male household heads, Palangana and Kapkana (Fig. 4). A total of 675 m² between 1969 and 1971 were excavated in 3 × 3 m units, with all materials (e.g., bone, wood, chipped stone, rock) piece-plotted in two dimensions. The faunal collection consists primarily of caribou (*Rangifer tarandus*), with some Dall sheep (*Ovis dalli*), ptarmigan (*Lagopus lagopus*), and canid (*Canis*). Surface condition of the bone is excellent with minimal post-depositional weathering. Portions of the faunal assemblage have been previously examined (Binford, 1978; Enloe, 1993; Todd et al., 1985), with sharing behaviors analyzed in regard to the sheep assemblage by Binford (1984).

The primary residents, Palangana and Kapkana, are known to have been friends and to have had differing hunting abilities. Palangana was

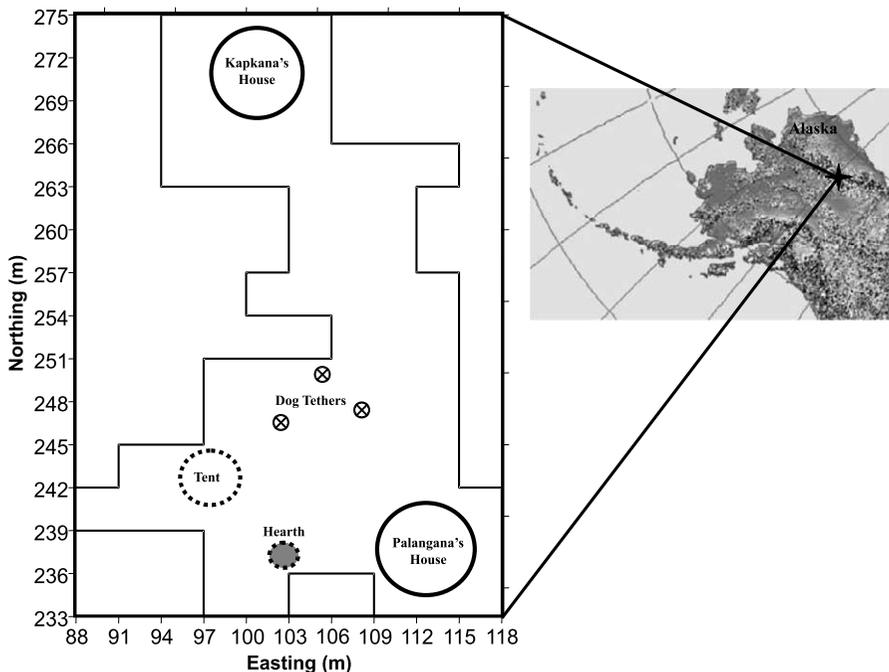


Fig. 4. Location of the Palangana site in North-central Alaska and schematic map of the excavated area.

remembered as a prodigious and able hunter of caribou, while Kapkana was noted for his skill as both a flintknapper and a bone toolmaker. These facts suggest that a cooperative relationship between the two may have existed. Their reliance on relatively large game, differences in their hunting ability, and the residential nature of the occupation presents a favorable situation for meat sharing to have occurred.

Nunamiut sharing

Ethnographic accounts of the Nunamiut (Gubser, 1965; Ingstad, 1954) attest to the importance of meat sharing, as both a means of distributing needed resources and labor, and maintaining cooperative social relationships, features that are common to many inland Eskimo groups (e.g., Burch, 1980, 1988; Condon et al., 1994; Damas, 1972; Guemple, 1971; Wenzel, 1995). In the winter, the Nunamiut traditionally subsisted primarily on frozen caches of caribou killed during the fall migration, supplemented by occasional, single animal kills made throughout the winter (Binford, 1978; Gubser, 1965; Ingstad, 1954). By late October, small winter camps are established and reliance on stored resources begins:

...the winter households are most commonly living out of meat stores accumulated during the Fall migration...sharing out of stores is considered 'women's business' in that woman are generally responsible for removing meat from stores and for its disposition. This meat regularly circulates in winter camps largely in terms of female labor concerns...Thus a kind of demand pooling in the distribution of meat out of household stores is constantly occurring in winter camps. (Binford, 1991b, p. 101)

The majority of the Palangana site faunal collection consist of processed caribou, presumably derived from winter meat caches. It is possible that some of the caribou assemblage and most, if not all, of the sheep and ptarmigan bones were derived from winter hunting as Dall sheep are actively hunted during the winter (Gubser, 1965, p. 289). Binford's (1978, 1984) study of the Dall sheep assemblage (MNI = 2) was based on differences in element frequencies between the Palangana and Kapkana households. He concluded that the sheep remains are differentially represented in the two assemblages (Binford, 1984), with remains of both animals present at each household, a pattern which suggests a variance reduction type of sharing governed the distribution of sheep.

The Nunamiut store caribou for winter use both in caches located beyond the immediate vicinity of their habitation sites, and in storage areas adjacent to their households (Binford, 1978). Many of the factors contributing to hunting risk could be considered inconsequential for cached fauna, as storage eliminates the risks associated with variable encounter rates and search costs. However, retrieving meat from a distant cache, particularly during the winter, is still a risky procurement endeavor. Many of the same factors that result in hunting variance (weather conditions, transport costs, skill, and time) could also influence the retrieval of stored caribou and the package size of meat retrieved. Therefore, the predominant reliance on stored caribou at the Palangana site does not negate the conditions that encourage sharing as outlined by evolutionary ecological models. Variance is present among men whose task it is to retrieve cached items, in the package size of cached goods brought back to winter residences, and the caribou available for household consumption.

What would caribou sharing look like at Palangana?

The Palangana and Kapkana household faunal remains are analyzed based on assemblage characteristics and anatomical refits. If sharing occurred among the occupants of the Palangana site, differences or similarities between the two assemblages could take a variety of forms. Three basic arbitrary patterns (Fig. 5) in household assemblage characteristics and refit type and frequency are proposed. These patterns are based on the modeled assemblages and provide test scenarios for comparison to the Palangana data.

Scenario 1. Tolerated theft sharing between households. If caribou were distributed between the Kapkana and Palangana households, in a manner comparable with tolerated theft, a consistent provider/receiver relationship should be evident. One of the households will have a larger faunal assemblage, with a greater number of intermembral refits, and greater numbers of high utility elements. Ethnohistoric information suggests that the Palangana household will likely be the provider and shared caribou will be primarily derived from his stores.

Scenario 2. Variance reduction distribution between households. If caribou were shared in accordance with variance reduction, both the Palangana and Kapkana households would provide and receive caribou carcass segments. The

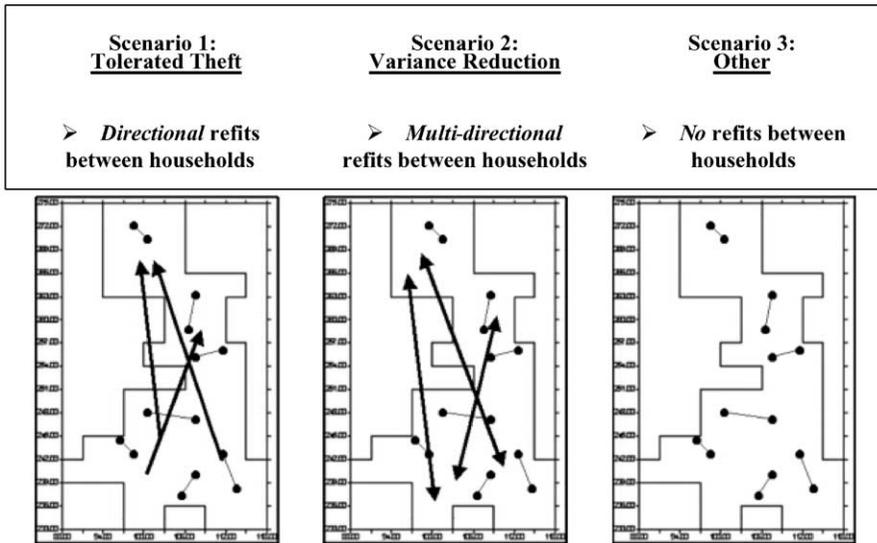


Fig. 5. Proposed refit patterns for the Palangana household assemblages.

assemblages from each household would contain similar elements in similar relative frequencies. Anatomical refits found within each household will also be present and on similar elements and in similar quantities. Refits between houses will indicate that sharing occurred and interhousehold conjoins will likely be found on elements or anatomical segments that do not refit within household assemblages.

Scenario 3. No sharing. If both the Palangana and Kapkana households were well provisioned for the winter (i.e., minimal variance and package size differences) and had no economic commitments to one another, sharing is unlikely to have occurred. No anatomical refits would conjoin faunal elements between households, although refits would likely occur within households. The assemblages of each household should be comparable in element frequency and element diversity.

Methods

Since anatomical refitting is only possible with paired appendicular elements and previous analysis (Binford, 1978) provides data regarding axial elements, only the os coxae, femur, tibia, metatarsal, scapula, humerus, radius–ulna, tarsals, and carpals were examined in this study. With the aid of a comparative caribou skeleton, all limb bones and fragments, regardless of size, were collected, grouped by element, and sided when possible. Ex-

cavation unit coordinates of each specimen allowed each bone to be assigned to either Palangana's or Kapkana's household assemblage. Maximum length and the presence of morphological landmarks and features were recorded for each specimen. In addition, all long bone fragments and articular ends were examined for carnivore damage, tool cut marks, impact fractures, and breakage type. With the exception of breakage type, these features were simply recorded as present or absent. Breakage was recorded as green, dry, indeterminate, or unbroken based on fracture surfaces and morphology (Lyman, 1994). Following Enloe's (1991) procedures, all articular ends of limb elements (excluding phalanges) were measured and examined for possible refits within and between households. Identified refits were evaluated based on the congruency between recorded metric attributes and repeated visual inspection of non-metric features that are unique to each element examined.

Results

A total of 1819 identified limb specimens were examined. An additional 239 long bone specimens, not identifiable to element, were also tabulated (Table 2). Element frequencies provide a basic measure of carcass redistribution only if the effects of other human behaviors, taphonomic processes, and methodological issues can be excluded as primary factors contributing to element

Table 2
Summary of NISP and butchery data per element

Element	NISP	% NISP w/cutmarks	% NISP w/impacts	% NISP w/green breaks
Inomminate	110	60.91%	0%	94.55%
Femur	140	45%	36.43%	97.86%
Tibia	264	28.30%	31.82%	93.94%
Metatarsal	329	18.54%	31.31%	99.70%
Scapula	96	35.42%	0%	75%
Humerus	248	41.53%	46.77%	97.98%
Radius–ulna	375	16.27%	27.47%	97.33%
Metacarnal	257	17.63%	33.21%	98.76%
Unidentified	239			
Total	2058			

representation. The predominance of low density elements such as vertebrae and ribs (Lyman, 1994) suggests that density-mediated attrition did not significantly influence the assemblage composition. Other processes, such as butchery and carnivore modification, played larger roles in altering element representation and must be addressed before these differences can be contributed to food sharing.

Carcass butchery and processing

Intensive processing activities, particularly marrow and grease extraction involving the fragmentation of long bones, are known both ethnohistorically (Binford, 1978) and archaeologically (Enloe, 1993) to have occurred at the Palangana site. The butchery of caribou carcasses ultimately relates to the nature and size of carcass segments and anatomical elements that could be potentially shared between households and the identifiability and accuracy of element frequency measures. Comparing MAU% of the complete assemblage to both meat and marrow utility curves (Fig. 6) suggests that marrow extraction has altered the representation of elements with high marrow content. An inverse relationship exists between relative marrow richness and element abundance at Palangana (Fig. 6), as high marrow yielding elements such as the metapodials, tibia, radius–ulna, and femur are under-represented in the assemblage.

Cutmarks, impact fractures, and green bone breaks are common. High meat utility elements, the os coxae, femur, humerus, and scapula, display cutmarks on over 35% of the elements examined (Table 2). Impact fractures are consistent in frequency across all elements, except for the os coxae and scapulae, the two elements with the lowest marrow content of all major limb ele-

ments. Likewise, green bone breaks are extremely common, with over 93% of all specimens (with the exception of the scapula) displaying green fractures. All the elements examined were processed by humans for meat and/or marrow extraction, with cutmark and impact frequencies varying by element in direct relation to nutritional utility.

Carnivore modification

Domestic dogs were kept by the Palangana site occupants, evidenced by dog tethers found during the site excavation (Binford, 1978, 1984). Nunamiut dogs serve as pack animals and are important economic assets. Without dogs, cached caribou could not be retrieved and transported to winter residences. Dogs are kept and cared for by each household. They are fed by their owners from the same stores that were used to feed Nunamiut families (Binford, 1978; Gubser, 1965; Ingstad, 1954). The presence of dogs at Palangana potentially affects the examination of sharing behaviors in two ways. First, because dogs are fed by the households who own them they must be considered dependent consumers. If sharing occurred at the site to alleviate resource needs, then the needs of humans and dogs must be considered. Food sharing is generally considered only in relation to human resource requirements. However, the sharing of caribou could provide a distributive mechanism insuring adequate resources for both humans and dogs, and meat could be distributed between households for the primary purpose of providing dog food. Dogs may also modify limb elements, by altering the analytical visibility, or effectively removing limb elements from the assemblage, dogs could significantly bias the element composition of the site.

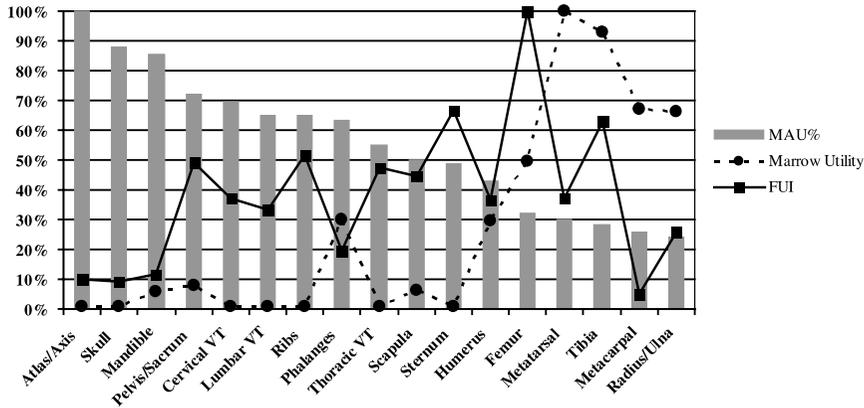


Fig. 6. MAU% compared to food utility index (FUI) and marrow utility indices for the Palangana caribou assemblage.

Sixty-seven percentage of the os coxae in the collection and 56% of the scapulae displayed modification due to carnivore gnawing, but this form of modification occurs on less than 1% NISP of all other limb elements. Evidence of carnivore modification is absent on the long bone articular ends. Dogs at the site were either not allowed access to these anatomical portions or consumed them so completely that absolutely no evidence was left on an otherwise well-preserved faunal assemblage.

Household assemblage characteristics

If a cooperative sharing relationship existed among the occupants of the Palangana site, then barring significant post-depositional modifications, differences should exist between the faunal assemblages of each household. The complete faunal inventory can be divided, based on the spatial division between the excavated household areas, into Kapkana's and Palangana's household assemblages. Behaviors and processes not directly related to caribou sharing may have altered the element composition of the site's faunal remains, but these processes are evidenced for both households. Thus, their influence on element frequency and refitting bias may be considered comparable. Data collected for the current study and those of Binford (1978, Table 8.4) reveal several differences in element representation (Table 3).

MNE values indicate that the Palangana household assemblage is larger for most elements examined, although differences in element frequencies alone do not necessarily indicate sharing. To address the question of sharing it is the *relationship between element frequencies* that is of

greatest interest. If carcass segments or individual elements were consistently distributed from one household to another, then elements present at one household should be under-represented at the other. This pattern would hold unless the same kind of elements were routinely given and received from the Palangana and Kapkana households.

The relationship between interhousehold element representation is explored in two ways. Rank order statistics are performed on the complete assemblages; χ^2 is then used to test the significance of individual element and limb representation between the household assemblages. Unlike standard measures of assemblage content, such as MAU and MAU%, rank order evaluates the relative contribution of each element to the collection, regardless of its frequency within the skeleton. The most abundant element in terms of MNE (Table 4) is ranked "1", the least abundant "0", all others fall in between depending on their frequency within each household assemblage (Fig. 7).

Comparing the element ranking of each household assemblage (Fig. 7) shows that of the axial elements, the axis, thoracics, and cervicals contribute more to the Kapkana assemblage relative to that of Palangana. The reverse is true for appendicular elements. Bones of both the upper forelimb and hindlimb generally display higher ranking in the Palangana assemblage. Notable exceptions are the os coxae and scapula, both high meat utility elements, which rank higher in the Kapkana assemblage. Although the Palangana assemblage has a greater MNI (43 versus 32), this alone does not explain the relative differences in element frequencies. There is no evidence to suggest differential preservation among areas of the site or between households.

Table 3
Household assemblage composition

	Palangana			Kapkana		
	MAU	MAU%	MNE*	MAU	MAU%	MNE*
Antler	25.5	59.30%	51	17.5	54.69%	35
Skull	43	100%	86	20.5	64.06%	41
Mandible	41	95.35%	82	20.5	64.06%	41
Atlas	42	97.67%	42	30	93.75%	30
Axis	28	65.12%	28	31	96.88%	31
Cervical VT	23.4	54.42%	117	26.8	83.75%	134
Thoracic VT	16.14	37.53%	210	23.36	73.00%	304
Lumbar VT	28.2	65.58%	170	18.6	58.13%	112
Os coxae	20	46.51%	40	32	100%	64
Ribs	27.07	62.95%	703	19.64	61.38%	511
Sternum	21	48.84%	21	14	43.75%	14
Scapula	20.5	47.67%	41	15.5	48.44%	31
Humerus	21.5	50.00%	43	9.5	29.69%	19
Radius	8	18.60%	16	9.5	29.69%	19
Ulna	7.5	17.44%	15	7	21.88%	14
Carpals	9.3	21.63%	56	6.1	19.06%	37
Metacarpal	10.5	24.42%	21	8	25.00%	16
Femur	18	41.86%	36	5	15.63%	10
Tibia	15	34.88%	30	5.5	17.19%	11
Tarsals	6.16	14.33%	37	3.5	10.94%	21
Metatarsal	12	27.91%	24	9.5	29.69%	19
First palange	28.87	67.14%	231	16.75	52.34%	134
Second palange	27.36	63.63%	219	15.13	47.28%	121
Third phalange	22	51.16%	176	14.63	45.72%	117

* Estimated MNE values (for elements except os coxae, femur, tibia, metatarsal, scapula, humerus, radius–ulna, and metacarpal) from Binford (1978), Table 8.4.

The hindlimb

MNE values for the hindlimb (os coxae, femur, tibia, and metatarsal) are presented for both households in Fig. 8. The Kapkana household assemblage is dominated by os coxae (MNE = 64), with relatively few femurs and tibias. Palangana's assemblage is less varied in element frequency, with MNEs decreasing in number from the os coxae to the metatarsal. Comparing the two hindlimb assemblages shows an inverse relationship between the households, elements that are relatively abundant in one household are relatively under-represented in the other (Fig. 8).

To test the significance of hindlimb representation between the households χ^2 is performed on individual elements. Identical statistical analysis is performed on the household hindlimb assemblages from the tolerated theft sharing model (Table 4). The carcass segments distributed in the modeled assemblages (Fig. 1) are translated as household element MNEs in Table 4. Hindlimb elements are tested for significance between

Household One, the primary provider, and the three receiving household assemblages. Comparing the modeled non-equal assemblage values to those derived from Palangana indicates that distribution of caribou at the site occurred in smaller anatomical portions than that modeled. Clear from the model is that elements that are distributed *do not* display significant differences between households and elements that are preferentially kept by the providing house do. Element differences between providing and receiving households are significant for elements not shared and elements distributed are present in comparable frequencies between households.

From analysis of the hindlimb, two conclusions can be drawn concerning the Palangana and Kapkana assemblages. First, their relationship is similar to that between the modeled tolerated theft assemblages. The Palangana assemblage is similar to Household One, the primary provider, and Kapkana's is similar to the receiving households. Second, these differences between household MNEs suggest that sharing did occur

Table 4
 χ^2 analysis of the hindlimb

	Palangana	Kapkana	Significant at 0.05	χ^2
Innominate	40	64	No	5.54
Femur	36	10	Yes	14.7
Tibia	30	11	Yes	8.8
Metatarsal	24	19	No	0.58
	Household 1	Household 2	Significant at 0.05	χ^2
Innominate	10	10	No	
Femur	18	4	Yes	8.91
Tibia	18	4	Yes	8.91
Metatarsal	18	4	Yes	8.91
	Household 1	Household 3	Significant at 0.05	χ^2
Innominate	10	10	No	
Femur	18	4	Yes	8.91
Tibia	18	4	Yes	8.91
Metatarsal	18	4	Yes	8.91
	Household 1	Household 4	Significant at 0.05	χ^2
Innominate	10	2	No	5.33
Femur	18	6	Yes	6
Tibia	18	6	Yes	6
Metatarsal	18	6	Yes	6
	Household 2	Household 3	Significant at 0.05	χ^2
Innominate	10	10	No	
Femur	4	4	No	
Tibia	4	4	No	
Metatarsal	4	4	No	
	Household 2	Household 4	Significant at 0.05	χ^2
Innominate	10	2	No	5.33
Femur	4	6	No	1
Tibia	4	6	No	1
Metatarsal	4	6	No	1

between households and distribution varied by element. The abundance of os coxae at the Kapkana household relative to other limb elements in the assemblage suggests that os coxae units were potentially “received” from Palangana or other unexcavated households at the site. The significant differences for the femur and tibia, which were aggregated at the Palangana house, suggest that the residents of the Palangana household retained these high meat and marrow utility elements.

The forelimb

Forelimb elements, the scapula, humerus, radius, ulna, and metacarpal are analyzed in the same fashion as bones of the hindlimb. Variability

between household MNEs is not as pronounced for the forelimb as it is for the hindlimb (Fig. 8). The χ^2 analysis (Table 5) reveals only one significant element difference between households, the humerus, which is high in both meat and marrow contents. Forelimb element values are again compared to the modeled tolerated theft assemblage. Unlike the hindlimb, all elements of the forelimb were distributed as one complete anatomical segment in the modeled assemblages (Fig. 1). Differences between households are significant for all elements (Table 5). For the Palangana and Kapkana assemblages, only the humerus is significantly different, relatively over-represented in the Palangana household. The scapula, radius–ulna, and metacarpal are comparably represented in both household assemblages.

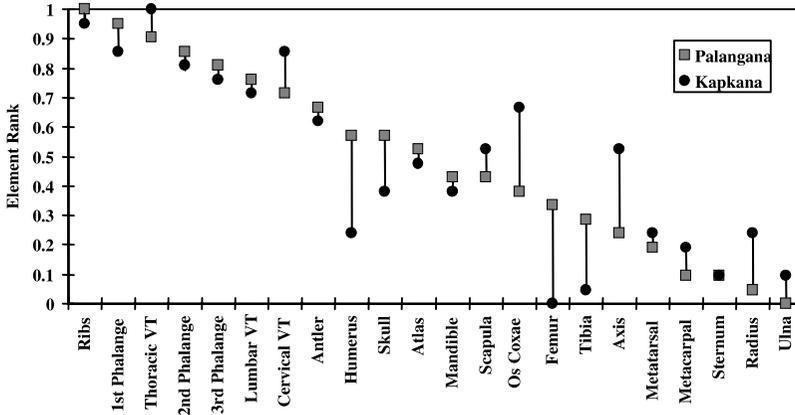


Fig. 7. Rank order representation of faunal elements in the Palangana assemblage. Discrepancies in the rank values of individual elements by household indicate an unequal representation of these elements, suggesting an unequal pattern of distribution. Note the differences in the relative element rank present in the humerus, os coxae, femur, tibia, axis, and radius between households.

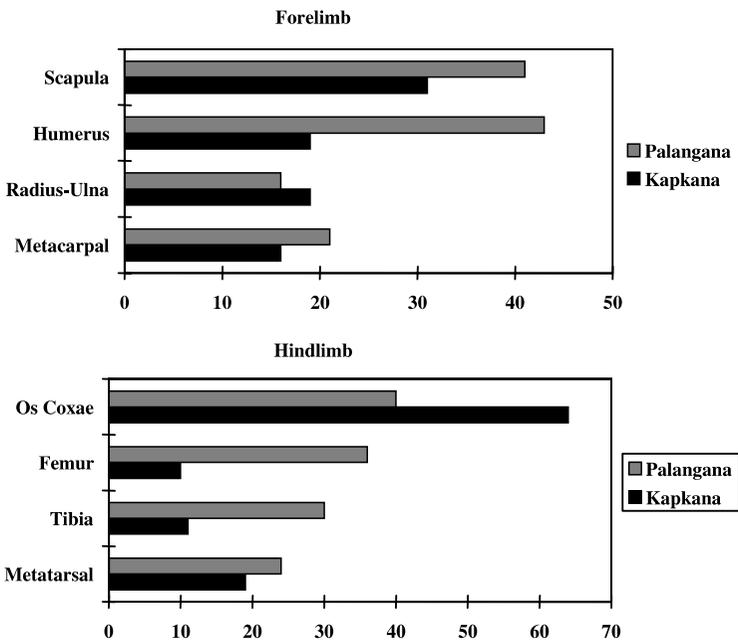


Fig. 8. Household MNE values.

Based on MNE differences within the Kapkana and Palangana collections, distribution between households appears likely. The patterns of element representation are more congruent to those found in the modeled tolerated theft distribution than the equal variance reduction scenario. The relationship between Palangana and Kapkana resembles a provider/receiver faunal assemblage.

High general utility elements such as the femur, tibia, and humerus, which are rich in both meat and marrow, occur more frequently in the Palangana household and are significantly under-represented at Kapkana's. MNEs for adjacent limb elements (Fig. 8) vary independently of one another, indicating that smaller anatomical segments than those modeled were distributed.

Table 5
 χ^2 analysis of the forelimb

	Palangana	Kapkana	Significant at 0.05	χ^2
Scapula	41	31	No	1.39
Humerus	43	19	Yes	9.29
Radius-ulna	16	19	No	0.26
Metacarpal	21	16	No	0.68
	Household 1	Household 2	Significant at 0.05	χ^2
Scapula	34	8	Yes	16.1
Humerus	34	8	Yes	16.1
Radius-ulna	34	8	Yes	16.1
Metacarpal	34	8	Yes	16.1
	Household 1	Household 3	Significant at 0.05	χ^2
Scapula	34	8	Yes	16.1
Humerus	34	8	Yes	16.1
Radius-ulna	34	8	Yes	16.1
Metacarpal	34	8	Yes	16.1
	Household 1	Household 4	Significant at 0.05	χ^2
Scapula	34	14	Yes	8.33
Humerus	34	14	Yes	8.33
Radius-ulna	34	14	Yes	8.33
Metacarpal	34	14	Yes	8.33

Anatomical refitting

Bilateral and intermembral refits conjoin elements within and between the Palangana and Kapkana households. Bilateral refits and intermembral refits are shown, as they occur across the site in Fig. 9. The elements conjoined are listed in Table 6. Due to the effects of carnivore and human bone modification behaviors, only refits, which could be verified with osteometrics, were included in the analysis. Thirteen bilateral os coxae refits were found. Nine from the Kapkana assemblage and four from the Palangana household. Four distal femur articular ends are identified as bilateral mates, one set from the Kapkana assemblage and one from Palangana's. An additional proximal femur mate conjoined two elements between households, the only interhousehold hindlimb refit. One bilateral distal tibia mate is identified in the Palangana assemblage. No bilateral metatarsal refits were found, although a series of distal tibia/tarsal/proximal metatarsal intermembral mates are identified in each household (Table 6).

Twenty-three forelimb refits are identified (Table 6). Three conjoin elements from different households. One is an intermembral refit, linking a proximal radius from the Palangana assemblage to a distal humerus in the Kapkana household.

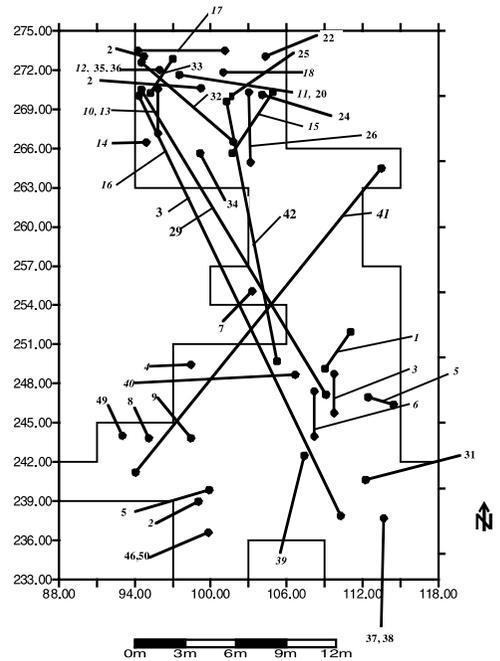


Fig. 9. Map of anatomical refits between households, italicized numbers represent bilateral refits, regular type represents intermembral refits (all numbers correspond to refits listed in Table 6).

Table 6
Summary of refitted material

Refit No.	Elements refit	Household
Hindlimb		
1	Right os coxae + left os coxae	P
2	Right os coxae + left os coxae	P
3	Right os coxae + left os coxae	P
4	Right os coxae + left os coxae	P
5	Right distal femur + left distal femur	P
6	Right distal tibia + left distal tibia	P
7	Distal tibia + astragalus	P
8	Distal tibia + fused central and fourth tarsal + fused second and third tarsal	P
9	Astragalus + fused central and fourth tarsal + fused second and third tarsal + proximal metatarsal	P
10	Right os coxae + left os coxae	K
11	Right os coxae + left os coxae	K
12	Right os coxae + left os coxae	K
13	Right os coxae + left os coxae	K
14	Right os coxae + left os coxae	K
15	Right os coxae + left os coxae	K
16	Right os coxae + left os coxae	K
17	Right os coxae + left os coxae	K
18	Right os coxae + left os coxae	K
19	Right distal femur + left distal femur calcaneus + astragalus + fused central and fourth tarsal + fused second and third tarsal + proximal metatarsal	K
20	Astragalus + fused central and fourth tarsal	K
21	Astragalus + fused central and fourth tarsal	K
22	Astragalus + fused central and fourth tarsal	K
23	Distal tibia + lateral malleolus	K
24	Distal tibia + lateral malleolus	K
25	Distal tibia + lateral malleolus	K
26	Proximal metatarsal + fused central and fourth tarsal	K
27	Fused central and fourth tarsal + fused second and third tarsal	K
28	Right proximal femur + left proximal femur	PK
Forelimb		
29	Distal humerus + proximal radius	PK
30	Distal humerus + proximal radius	P
31	Distal humerus + proximal radius	K
32	Distal humerus + proximal radius–ulna	K
33	Proximal radius + proximal ulna	K
34	Proximal radius + proximal ulna	K
35	Proximal radius + proximal ulna	K
36	Proximal radius + proximal ulna	P
37	Proximal radius + proximal ulna	P
38	Proximal radius + proximal ulna	P
39	Proximal radius + proximal ulna	P
40	Right scapula + left scapula	PK
41	Right scapula + left scapula	PK
42	Radial carpal + intermediate carpal + ulnar carpal + fourth carpal	K
43	Intermediate carpal + ulnar carpal + fourth carpal	P
44	Ulnar carpal + fourth carpal	K
45	Ulnar carpal + fourth carpal	P
46	Radial carpal + intermediate carpal + fourth carpal	K
47	Radial carpal + intermediate carpal + fourth carpal	P
48	Radial carpal + intermediate carpal	P

Table 6 (continued)

Refit No.	Elements refit	Household
49	Radial carpal + intermediate carpal	P
50	Radial carpal + intermediate carpal	P
51	Radial carpal + intermediate carpal	P

The remaining two interhousehold refits are matched right and left scapulae. These refits establish the sharing of forelimb elements from a minimum of two caribou. The majority of forelimb refits are intra-household intermembral conjoins between the proximal radius and ulna, and carpal groups.

Conclusions

Based on differences in skeletal element frequencies (Fig. 8) and rank differences in element representation between households (Fig. 7), the os coxae appears the most likely element to have been distributed between households. Its relative over-representation in the Kapkana household is matched by an under-representation in the Palangana assemblage. However, no bilateral refits of os coxae halves conjoin the two households. Whether the os coxae was shared as a discrete meat package, or as part of a larger anatomical segment including adjacent elements such as the sacrum and lumbar vertebrae, cannot be determined without further analysis of these axial elements. The femur and tibia, high meat and marrow utility elements, are significantly over-represented in the Palangana assemblage. Although the presence of one bilateral femur refit establishes sharing of this element between households, the femur generally appears to have been preferentially kept by Palangana, acting as the providing household. The relationship between assemblages regarding the metatarsal is unclear. Element frequencies are similar between households, but refits were not found, linking this element between the two assemblages.

Forelimb element frequencies are significantly different for the humerus only and suggest that this element was disarticulated from adjacent bones (the scapula and radius-ulnae), prior to distribution. Refits within and between households verify this pattern. Like the femur, the humerus is most abundant in the Palangana sub-assemblage and refits to an element from Kapkana's household. Although it cannot be definitively established whether Kapkana received

a humerus from Palangana, or if Palangana received a radius from Kapkana, the former appears most likely when element frequencies are taken into account. The two bilateral scapulae refits between households indicate that high meat utility forelimb elements were shared between the site's residents more than marrow-rich bones.

Patterns of caribou distribution

Caribou were shared among the occupants of Palangana's house and Kapkana's house at the site. Distribution of stored caribou between the households altered the size and content of the two assemblages in a manner commensurate with the empirical predictions of tolerated theft. For the limb bones analyzed, the pattern of element frequencies and refits resembles the modeled tolerated theft distribution and corresponds to Scenario 1 (Fig. 5) of the expectations outlined previously. Meat yielding elements such as the os coxae and scapula were received by the Kapkana household and appear to have been the most frequently distributed items. High meat and marrow bones like the femur and humerus were also shared, although they appear to have been preferentially kept by the providing household. Palangana, the more proficient hunter, was a provider, Kapkana, a receiver.

There were originally four households at the Palangana site. Based on the two households analyzed, it cannot be determined if the element frequency differences between them are only attributable to food sharing strictly between Palangana and Kapkana; although interhousehold refits attest that caribou were shared between the two. However, their relationship to the other two households cannot be examined without further excavation. Regardless of how and if these additional site occupants participated in food sharing, the provider/receiver roles evident in the Palangana and Kapkana faunal assemblages stand. The significant differences and similarities in element frequencies coupled with anatomical refits indicate that some portion of the Kapkana assemblage was received directly from Palangana.

The Palangana and Kapkana households were compared only in relation to the modeled equal variance reduction and non-equal tolerated theft assemblages. Consequently, sharing through meat exchange cannot be eliminated as an explanation for the patterning found in the sub-assemblages. If Kapkana provided other goods or services, perhaps chipped stone and bone stools, in return for caribou, his household assemblage could appear as a “receiver” simply because the goods he provided are not visible in the faunal assemblage. Without additional evidence, food sharing in a manner similar to tolerated theft is the dominant distributional pattern at the Palangana site. At the time of occupation, immediately procured game (Dall sheep) were distributed equally among households (Binford, 1984) and alternatively stored caribou were shared unequally.

A similar pattern of caribou distribution was found at Pincevent, wherein high meat utility elements were shared more frequently than high marrow utility elements (Enloe, 1991; Enloe and David, 1992). In his analysis of food sharing at Pincevent, Enloe (1991) contrasted the distribution of carcasses by Magdalenian hunter-gatherers to foragers with storage-based economies, stating that:

Contrary to the model proposed for subsistence organization like logistical collecting, in which we expected *food storage in lieu of food sharing*, the Magdalenian occupants of this site did not practice exclusive use of carcasses at each household. (Enloe, 1991, p. 287 emphasis added)

This similarity in the elements distributed between the Palangana households and the Pincevent hearths reinforces the statement that food storage does not necessarily negate the potential for food sharing.

The presence of domesticated dogs must also be considered an economic factor, which potentially influenced the distribution of caribou resources. The os coxae and scapula are the only elements examined in the collection displaying extensive carnivore modification, and it is these elements, which were most likely shared. These elements in the Kapkana assemblage, partially derived from Palangana or other households, might have been utilized primarily as dog food. Sharing of caribou between households could then be interpreted as a response not to human caloric needs, but to the needs of domestic dogs. Since dogs are dependent consumers, in a sense no

different from young children, sharing to feed dogs and sharing to feed other humans are economically similar responses to resource stress. However, of the six elements conjoined between houses only two are located in densely carnivore-modified areas. Based on this research, a relationship between food sharing and the consumption of resources by dependent animals cannot be firmly established.

Identifying sharing patterns archaeologically

The terms “equal” and “non-equal” distributive strategies are perhaps a more fitting description of resource sharing as presented here. Both tolerated theft and variance reduction strategies could present comparable archaeological signatures, dependent upon the period of time represented in an archaeofaunal assemblage. For instance, as modeled here a variance reduction strategy could be expressed in an assemblage of relatively short occupation duration as a tolerated theft pattern. Assuming all households did not participate in both giving and receiving resources due to the temporal span of occupation, particular households could easily appear as primarily “donors” or “receivers”—regardless of their future reciprocal intent. Similarly, a tolerated theft strategy could, with increased temporal duration, result in a variance reduction signature for archaeofaunal assemblages. Dependent on the length of the site of occupation, the resolution of distributive acts is susceptible to variable interpretations. Thus, characterizing the mode of caribou sharing at the Palangana site as tolerated theft must be more generally considered a non-equal form of distribution, one utilized by the site occupants at this particular residential site. Variance reduction and tolerated theft provide useful baseline models of resource sharing; however, in site-based archaeological analyses without clear temporal resolution, the models utilized here are only capable of distinguishing between relatively equal and non-equal patterns of distribution.

The sharing of caribou at the Palangana site establishes the fact that although goods destined for storage may not be shared at the time of initial procurement, once they re-enter a community as consumable goods sharing becomes a viable mechanism of distribution. Based on relatively simple methods of faunal analysis, sharing can be addressed archaeologically in contexts where households or other residential units can be identified. Further, by developing a model of

tolerated theft (i.e., non-equal sharing) and variance reduction (i.e., relatively equal sharing) and applying it to an archaeological case, a general relationship between the directional flow of food resources among consumers can be positively linked to faunal assemblage attributes.

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