Hunting and Butchery Patterns of the Evenki in Northern Transbaikalia, Russia

A Dissertation Presented

by

Yoshiko Abe

to

The Graduate School

in Partial fulfillment of the

Requirements

for the Degree of

Doctor of Philosophy

in

Anthropology

Stony Brook University

August 2005

Abstract of the Dissertation

Hunting and Butchery Patterns of the Evenki in Northern Transbaikalia, Russia

by

Yoshiko Abe

Doctor of Philosophy

in

Anthropology

Stony Brook University

2005

This dissertation study is an ethnoarchaeological study of hunting and butchery among a small group of forest-dwelling hunters in Siberia. It documents a situation where there was in effect a uniform method of hunting, no differential transport and no sharing. The study thus sheds light on the behavior of a small family-sized group provisioned by whole animals that were consumed as they were caught – in other words, a 'single hearth' group engaged in an immediate return strategy. As such, it is uniquely suited for comparison to other ethnoarchaeological studies, and for its use as an analog of dispersed group behavior for archaeological studies. This is also the first large-scale, zooarchaeology-oriented, ethnoarchaeological study of a group in the cold boreal forests of Eurasia, and will be useful to the interpretation of the archaeological record of cold and temperate zones in Eurasia and the circumpolar north.

The sequence of kill to discard of large mammal bone is documented completely, including the phases of cooking and consumption. Each skeletal element is analyzed in terms of butchery procedure, processing time, use, and modification. This study proposes a different model for skeletal element ranking and use that would be more appropriate when studying cultures that have boiling technology. A new GIS image-analysis approach that allows direct comparison with other experimental and archaeological collections was used for the analysis of surface modification. Comparisons against a South African collection show that while disarticulation marks on ungulates are similar across cultural and geographical boundaries, culinary preferences and cultural behavior could also leave a trace and must be included in the interpretive framework.

Table of Contents

List of Figures

List of Tables

List of frequently used abbreviations and terms

Non-English terms

Chachaki	muscle-meat bundle
Dramah	vertebrae-and-rib unit
Gluhar	capercaille
Kabarga	musk deer
Kamus	lower limb fur
Pechka	wood-burning stove
Sig	whitefish

People
(The following abbreviations are used in figures and tables)

YA:	Yakov. Male, old
VS:	Vasili. Male, leader
VD:	Vadim. Male, young
YU:	Yulia. Female
SA:	Sasha. Male, non-family member
MI:	Misha. Male, relative
YO:	Yoshiko.
NI:	Nils.

Other
(The following abbreviations are used in figures and tables)

DomR	Domesticated reindeer
G(number)	*Gluhar* (capercaille)
K(number)	*Kabarga* (musk deer)
M(number)	Moose
R(number)	Reindeer (wild)
S(number)	Sable
F	Fall field season
S	Spring field season

Skeletal elements and related terms

AT	Atlas
AX	Axis
CE	Cervical vertebra
CR	Cranium
FE	Femur
HU	Humerus
IN	Innominate
LU	Lumbar
MC	Metacarpal
MD	Mandible
MT	Metatarsal
PH	Phalanges
RAUL	Radioulna
SA	Sacrum
SC	Scapula
ST	Sternum
RI	Rib
TH	Thoracic vertebra
TI	Tibia
L	Left
R	Right

Acknowledgements

This dissertation study has been supported by the goodwill of many people and organizations. This work would not have been possible without the support of my advisor, Curtis Marean, and committee members Elizabeth Stone, Karen Kramer, John Shea, and David Anderson. I would especially like to thank Curtis Marean for all his help, patience, prodding, more patience, and support. It was his casual comment that led me to join my first ethnoarchaeological expedition, and for that I would be eternally grateful. Elizabeth Stone was, to me, a role model as a person as well as an advisor, and I would like to thank her for her endless enthusiasm in all things, including my project. Karen Kramer shared with me her insights and practical advice that helped me immensely in the field. She also provided invaluable comments that helped organize a confused account of a field study into a dissertation, together with Rusty Greaves (thank you, Rusty!). John Shea was always ready to give a hand, his support, and his amazing knowledge of current research. I am glad he was always there. I was honored to have David Anderson on my committee, and would like to thank him for his time, patience and sincere interest in a project so different from his own.

The fieldwork would not have succeeded without the goodwill and generous cooperation of the study group, and to them I would like to express my sincere gratitude. I cannot thank enough Dr. Oleg V. Kuznetsov, professor at the Department of Cultural and Social Anthropology at the State University of Chita, Russia, for his time and expertise, for letting me join his circle of friends, and for his own enjoyable company. Dr. Nils Røv, research ecologist at the Norwegian Institute of Nature Research in Trondheim, Norway graciously agreed to be my field partner and provided rocklike moral support throughout the field study. I thank him for being there, and for still considering me a friend after having to spend six months in a small tent in the middle of nowhere with me.

Many other people provided their kind assistance during the fieldwork phase. I would like to particularly thank Victor Kolosov, director of Chita State Museum of Human and Natural History, for his welcome and support. The goodwill of Yevgenyi Ivashenko, head of administration of Kalar District, Chita Region, and Natalia Gabysheva, head of the Chita region branch of Russian Association of Indigenous Peoples of the North, are also greatly appreciated. I am also grateful for the friendship and assistance offered by Andrei Davidov, vice head of administration of Kalar District, and Andrei Prostakishin, director of the Museum of Kalar District. The fieldwork would never have got off the ground without the help from Alexander at TUSM. I would also like to thank my friends in Chita, especially Olga, Lena, Igor and Alex.

The fieldwork was generously supported by the L.S.B. Leakey Foundation and the Wenner-Gren Foundation for Anthropological Research. Dr. M. V.

Konstantinov, Dr. O. Grøn, and Ian Buvit deserve my thanks for getting me started in Siberia in the first place. I would like to thank R.T. Gould for his advice in field gear, and T. Love and I. Oshima for their generous assistance in ArcView extensions. Lydia Belousova in Moscow has also offered me more help than I could accept.

I greatly appreciate the help and support of faculty and staff at Stony Brook, including Jason Ur, Kathy Twiss, David Bernstein, Pat Crawford, Diane Doran, Gretchen Gwynne, Janet Masullo and Jean Moreau. I would also like to thank Donna Sammis at Interlibrary Loan. I cannot have finished without the generosity and help of Thomas and Anncathrin. I could not have survived graduate school without help, friendship, and support from (ex-) fellow students including Yin Lam, Naomi Cleghorn, Brian Bingham, Daria Merwin, Theresa Dombach, Zach Davis, Kyle Brown and Matt Sisk, and from friends Karin and T. Momose.

Last but not least, I thank Chris Fockenberg and my parents for their love, unflagging faith, and support.

Chapter 1: Introduction

This dissertation study is an ethnoarchaeological study of hunting and butchery among forest-dwelling hunters in Siberia. The key question asked in this study is whether ecological or environmental predictors of hunter-gatherer behavior (Binford 2001:23; Kelly 1995) and/or models of behavior posited through past ethnoarchaeological studies (e.g. utility, transportation, and food sharing (Binford 1978; Marshall 1994; O'Connell, et al. 1988a; 1990)) can explain the behavior observed among a small group of Evenki hunters. By exploring this question, this study sheds light on the behavior of a small family-sized group engaged in an immediate return strategy – a situation extrapolated through archaeological remains for many periods and locations throughout the Paleolithic.

The significance of this research can be summarized in four points. First, this study offers the most complete sequence from kill to discard of large mammal bone yet done for hunting peoples (or full 'observational control', to use a phrase of Gifford-Gonzalez (1989a), notably including the phases of cooking and consumption which were only partially observed in studies with larger group size. The full sequence is documented for each skeletal element, including the processing time, fragmentation and surface modification.

Second, the surface modification is reported using a new image-analysis approach (Abe, et al. 2002; Marean, et al. 2001) which allows direct comparison with a South African experimental collection by Nilssen (2000), and would allow future comparison with archaeological collections elsewhere. The comparison against Nilssen's data highlights the differences in surface modification resulting from differences in cooking and culinary preferences between these two groups, while confirming the basic similarity of disarticulation marks in ungulate prey across cultural and geographical boundaries.

Third, this study documents an ethnoarchaeological case where there was in effect a uniform method of hunting, no differential transportation and no sharing – i.e. a 'single hearth' situation provisioned by whole animals, consumed as they were caught. Factors behind this pattern include modern tools, unique situations, and environmental/cultural causes that must be carefully considered, but still, the absence of such major variables makes this study uniquely suited to for other ethnoarchaeological studies. The absence of these two major variables (transportation and sharing) also allows this study to focus on other variables.

Lastly, this study is the first large-scale zooarchaeology-oriented ethnoarchaeological study of a group in the cold *taiga* (boreal) forest zone of Eurasia. As such, this study will hopefully be useful to the interpretation of the archaeological record of both cold and temperate forest areas of Eurasia as well as other circumpolar areas, and also for hunter-gatherer studies.

1.1 The Circumpolar North

Indigenous groups in the far north on both American and Eurasian continents are often collectively called circumpolar peoples. The circumpolar north is a “convenient abbreviation” for the two high-latitude ecological zones, the Arctic and Subarctic (Armstrong, et al. 1978:1). Groups in the circumpolar north have not only a cultural continuity from the past, but a political and economical unity in the present. However, precise definitions of the two ecological zones – and subsequently the definition of the circumpolar region – vary by subject and discipline. Boundaries are commonly based on latitude, extent of sea-ice, mean monthly temperature, the extent of permafrost, the extent of tundra, or geopolitical considerations (Nuttall 1998:21). Usually Alaska, northern Canada, Greenland, Iceland, northern Fennoscandia, and the Russian North are considered to be in the circumpolar zone by social scientists (Nutall 1998:22) (Figure 1.1a). In this discussion, the vegetation type – tundra vs. *taiga* (boreal forest) – would be considered the main difference between the Arctic and Subarctic zones, with the treeline serving as a boundary (Figure 1.1b).

By any definition, the main characteristic of the circumpolar region would be its cold and harsh environment. Hunter-gatherers and pastoralists have traditionally occupied this region until modern agriculturalists and industrialists expanded into the area. Hunter-gatherers have been defined economically as a people without domesticated animals (except dogs), or socially as band societies with small groups with flexible membership and egalitarian sociopolitical relationships (Kelly 1995:2). While anthropological studies of hunter-gatherers initially started as a search for a unique and common factor that would represent the ancestral hunter-gatherer state, the *variability* of hunter-gatherer societies had become the focus of anthropological study since the “Man the Hunter” conference in 1968 (Kelly 1995; Lee and DeVore 1968).

Variability of hunter-gatherer societies, especially in subsistence behavior, has been described using cultural ecological or behavioral ecological approaches (Bettinger 1991; Kelly 1995). These approaches explain behavior through its relationship to ecological and environmental factors. Extensive global surveys of hunter-gatherers have been conducted by both Kelly (1995) and by Binford (2001), describing the spectrum of variation in hunter-gatherer societies. Descriptors of biological or environmental characteristics such as latitude, effective temperature (ET), ‘temperateness’ (TEMP) and primary production (PP) has been introduced from related fields into hunter-gatherer studies by Binford (1980), and using these descriptors, both Kelly and Binford have deduced general trends and models that predict *expected* hunter-gatherer behavior for a certain environments.

The more recent work by Binford (2001) expanded Kelly's (1995) and included 339 hunter-gatherer groups from around the world in his sample. Binford demonstrated that within major subsistence categories (i.e. hunting, fishing, or foraging), generalizations could be drawn and patterns could be discerned between variations in social organization (such as group size) and subsistence behavior (such as mobility patterns and the presence/absence of storage), and variations in environmental productivity (represented by proxies such as latitude, ET and TEMP). While the survey of 339 known groups are biased towards the North American record in terms of northern latitude groups (e.g. see Table 8.01, 2001:245-251), his work presents a 'frame of reference' of relationships between behavior and the environment. Importantly, his work allows the anthropologist to predict hunter-gatherer behavior from environmental descriptors.

Binford demonstrates, for example, that behavior such as reliance on animal or aquatic resources, reliance on storage, group size, and the males' contribution to the diet changes with environmental productivity (2001: 257-307). In both his sample study groups and in his predictions, hunter-gatherers in the circumpolar region place heavy emphasis on hunting and the exploitation of marine or aquatic resources, and less on plant resources. Binford also described these cold-environment hunters as logistically mobile collectors – i.e. groups that pursue a strategy of sending out task groups to procure specific resources while remaining relatively sedentary in terms of the movement of the group as a whole (Binford 1980: 10). All hunter-gatherers in the circumpolar region share these general traits in subsistence patterns, as well as sharing some cultural traits (as discussed later).

Thus, the circumpolar region has often justifiably been discussed as a single unit with many shared traits. However, subsistence behavior varies between continents, and between ecological zones – i.e. between hunter-gatherers in North American and Eurasian continents, and between groups in tundra and *taiga* zones. Both differences concern the exploitation of reindeer/caribou[1], or *Rangifer tarandus*. The main difference between the two continents is that Eurasian circumpolar groups traditionally exploited wild reindeer with the help of domesticated reindeer, while North American groups did not (Figure 1.2). Additionally, the behavioral and biological differences of tundra and woodland reindeer subspecies require different hunting and exploitation strategies between the two ecological zones.

Tundra reindeer can be characterized as seasonally extremely gregarious (i.e. forming large herds at certain times of the year) and extremely migratory (i.e. traveling over large distances), while on the other hand, the woodland species engage in much shorter migrations and do not aggregate into large herds (Ingold 1980). Generally, groups exploiting tundra reindeer hunt a larger number of animals at certain times of the year, at certain locations in the landscape. These major hunting events usually involve communal cooperation, investment into building corrals, traps, and other tools, and strategic hunting methods (e.g.

[1] Caribou is the name given to reindeer in North America.

ambushes and decoys). Large number of animals are killed within a short period of time, stored, and used. In contrast, forest reindeer are found year-round within a smaller territory, albeit in smaller groups. The boreal forest is also inhabited by other ungulate species of roughly equivalent size, such as the red deer, moose, and roe deer. Thus large-scale communal and strategic hunting is replaced by smaller-scale, simple forms of hunting (Syroechkovskii 1995). Woodland reindeer are also physically larger than their tundra counterparts, and played an important role in reindeer domestication.

Within the Eurasian continent, reindeer domestication comes in many forms. To summarize Krupnik, there is an ecological-economic continuum with a 'small-herd, free-ranging herding combined with other subsistence activities' system at one end, and large-scale commercial herding with commodity-oriented production for external markets at the other end (Krupnik 1993:87-88) (Figure 1.3). The former end is characterized by the "intensive bond of tameness between man and animal" (Ingold 1980:169). The latter can be also termed "carnivorous pastoralism" (Ingold 1980:101-110).

In the 'intensive bond' form of domestication – also termed domestication by socialization (Ingold 1974; 1980) – names are usually given to each reindeer, women and children are the primary caregivers, the reindeer forage without restraint (the protection and care forming the bond between human and deer), and their primary use as transportation (riding, packing, and sleds). By using reindeer for transport, the hunters are able to exploit resources (such as wild game) in their territory more efficiently. 'Intensive bond' approaches come in a variety of multiple-resource use systems, from almost exclusive hunting to hunting combined with some degree of pastoralism, i.e. the use of their domesticated reindeer as a food source.

Ingold places the extreme 'intensive bond' form of domestication at the origin of the domestication process, arguing that the increase in mobility was the original purpose for reindeer domestication in hunting economies. He further argues that reindeer domestication was developed in the *taiga* where larger woodland reindeer (the only kind large enough for riding) were found. The 'intensive bond' approach is practiced (in varying degrees) by subgroups of Evenki, as well as other forest-dwelling hunters such as subgroups of the Khanty, Mansi, Sel'kup, Nenets, and Tofalary (Pika 1999:93) (Figure 1.3a).

Following Ingold's argument, reindeer domestication spread from the forest to the tundra, first making possible the herd-following of migratory tundra reindeer, and from there to the more managed form of "carnivorous pastoralism" (Ingold 1980:101-110). Carnivorous pastoralists keep larger herds but their reindeer are less tame. Their domesticated herds thus must be more intensively herded, and herding tasks usually fall to the men, reducing the time spent in hunting. While some reindeer are still used for transportation, the domesticated herd (as opposed to wild game) provides a large proportion of the diet. The extreme form of carnivorous pastoralism was practiced by groups in the tundra or tundra-forest ecotone (e.g. Nganasan, Enet, Khanty, and reindeer Chukchi) (Levin and Potapov 1964) that managed and/or exploited large migratory herds (Figure 1.3b). It should be noted that Siberian groups were singularly focused on meat as a food resource; systematic milking was not common in Siberia and has only been seen among the Saami (Ingold 1980:102).

Regardless of the style of domestication, the presence of domesticated reindeer allowed Eurasian groups to expand beyond the tundra-*taiga* ecotone and to pursue diverse forms of subsistence behavior. Additionally, Siberian groups were hemmed to the south and west by highly developed agricultural and pastoral societies, which increasingly pressured hunter-gatherer populations from these directions over time. As a general overview, the combination of reindeer domestication and north-easterly migration pressure can be said to have resulted in the current distribution of groups in Siberia today, where most major cultural/linguistic groups occupy both the tundra and *taiga*. This is in sharp contrast to the situation in North American, where the one group exploits the tundra almost exclusively, and others the boreal forest, or at most, the forest-tundra ecotone (Figure 1.4).

Despite such differences, groups on both continents and in both ecological zones share certain cultural characteristics, specifically in religious beliefs (Graburn and Strong 1973). The so-called circumpolar religion is characterized by shamanism and animistic beliefs. Pertinent to this study among the shared traits of a circumpolar cultural/religious complex is animal ceremonialism. It is a "ritual complex surrounding the catching, killing, and burial of game" of which the two important elements are "the maintenance of a respectful attitude to the animal, and the proper treatment of its remains after it has been killed and eaten", including the protection of the bones of the slain animal (Hultkrantz 1994:357; see also Ingold 1987:243-273 for discussion of underlying belief system). Lissner (1961:141) provides this succinct explanation for animal ceremonialism:

> [N]o living creature can rise from the dead unless his bones are unscattered and undamaged, and since it is considered improper to prevent such resurrection, many taiga and tundra folk take the bones of deer, elk, or other game carefully into the forest and lay them out on raised platform or hang them from trees.

Circumpolar animal ceremonialism manifests most strongly in the treatment of bears. Eurasian groups such as the Evenki, Ainu, Even, Orochi, Yukaghir, and Nivkhi have a form of bear ritual that involves the accurate placement of the bones and their deposition at a special location. They are also documented among North American Subarctic groups (Feit 1994; Tanner 1979). While usually less spectacular, animal ceremonialism exists for other species as well. Ceremonialism surrounding ungulates is best documented for the Misatassini Cree (Tanner 1979). Ceremonial acts include cleaning up traces of butchery in respect of the dead animal, displaying certain carcass parts after a hunt, eating them in a certain order, prohibiting dogs from gaining access to meat and bones, displaying skulls, antlers, suspending bones from trees, depositing bones away from dogs, using bones in divination, and not making fun of the animals and trying to avoid offending them as a general rule (Tanner 1979:78-178). Similar examples, although with less detail, are reported for the Micmac and the Kuchin among North American groups (Martin 1978; Osgood 1936). Among Eurasian/Siberian groups, depositing the remains of red deer and reindeer on platforms have been reported for the Evenki and the Even (Ansimov 1963a, b; Speavakovsky 1994). The care and respect given to the prey and carcass during the hunt, butchery, and deposition of remains is an issue that is directly relevant to this study, and should be kept in mind in the discussion of hunting and butchery.

1.2 The Evenki

While the study group pursues a hunting strategy in the *taiga* (boreal forest) zone of Siberia, the Evenki people as a whole occupy multiple ecozones and internally vary greatly in subsistence type. It must be remembered that the identity of the Evenki as a national group is largely a creation by Soviet ethnographers and the flexible and occasionally contradictory national identity of the modern Evenki has been a topic of anthropological study (Anderson 1995; 1999b; 2000a). The following discussion is about the Evenki in general, and study group's specific characteristics will be addressed in the following chapters.

The Evenki are spread across North Asia in a vast area of approximately 2,500,000 – 3,000,000 km^2, from Taimyr Peninsula to the northwest, to the Pacific coast of the Russian Far East, and in Mongolia and Manchuria (northern China) to the south (Anderson 1999a, 2000b; Vasilevich and Smolyak 1956). Their population is approximately 30,000 in the former USSR[2], and an additional 30,000 in China and Mongolia (Pika 1999). The Evenki in northern areas (i.e. tundra and boreal forest) generally engage in hunting and fishing while maintaining domesticated reindeer for transport, or larger-scale reindeer breeding. The southern Evenki (in the steppes) are horse and cattle pastoralists or farmers. The Evenki speak a Tungus-Manchu language and have traditionally been organized into patrilineal clans (Anderson 1999a; Graburn and Strong 1973; Service 1971; Shirokogoroff 1929, 1935; Vasilevich and Smolyak 1956). The continuity of the Evenki culture to the Neolithic Glaskovo period (1,800 – 1,300 BP) in the Lake Baikal area has been widely accepted by Russian archaeologists (Anderson 1999a; Okladnikov 1959:31-33). From the style of their riding equipment, the Evenki are credited by some for independently

[2] Census from 1989.

domesticating the reindeer (Ingold 1980:104-5; but see also Laufer 1917), and definitely took part in the dissemination of reindeer domestication to other groups such as the Koryak and the Chukchi (Krupnik 1993:161).

Early observers of the northern hunting Evenki have commented on their high mobility, with all the Evenki of a certain area migrating together over years and decades, covering vast distances in a single generation (Anderson 1999a; Bell 1764; Bush 1871; Erman 1848; Ssorin-Chaikov 1998:31). Traditionally, hunting was the commonest and most favored occupation in the Siberian *taiga*, an area with low winter precipitation. The focus was on wild woodland reindeer, red deer, and fowl. Trapping played a small part in their economy until taxation by the Russians (to be paid in fur) and the mass influx of Russian traders in the 17th century. Since then, fur hunting (sable, ermine, wolverine, and fox) became the main activity in midwinter. Fishing was not a major part of the economy in the past (with a few geographical exceptions), and limited to the summer months.

The bow and arrow (double compound bow or simple bow) and a large knife on a long handle used both as an axe and spear were their main hunting implements. Wooden traps were used for trapping in earlier times. Guns were introduced by the end of the 18th century, together with steel traps, snares, and fishnets. The spears, knives, and other metal items were made in each household or by specialized Evenki craftsmen long before direct Russian contact. Their main foods were fish and meat, the meat being consumed as boiled meat and soup, or roasted on a spit. Red deer and reindeer meat were also made into dried meat, which were turned into powder and subsequently boiled (Shirokogoroff 1929; Vasilevich and Smolyak 1956).

The hunting Evenki kept a herd of domesticated reindeer, usually about 25 head per household, with the richest still limited to about 60 reindeer. The Evenki did not use dogs for herding, a distinction from Samoyeds (e.g. Nganasan, Enets, and Nenets) (Shirokogoroff 1929:32; Syroechkovskii 1995; Vasilevich and Smolyak 1956:629). The hunting Evenki (the subject of this study) are thus mostly *taiga*-dwelling people (again with geographical exceptions) who hunted the forest subspecies of reindeer as well as other woodland ungulate species with the assistance of domesticated reindeer. The Eurasian forest reindeer (*Rangifer tarandus fennicus*) are, like other woodland reindeer, larger and less gregarious than tundra reindeer. They undertake only short altitudinal migrations, and are practically in the same area year-round (Banfield 1961; Ingold 1980). Domesticated reindeer are distinguishable from the local wild population only by pelage (Banfield 1961) and some behavioral characteristics. While biological differences between populations across areas were reported (Dmitriez and Ernst 1989), they are zooarchaeologically indistinguishable unlike other domesticated species. Reindeer domestication was not, in the *taiga*, a form of intensification, but rather a form of *extensification*, allowing access to resources over a larger area (Winterhalder 2001).

Other Siberian groups with similar forest focus are subgroups of the Khanty, Mansi, Sel'kup, Nenets, and Tofalary (Pika 1999:93) (see Figure 1.3a). Together, they are distinct from northern Siberian groups that manage and/or exploit large migratory herds in the tundra or tundra-forest ecotone (e.g.

Nganasan, Enet, Khanty, and reindeer Chukchi) (Levin and Potapov 1964) (see Figure 1.3b). The Evenki can also be distinguished from large-scale reindeer breeders that manage herds for their produce, such as the Saami (Beach 1981; Pelto 1973), and from pastoralist Siberian groups that use reindeer, such as the Tuva (Levin and Potapov 1964)[3]. Large-scale reindeer herding for meat and other products became predominant in most northern Siberian regions in Soviet times, becoming the major employment for three-quarters of Siberian minority groups including the Evenki (Pika 1999:92).

In a similar manner, the hunting Evenki also significantly differ from Arctic (e.g. Nunamiut) and Subarctic (e.g. Kuchin) reindeer hunters in North America who exploit migratory herds of tundra reindeer (Binford 1978; Graburn and Strong 1973; Osgood 1936). The Evenki also substantially differ from the North American Subarctic (hereafter 'Subarctic'). Subarctic boreal forest hunters were documented within a depleted large game environment and after they became heavily focused on hunting, due to the fur trade. Boom-bust population fluctuations of flora and fauna and their effects, such as starvation, on native groups have been well documented in the Subarctic (e.g. Martin 1978; Rogers and Black 1976; Tanner 1979; Waisberg 1975; Winterhalder 1983) and are considered a characteristic to the Subarctic, but the factor of prey population flux has been less emphasized in Siberian literature, perhaps indicating a healthier large ungulate population.

Possibly due to this factor, Subarctic groups differ from the Evenki in employing collective hunting strategies for large game, and also the use of traps and/or snares for large game (Nelson 1986). The lack of the use of large-game snares among the Evenki could, of course, also be due to the presence of their domesticated reindeer herds, which are free-ranging and would be susceptible to such traps. Another major difference, in terms of the topic of this study, is the availability of a large and edible fur animal (beaver) as the major prey species in the Subarctic (Nelson 1986), which could explain why the Evenki's dual focus – meat animals and fur animals –sharply contrasts with the Subarctic strategy.

The Subarctic ethnographical record nevertheless often provides the closest comparison to the hunting Evenki, as they share a common socioeconomic adaptation following the introduction of the fur trade, termed atomism. Atomistic societies, or societies in a state in which the primary concern is placed on individual – not communal – interests (Honigmann 1968; Munch and Marske 1981), have been demonstrated to result from acculturation into the market economy (such as the fur trade) and subsequent economical dependency on non hunter-gatherer societies (Binford 2001:16-20, 309; Murphy and Steward 1956). Atomistic groups live in more dispersed nuclear family units, and the nuclear family units themselves might have an atypically high ratio of workers (e.g. adults and/or males). This societal form emerges if the benefits of

[3] In the past, the Saami in the mountainous areas hunted woodland reindeer, fished, and kept reindeer for transport (Beach 1981:65-67; Hultkrantz 1994:353) until the woodland species went extinct in the 18th century. However, coastal Saami groups were large-scale herders from early on.

communal support (such as sharing food in bad years) could be substituted through commercial trade. When this is the case, it becomes more profitable for an individual family to spread out over large territories and intensively exploit cash crops, such as the fur animal population, even at the cost of decreasing social contact. The division of hunting territory by families – already in place among the Evenki of Transbaikalia in the 1910's (Shirokogoroff 1929:300) – can be said to be a form of atomism. While this situation has been called the antithesis of the idealized communal hunter gatherer society, it can also be considered as a prolonged version of the seasonal dispersal documented in all hunter-gatherer groups when conditions (i.e. resource availability) warrant it (Binford 2000:309).

The study group is located in the Transbaikalian region of Siberia. The Transbaikalian Evenki have been extensively studied by Shirokogoroff in the 1910's (Shirokogoroff 1929; 1935), and the Kalar area in which the study group is located has been singled out for its good reindeer habitat and the presence of a larger-than-average reindeer herding focus in that period (1935:47). A little over 1,200 Evenki live in the currently live in this area[4]. There has been a spate of recent sociocultural anthropological fieldwork among the Evenki by Western researchers, most among Soviet-introduced large-scale reindeer herding brigades in the tundra/forest ecozone[5] (Anderson 1995; 2000a; Campbell 2001; Kwon 1993; Ssorin-Chaikov 1998), but also among the Transbaikalian Evenki (Anderson 1991; 1992; Fondahl 1998). Fondahl describes a mixed hunting/herding economy in the area (1998). Anderson (1992:90) compiles the following recent history in the region:

> The rocky taiga of this region is not suitable for cattle nor for agriculture – but it excels in providing wide pasters of *yagel'* [reindeer moss] for the reindeer herds of the Evenki. The [sable] fur from this area is also of the highest quality… Since the seventh century, Chinese traders, Russian Cossacks, and Soviet trade officials have come to [Transbaikal] for its "soft gold"… Typically, [Evenki] families ride their reindeer along clan-allocated routes, constantly finding new *yagel'* pastures for their deer while shooting the lucrative Siberian sable…The uniqueness of this semi-nomadic, hunting/herding economy makes it as difficult to "classify" as it is to "rationalize"… Following the conclusion of the Russian civil war, various waves of activists came… to transform their indigenous institutions… Family controlled reindeer herds were formally collectivized into artels… and later into collective farms…

The study group (described in Chapter 3) is thus expected to show the characteristics of northern boreal hunters, of the hunting Evenki, and also match

[4] From the Russian Association of Indigenous Peoples of the North website (www.raipon.org).
[5] While these studies deal with modern brigades, they all include accounts of wild game hunting, indicating the continuing existence of the hunting tradition.

the reported Transbaikalian adaptation. Following the trend across latitudes, the study group is expected to rely on animal and/or aquatic resources to the exclusion of plants, follow a logistical settlement system, and to use extensive storage. Following historically documented trends, the study group is expected to have a complex multiple resource base, including hunting, trapping, fishing, and domesticated reindeer use. The expected Transbaikalian quirks within the hunting Evenki pattern would be, then, a greater focus on herding than expected among *taiga* groups, and a focus on trapping following a long tradition of demand for 'soft gold' (i.e. sable fur). These expectations will be assessed following the description of the group and their activity pattern in Chapters 3 and 4.

1.3 Background to the study

1.3.1 Ethnoarchaeological background

This dissertation, being a study of butchery and hunting patterns of the Evenki, straddle the fields of ethnoarchaeology and zooarchaeology. Past ethnoarchaeological studies that similarly cover butchery activities extensively and are thus used widely in zooarchaeological interpretation include studies of the Nunamiut of Alaska (Binford 1978; 1981; 1984b), Hadza of Tanzania (Bunn, et al. 1988; Lupo 1994; Monahan 1998; O'Connell, et al. 1988a; 1988b; 1990; 1991; Oliver 1993), Okiek of Kenya (Marshall 1991; 1994), Kua of Botswana (1993a; Bartram 1993b; 1999), and the !Kung San of Botswana (Yellen 1977; 1991), and others (Binford and Bertram 1977; Crader 1983; Gifford-Gonzalez 1989a; Jones 1993). These studies document the full range of behavior related to large mammal procurement and use, from hunting to butchery to use to discard, albeit with differing degrees of detail in each category. Taking the middle-range theory (Binford 1977a) approach, these studies also model aspects of subsistence behavior against potentially archaeologically measurable variables. Most of these studies document faunal remains in postdepositional contexts, testing whether the modeled aspects of behavior can be detected in the archaeological record.

The usefulness of these ethnoarchaeological studies to zooarchaeology stem from their widely applicable models. The predictive relationship suggested between the utility of animal body parts and transport/butchery decisions – originally extrapolated in Binford's Nunamiut study (1978) – has since become the main interpretive tool used by zooarchaeologists. While various utility indices have been since suggested (e.g. Metcalfe and Jones 1988; see also extensive discussion in Marean and Cleghorn 2003), the positive relationship between return rates (calculated from the amount of edible parts) of and the likelihood of the body part being utilized is a model that has proven to be widely applicable to both ethnographical and archaeological records. Similarly, a predictive model about transport decisions has been developed through studies of the Hadza, which ties transport decisions to distance and/or size of prey, in addition to the utility of parts (O'Connell, et al. 1988a). These two models – utility and transport decision – are pertinent to this study and will be discussed in the following chapters. Another important topic that ethnoarchaeological studies (particularly the studies of Okiek and !Kung) address is the relationship between sharing decisions and group size.

To put the present study in context, this study can be said to differ from the abovementioned studies in three significant ways. The first is *group size*. While complexity in actualistic research is expected, one variable – group size – seems to be a major cause of variation in butchery studies and yet inevitably poorly controlled for. All past studies deal with large group situations with multiple households, consumption groups, or hunters/carriers on hunts, resulting in high variability in carcass part distribution and use. Large group size also complicates the task of observation, methodologically speaking, as carcass parts are simultaneously processed or used out of observation. The complexities were simplified in this study because the study group was a single-unit group, and furthermore exhibited solitary hunting practices. Both of these traits significantly reduced variability, and provided an almost 'laboratory condition' study of a single family group's subsistence behavior. The absence of inter-household sharing is a characteristic that could potentially position the study group as a 'control group' for future studies in sharing (R. Greaves, personal communication).

The single-group, single-hunter aspects of this study is also useful as a directly comparative sample to the ethnographical and archaeological record. Historically, many hunter-gatherers have periods of dispersal as part of their annual cycle, in some cases disaggregating into their minimal household units (Binford 2001:308-309). While some early eyewitness accounts and ethnographies exist, detailed subsistence patterns in a single-group situation have not been adequately investigated as groups living in such conditions have become increasingly scarce, although this study group proved to be a welcome exception. Single-group, single-hunter situations also undoubtedly occurred in the archaeological context. An example is the Middle Paleolithic, specifically Neanderthal sites in Europe that indicate a repetitive pattern of small or even solitary occupations with an absence of sharing (Petitt 1997; Soffer 1994). As this pattern is in marked contrast to those found in sites of anatomically modern humans, it has been interpreted as a non-modern pattern. This study could contribute to this debate.

An unintended benefit of studying a small group was that it unavoidably brought into focus the intentions (or meaning) of individual actors behind hunting and butchery behavior. By documenting the reasoning underlying hunting and butchery actions, the interpretive signs of animal ceremonialism, for example, might be discerned. The recovery or interpretation of meaning from the archaeological record has been the aim of hermeneutic postprocessual approaches (Hodder 1987; Preucel 1995). A criticism of this approach is that multiple actors and intentions would be palimpsetted in archaeological contexts (Preucel 1991:23). This study, by documenting the intentions and providing the final product – combined surface modification – that the archaeologist might face, sheds light on this problem.

The second major difference between this study and past ethnoarchaeological studies is this study group's culinary practice – their cooking method was almost exclusively by boiling. In past studies mentioned above, boiling is practiced only after extensive removal of meat, and thus this group's cooking strategy is in marked contrast to all other studies. The need to study the effect of different culinary practices have been advocated by Gifford-Gonzalez and others (Gifford-Gonzalez 1991b; Monton Subias 2002; Yellen 1977), and this study would provide data from the previously undocumented far end of the spectrum.

Lastly, except for the influential study of the Nunamiut (Binford 1978), none of the recent studies have dealt with groups in cold or temperate zones. This study documents an important segment of ecological variation of the hunter-gatherer world. Cold or temperate forested areas differ from the tundra or forest-tundra ecotone documented among the Nunamiut in that (in terms of butchery studies) the mass migratory herds of tundra reindeer are not present, and fuel is plentiful. While the Okiek study (Marshall 1991; 1994) documents forest-dwelling hunter-gatherers, Africa differs greatly in terms of prey species, predator stress, and climatological and environmental factors. The North American Subarctic ethnographic record is rich in the documentation of subsistence behavior (e,g, Martin 1978; Nelson 1986; Osgood 1936; Rogers and Black 1976; Tanner 1979; Waisberg 1975) and parallels have been drawn to the European record (e.g. Holliday 1998), but the heavy trapping focus and reduction of the large game population prior to anthropological research (resulting from European contact; see Tanner 1979) has limited their usefulness as a comparative sample. Subsistence behavior of hunter-gatherers focusing on individual of small groups of non-migratory woodland prey would be important in the interpretation of the Upper Paleolithic and later records in Southern Europe where such patterns have been proposed (e.g. Burke and Pike-Tay 1997; Pike-Tay and Bricker 1993; Straus 1996).

An additional point that needs to be mentioned is that, unlike past studies, the postdepositional context was not examined due to the culture-specific discard practices of the study group. The study group adhered to circumpolar animal ceremonialism to a degree that almost all large mammal bones were kept as intact as possible, deposited in a specific location in their base camps, and kept away from scavengers (details in Chapter 6). From these discard practices, post-depositional dispersal and damage was judged to be minimal to nonexistent (in the time scale of the field study) and the faunal remains were intercepted immediately prior to discard and deposition for study, instead of in a postdepositional context. In fact, almost all bones studied were subsequently deposited into a bone disposal box that left no room for ravaging by animals, or scattering by other factors (see Figure 3.7d). Exceptions (e.g. bones that were given away to dogs) are noted in the text of subsequent chapters. It must be stressed that this does not make this study less useful than other ethnoarchaeological studies, as taphonomy must in any case be considered when comparing a modern ethnoarchaeological sample to the archaeological.

1.3.2 Zooarchaeological background

Butchery has been defined narrowly as the removal of meat (Russell 1987), or widely as the "reduction and modification of an animal carcass into consumable parts" (Lyman 1987:252), which includes all forms of carcass products including, but not restricted to, food. Specifically, butchery can be defined as "a task of dismemberment" or a "series of acts beginning when the animal is killed and continuing at varying junctures until the animal is totally consumed or discarded" (Binford 1987:48, 63). Butchery, or carcass dismemberment, is heavily intertwined with the acts of transport, cooking, and consumption, and constitutes a major part of human subsistence behavior.

The basic task of the zooarchaeologist is to reconstruct the use of animal products by ancient populations through animal skeletal remains. Through this reconstruction, the zooarchaeologist aims to shed light on aspects of larger human behavior. The early series of papers by White (1952; 1953; 1954; 1955; 1956) illustrates the wide range of interpretations possible from animal remains, ranging from butchery methods, hunting patterns, transportation decisions, and group size of a given site, to cultural relatedness between sites and the identification of different types of sites. His work is an early application of ethnoarchaeology, as he compared skeletal element abundance data from Plains archaeological sites with ethnographic butchery data of modern Plains Indians. Early zooarchaeological studies (Frison 1970; 1971; Guilday, et al. 1962; Guilday and Tanner 1962; Lyman 1978; Wheat 1979) similarly focus on describing general behavioral patterns, using the “direct historical approach” of analogy (Ascher 1961:318), i.e. the comparison of archaeological material with observations from directly related modern cultures.

Zooarchaeology as a discipline has since grown to include paleoenvironmental reconstruction and taphonomic investigation in its main goals (Lyman 1994). The research perspective has generally shifted to a “general comparative approach” (Gould and Watson 1982:357) – where analogues do not necessarily have to be linked to the archaeological material through space or time – for these new topics as well as for behavioral studies. The environment, season of occupation, and site formation processes can be interpreted through zooarchaeological evidence (e.g. species, age, sex, and size of animals) and the analyses of depositional and mechanical characteristics of bone remains (e.g. orientation, breakage, and density). These aspects of zooarchaeology have developed through actualistic studies that incorporate approaches from other disciplines (such as biology or material science) in their background (e,g, Andrews 1990; Berhensmeyer 1978; Lyman 1984). Due to this scientific basis, the general applicability, or uniformitarian assumption (i.e. the assumption that bone has responded to the impacts of various agents uniformly over time (Gifford-Gonzalez 1989b:43)) has generally not been questioned, although some approach this assumption with more care than others (Gifford 1981).

For the study of human behavior through zooarchaeological remains (i.e. butchery studies), the general comparative approach has been more cautiously applied. For behavioral studies, the triad of *reasoning by analogy*, *uniformitarian assumptions*, and *actualistic research* has to be carefully balanced. It is first necessary to choose the modern counterpart of an archaeological group under study, by analogy. Then “methodological uniformitarianism” (Gifford-Gonzalez 1989b:43-44) is employed to move from actualistic research (e.g. the analysis of skeletal element composition and surface modification) to behavioral interpretation (e.g. butchery strategies, use strategies, and more removed behavioral information such as site type, group size, and food sharing).

More so than taphonomic or paleoenvironmental studies, the sheer variability of human behavior has made behavioral studies a hard topic to study or model under adequately controlled conditions. While experimental studies in butchery studies have been numerous (e.g. Bennett 1997; Bonnichsen 1979; Church and Lyman 2003; Lupo 1998; Lupo and Schmitt 1997; Madrigal and Capaldo 1999; Madrigal and Holt 2002; Outram and Rowley-Conwy 1998; Shipman, et al. 1981) and have contributed greatly to the field, behavioral interpretations are still heavily based on ethnographic studies. Both kinds of studies have, under the general comparative approach, produced general law-like principles or models that are applicable over time and space, and have been used, for example, in the hunter-scavenger debate over Plio-Pleistocene hominids (Binford 1981; Blumenschine 1986, 1988, 1995; Bunn 1986; Bunn and Kroll 1986; Chase 1988; Shipman and Rose 1983), and in the determination of the level of success of early hominids as hunters and their position in the carcass consumption sequence (Binford 1984b; Capaldo 1995; Klein 1978; Marean and Kim 1998; Selvaggio 1998; Stiner 1991, 1994).

The applicability of modern analogues to interpret past behavior has always remained a point of concern (see Binford 1984a; Gould and Watson 1982; Wylie 1982), yet interpretation through analogy has always been and will always be a part of butchery studies. The interpretive bridges required to link the archaeological object to modern analogue is best described by Gifford-Gonzalez's model of zooarchaeological inference (Figure 1.5), where each pair in a nested sequence is connected by empirically evaluable bridging statements (Gifford-Gonzalez 1991a:229). These bridging statements, or inferences, are only accomplished through ethnoarchaeological studies.

Traditionalist views have held that an analogical argument is stronger when the points of similarity are numerous, are more similar in detail, and cover a wider range of behavior – i.e. a direct historical approach (see discussion in Gould and Watson 1982:359). However, as previously mentioned, the recent trend is towards a more generalized and even cross-cultural (Binford 2001:5) approach. The latter approach relies heavily on the assumption of methodological uniformitarianism in butchery, or anatomical determination.

To state simply, the assumption of anatomical determination is that surface modification marks "result from the most practical or efficient process for accomplishing a specific butchery task" (Lyman 1987:262). Expectations are that the anatomical constraints would result in a patterning or redundancy of butchery marks (Guilday et al. 1962), that carcass parts (i.e. anatomically associated meat) will be produced in universally consistent and recognizable units (Binford 1981), and that anatomical constraints would cause one task to logically follow the other (Lyman 1978). The latter would be the basis for the rider effect of low-utility parts being associated with high-utility parts (Binford 1978, 1981).

This study provides an ideal opportunity to test this basic uniformitarian assumption underlying the field of modern zooarchaeology. Using new methodology (see Chapter 2), accurate and comparable spatial data of butchery marks are analyzed for redundancy among butchery marks produced *within* the study group, and *between* the study group and an experimental collection created in geographically and culturally disparate conditions. By testing the uniformitarian assumption, these comparisons also attempt to clarify what variables (if any) causes differences in butchery marks frequency or position.

1.4 Test expectations

I will test the observed hunting and butchery behavior and the resulting bone modifications of the study group against two test expectations. By testing against these basic expectations, the unique variations of this group could be noted and their underlying causes explored. The two test expectations and accompanying test predictions are as follows:

Test expectation 1: The subsistence pattern of this study group should fit into frameworks set up by previous studies of hunter-gatherers (the ‘typical hunter-gatherer assumption’ test).

Predictions:

1. Study group behavior matches what is known or expected in circumpolar, boreal, or Evenki groups. Aside from the effects of being an atomistic group (see section 1.2) I expect little deviance from reported cultural behavior. Specifically, I expect a reliance on animal and aquatic resources to the exclusion of plants (as cold environment hunter-gatherers), a multiple resource base including hunting, trapping, fishing, and domesticated reindeer use (as Evenki), a greater focus on reindeer herding and a focus on trapping (as Transbaikalian Evenki).
2. Study group behavior fits what is expected from global survey of hunter-gatherers. Specifically, I expect a logistically mobile collector pattern (Binford 1980) and a heavy reliance on storage.
3. Study group behavior fits predictive models from past ethnoarchaeological studies. Specifically, I expect differentiated transport strategies (and accompanying variation in butchery) by prey type, intended use, and other factors such as distance from camp. I also expect transport/discard decisions and use/discard decisions to be made on the basis of utility, and correlate with utility indices.

Test expectation 2: Anatomy dictates butchery (the ‘uniformitarian assumption’ test).

Predictions:

1. Butchery patterns are explainable by anatomy. Specifically, I expect butchery procedures to be similar between all ungulates, due to their anatomical similarity, as long as the desired end product (i.e. what sort of part units they are butchered into) are the same, and that the procedure would be functional.
2. There would be no individual variations in butchery procedure and end surface modification.
3. There would be no major cultural or non-functional variations in end surface modification. Specifically, I expect butchery marks left by the study group and African butchers to have no consistent differences.

1.5 Chapter summaries

This dissertation has eight chapters and an appendix. In this first chapter, I have described the background of this study, and the test expectations that would be followed chapter by chapter.

Chapter 2 describes the methods and procedures followed in the field and laboratory. This includes a brief description of the GIS recording and analysis method for surface modification.

In Chapter 3, I introduce the study area and study group. I will also discuss the modern and acculturated aspects of the study group and how this would affect the usefulness of this study as an ethnoarchaeological sample.

Chapter 4 describes the overall subsistence-related temporal patterns of the study group (e.g. prey species and mobility patterns). I describe which resources are exploited (e.g. large mammals, birds, and fish) and when. I then discuss their similarities and differences with what had been reported for the Evenki in the past, and test the 'typical hunter-gatherer assumption'.

Chapters 5 to 7 follow the study group's large mammal acquisition activities from hunting to disposal. These chapters mainly focus on the two large ungulate species, musk deer (*kabarga*) and reindeer that were successfully hunted during the field season. In Chapter 5, I describe the hunting and transportation patterns, with each observed hunting incident described for the two species. Then I discuss and analyze the hunting methods and transportation decisions, and compare the observed patterns to those of known hunter-gatherer groups ('typical hunter-gatherer assumption' test).

Chapter 6 is devoted to butchery and use. I describe the different stages of butchery as I follow the carcass from kill to consumption. Attention is paid to the order of butcheries, the different parts resulting from butcheries, and processing time. Comparative analyses are made for both different species and different butchers. I discuss the role of anatomy in determining these variables, and the differences seen between individual butchers ('uniformitarian assumption' test). I also discuss the consumption process, focusing on the order of choice of consumption. I test this 'use pattern' against a utility index, as well as comparing the butchery process of the study group against other ethnographical studies ('typical hunter-gatherer assumption' test).

Chapter 7 deals with bone modification. Surface modification, recorded in spatial format, is presented by species and element, with each bone identified to the killed animal and thus to their hunting and butchery activities. I describe the surface modification patterns and discuss the presence/absence of variation between individual butchers ('uniformitarian assumption' test). I also compare between the study group and Nilssen's (2000) South African sample ('uniformitarian assumption' test).

In the conclusion (Chapter 8), I discuss test expectations and summarize the results. The Appendix is a description of customs, rituals, and beliefs related to hunting and butchery, observed during the field study.

Chapter 2: Methods

2.1 Ethnographic data collection

The field study was in planning since 1999, when I took part in a joint Norwegian-Russian ethnoarchaeological expedition led by Dr. Ole Grøn of NINA-NIKU (Norwegian Institute for Cultural Research, Norwegian Institute for Nature Research) and Dr. Oleg V. Kuznetsov of Chita Technical University (currently the State University of Chita). This study group was first visited by the Norwegian-Russian expedition in the summer of 1999, and subsequently in the summer of 2000.

The main research focus of the two expedition leaders was settlement archaeology, and other members had various research interests, such as fur and skin processing and production, plant lore, shamanism, reindeer domestication, and wildlife ecology. The expedition camped about 15 minutes away from the study group's camp, studied settlement remains in the immediate area, and interviewed the Evenkis on these various research topics, through Dr. Kuznetzov and two Russian university students who acted as interpreters. My main interest was in the large mammal remains left in the old settlements that dotted the area. I also studied the domesticated reindeer herd, together with biologist Dr. Nils Røv from NINA (Norwegian Institute for Nature Research).

The study group did not hunt much during our summer field seasons (although we might have missed some unproductive hunting trips, being located out of earshot of their campsite and unable to keep close tracks of comings and goings), and the summer studies were too short to observe a complete sequence of consumption of carcasses. I expressed my wish to conduct a complete hunting-season field study of this group as dissertation research to the two expedition leaders. My plan was to cover the colder months when most hunts took place, stay for more extended periods, and camp closer to the study group – close enough to observe and track their daily activities. This required a smaller group of researchers – the summer team outnumbered the study group two to one. While there was some disagreement with Dr. Grøn, Dr. Kuznetzov supported the project and agreed to a small party of three; specifically Dr. Røv, a Russian researcher, and myself. Dr. Kuznetzov also requested that we pull out of the field in the coldest months due to concerns of health and safety. Thus the field season was split in two. As the study group reportedly went to visit their relatives and barter for trade goods around New Year every year, leaving the field site around this time was assumed to have little effect on the study.

In the summer of 2000, I formally asked the study group for their permission. I specifically mentioned that I would like to stay with them for a longer period, and stay closer to their camp. I explained that I wished to observe their daily hunting and butchering activities, and follow them on their hunts. I would study their food remains, and record their butchery and hunting activities on video.

The study group had already seen me looking at, re-fitting, measuring, and drawing old bones left in various old campsites. They had also given permission for me to take a sample of bone fragments back to the United States, and noticed that I spent hours washing each of those fragments in the river. All of these activities were somewhat hilarious to the study group members[1], but my interests were clear, and combined with my interest in their domesticated reindeer herd, made sense to them – I was an odd sort of biologist perhaps.

They were also undisturbed by the thought of increased observation, unlike their attitude towards formal interviews. Interviews made them nervous (they said), as they were often not sure what the interviewer was exactly after – the wide variety of topics covered in the summer expeditions confused the issue. Vasili had a conviction record, and (as he later told me) the standard anthropological technique of rephrasing and repeating questions reminded him unpleasantly of police interrogations, and each repetition was duly noted by him. Dr. Grøn agreed to this dissertation study on the condition that my team restrict the study to the zooarchaeological and biological. This perhaps worked in our favour, as our aim was clear to the study group.

The study group was agreeable to the idea of a smaller group of researchers living closer to their camp, and assured us that they could provide the firewood, which was one thing we could not carry in with us. They did not object to being videotaped – in fact, when a documentary filmmaker from Norway joined the expedition in 2000 they rather enjoyed the replays.

The remaining question was my request to be allowed to follow the hunters on their hunts. Luckily, I had joined Dr. Røv on a one-week trek during a summer expedition, and group members were able to observe that I was physically able to go on such trips. The study group also invited me on a one-night hunt with them, which was in hindsight probably a test. I managed to inhale a mosquito and cough at exactly the wrong moment, but luckily the moose that might have been in the bog ahead of us was not there, and thus my cough did not wreck the hunt. In all likelihood, they just wanted to see if I understood the need for quiet, if I would follow directions, and most important of all, if I was an overall pleasant companion.

[1] Shirkogoroff observed in his 1910-1918 study some Evenkis putting bones together after boiling meat (and eating), asking each other the name for each part, and siding (determining left or right) the bones as a pastime (1935:74). During the field study, Yakov's expertise in bone siding and identification became very clear. Perhaps it was my clumsy attempts to do the same that amused them.

So the study group gave their permission for me to study them. I promised to arrive in the fall of 2001. This promise had to be kept, as there was no way to communicate a change of plans with them.

The field study was conducted in two three-month periods in 2001 and 2002. I lived within the study group's campsite and stayed with them for all their waking hours. Whenever there was activity, I followed with a camcorder and a notebook. By following hunters on hunts and keeping track of the carcass parts, I was able to film the kill, field butchery, transport, home butchery, and subsequent cooking butcheries in full sequence. Additional details of the field study are given in Chapter 3.

The method of close and continual observation results in detailed information. There was, however, the danger that the observations would become biased towards some individuals and miss others. Nevertheless, close observation was chosen for this study for several reasons. First, individual butchery variation (for the 'uniformitarian assumption' test) could not be recorded otherwise, and this was a focal point of this study. Second, I knew that the group would not have too many parallel butchery activities going on, as they cooked and ate as a single group. Third, I intended to – and did – follow the study group's dictates as to what I could or could not observe, and this precluded completely random sampling.

Data was recorded in four main forms: notes, video footage (digital video), still film, and drawings for the GIS recording system. The details on the first three are described below:

Notes

Ad hoc notes were taken about daily activities of each individual member of the study group. These notes listed the time, environmental conditions such as weather and temperature, and general observations. Detailed tabular lists about aspects related to hunting and butchery were kept on the following topics and rigorously kept up to date:

- Food consumption (day, meal, number of people at meal, menu, raw material used)
- New food items, or kills (day, animal, sex, weight, hunter, hunt location, time away at hunt, general observations)
- Hunting activity (day, time away at hunt, hunter, transport method, weapon, results, general observations)
- Information relating to animal use or hunting (day, time, commenter, comment – mostly about taboos, traditions, past hunting exploits)
- Bones recorded (day, animal, element)
- Butchery and use of each killed large animal (day, butcher, parts produced, weight, presence/absence of film footage)
- GPS records (day, time, trip name, trip type, track length, average speed, waypoint name and description)

- Film records (day, time, activity filmed, who was in the film, general description)

Other topics covered extensively, although not in tabular format, were the care and demographics of domesticated reindeer, major activities related to firewood production and consumption (date, person, method, and time spent for firewood procurement; date of baths and laundry days), and construction activities (e.g. sled-making, metal stoves, sewing, ski repair).

Time logs were taken for each trip that was followed by an observer. Originally a voice recorder was used for recording of trip details, but this proved too disruptive on hunts, as the hunter never got used to the fact that I was talking to myself. I switched to writing the time and coded information on a small notepad while walking. Note-based time logs recorded the time (to minute), location (GPS waypoint or description), activity, observations or actions made by the hunter, decision(s) made by the hunter, as well as the general trip details such as, transport method, date, intended purpose, and result. Logs were kept on long-distance camp moves, fishing trips, hunting trips, and domesticated reindeer searches. Logs started while on the trip were annotated after the return to the base camp, where the activities of the day was often recounted to the other members. Unobserved and recounted hunt stories were also recorded in time log format, with the time filled in where possible.

It should be noted that formal interviews were not conducted. Some direct questions were asked to fill in the details of hunt time logs at a later time (e.g. 'At what time did you spot the animal?' 'Why did we follow the second set of reindeer tracks, and not the first?'), but observer input was kept to a minimum during hunt and butchery activities. The information presented in this study was based on observation, and not from informant interviews.

Video footage

All observed butchery events were recorded on film (DV) using a hand-held camcorder. The night shot setting was used indoors and in dark conditions. The identity of the carcass and other information was stated at the beginning of the footage. While more commentary was recorded while observing the butchery, most of the audio was compromised by other sounds and conversations. The camcorder was also taken on hunts and long-distance trips, with footage usually starting at kill locations after cornering an animal.

Still film

A digital camera, film camera, and a memory stick attachment on the camcorder were used. The film camera was used to record two items: domesticated reindeer, and to record bones/ bone fragments as they were drawn. Unfortunately, the original film camera was stolen in transit to the first field season and was replaced by a hastily purchased Russian model, and being unused to this camera, indoor shots (i.e. bone pictures) taken in the first season were mostly unusable.

2.2 Butchery mark data collection

The butchery marks in this study were recorded using the GIS image-analysis approach (Abe, et al. 2002; Marean, et al. 2001). Also called the BoneGIS system, this system utilizes GIS software to map the position of the fragment itself (as well as the surface modification marks on them) onto photos of whole bones, thus recording the exact anatomical positioning of each. Different photos (hereafter called templates) were prepared for each skeletal element of reindeer, the main prey species of the study group. Recording by GIS software provides additional benefits, such as easy calculation of the number of marks falling in the same anatomical area, the facility for the drawing to be tied directly to a database record which provides additional information, and easy sampling and analysis of discrete datasets of spatial data using database functions.

The GIS image-analysis approach is also useful in correcting a common problem that zooarchaeological collections often cannot be directly compared to each other. Zooarchaeologists have in many cases quantified cutmark frequencies from archaeological collections using different counts. Some count the number of cutmarks directly, while others count the number of fragments that has a cutmark, using NISP or derived measures such as MNE. Often the frequency is presented as a proportion, typically as NISP cutmarked divided by the total NISP, or the MNE cutmarked divided by the total MNE (e.g. Blumenschine 1988; Bunn 1986; Frison 1970; Stiner 1994). While researchers strive to reduce inter-collection bias and increase inter-collection comparability by using proportions or derived measures, all of these counts are affected by the degree of fragmentation (Bartram 1993a), sample size, body size of the original animal, density, and other post-depositional processes that affect survival. This bias is especially acute when comparing heavily fragmented and taphonomically affected archaeological collections to modern experimental collections consisting of whole bones.

Rapson (1990) first suggested correcting cut marks by preserved surface area, in order to circumvent this problem. He suggested calculating the frequency of cutmarks per unit area, by multiplying the total cutmarks per specimen by 1000, and then dividing by specimen area which would estimate the number of cutmarks per 1000mm^2 of bone surface area for each specimen. The correction using the GIS image-analysis approach (which utilizes ArcView v3.2 and ArcView Spatial Analyst software) is a more precise and detailed correction using surface area as a denominator to divide cutmark counts (Abe et al. 2002).

A drawing of the existing surface area of a fragment, which was drawn in this study prior to observation under the microscope, can be converted to pixel counts indicating the area occupied by the fragment, and the area occupied by the anatomical drawing of the whole bone. The fragment area divided by the whole bone area is a proportional measure of the preserved surface area of that bone element. If there are multiple fragments falling on one area (i.e. there are more than one sample of the same element), the GIS approach calculates the preserved surface area using the MNE values of each pixel in the drawing (Marean et al. 2001).

While the ethnoarchaeological sample was less fragmentary than archaeological collections, this method was still crucial in allowing direct comparisons to Nilssen's (2000) data, which was experimental and therefore less fragmented. The number of surface modification marks falling on the drawing could be corrected using the surface area, and the corrected number would be the estimated number of cuts that would be found on one whole bone, as extrapolated from the preserved fragment area. The direct comparison of the study group and Nilssen's African sample was another focal point of this study, in testing the 'uniformitarian assumption', and the GIS system was the only system to date that made this level comparative analysis possible.

To record bones using the GIS system in the field, paper copies of the template (a photo of the bone in several views) were brought into the field and digitized later for analysis. Specific steps taken in the field recording of butchery marks to be used in the GIS method were as follows:

1. Fragments/bones were intercepted after eating, and before disposal.
2. The fragments were refitted where possible.
3. The bone/fragments were drawn on a printed out copy of the template, with one bone drawn on one template.
4. The whole surface of the bone/fragment was studied under a microscope, 25X and/or 50X.
5. Surface modification marks were drawn on the same drawing as the fragment, reproducing the size, shape, and position of the marks as accurately as possible. Cutmark types used by Nilssen (2000) were used with some modification. The drawing was annotated with additional information where necessary.
6. The bone or fragment was returned to the study group.

A more detailed description of the process of intercepting and drawing a bone is given in Chapter 7, as the process is hard to describe without background information in the study group's butchery and use practices.

After the field season, the paper drawings were digitized and the codes entered into an attached database. Nilssen's coding system (2000:386, 37-39) was used where possible. Codes used in this study are as follows (descriptions paraphrased from Nilssen 2000:37-39):

- Cut marks: incisions made by a knife perpendicular to the bone surface (Nilssen's type 1)
- Cut/shave marks: the knife shaves a portion of the bone after an incision is made (Nilssen's type 3)
- Cut/shave/cut marks: the knife makes an incision into cortical bone then shaves a portion of the bone after which it penetrates the cortical surface (Nilssen's type 5)
- Shave/cut/shave marks: the knife shaves a portion of the bone surface, then cuts into cortical bone and again shaves a portion of cortical bone (Nilssen's type 6)
- Shave marks: the knife blade is used at an acute angle to the bone surface and is moved in a direction perpendicular to the length of the blade causing a portion of cortical bone to be shaved away (Nilssen's type 7)

Additional or slightly different marks for this study were:

- Saw marks: the knife blade is used in a sawing motion with intent to mark a line along the surface of cortical bone (similar to Nilssen's type 11)
- Axe marks: marks made by the chopping action of an axe, deeper than a cut mark and with crushed bone pushed up on both sides of the mark
- Nick marks: marks made by contact with the point of a knife (similar to Nilssen's type 14)
- Human tooth marks: marks made during eating by study group members. It should be noted that these marks were often left on areas with soft tissue, and might not have been visible had the bone been cleaned to lab conditions.
- Percussion marks: marks made when cracking the bone open for marrow, with blows administered by axe-butt, hammer, or knife-back. These tools did not leave clear percussion marks (as stone tools would) when they did not successfully crack bone. Most identified marks were on successfully cracked areas (i.e. along a fragment edge), but many had damage on fragment edges where the mark would have been. Percussion points that can be reconstructed from fragmentation patterns (but missing percussion marks) are *not* drawn in the figures and are *not* counted as percussion marks.

Chapter 3: Study area and study group

3.1 Area overview

The hunting and butchery behavior of the study group is affected by the environmental factors specific to the study area, as well as individual or personal aspects ranging from personal skill and preference to group dynamics as well as day-by-day situational differences. In this chapter I will elaborate on the backdrop of factors specific to study area (and study group) that could affect the hunting and butchery behavior as a whole. Additional factors specific to each hunting or butchery incident will be described together with the incident in later chapters.

3.1.1 Environment

The study area is dominated by Lake Nichatka, a large (30km x 4km) and deep lake stretching roughly north-south. The surrounding area is typically hilly, with hills and mountains intersected by river valleys associated with Lake Nichatka. Numerous smaller lakes and streams dot the area as well. Due to the numerous waterways, the area is rather hard to travel in during the warmer months. The main settlement of the study group is situated on a river terrace at 550-600m above sea level, with nearby forested hillsides at 700-800m above sea level (Figure 3.1a).

The valleys and mountain foothills are mostly covered by *taiga* forest (Figure 3.1b and c), but open areas also exist around bogs, wetlands, and larger rivers. According to research ecologist N. Røv, the main *taiga* tree species in the settlement area are larch (*Larix gmelini)* and pine (*Pinus sylvestris)*, with scattered spruce (*Picea pumilla)*, cedar (*Pinus sibirica)* and birches (*Betula)*. Under-story bushes consist mainly of rhododendron, *Betula*, *Alnus, Pinus pumila* and *Salix*. On dry ground the field layer consists of cowberry (*Vaccinium vitis-idaea)* and *Empetrum*, as well as lichen (mainly *Cladonia*). Green mosses (*Bryales*) are also common. On wetter ground, *Ledum palustre*, *Potentilla* and blueberry (*Myrtillus uliginosum)* are dominant, and in bogs and wetlands, sedges (*Carex)* and cotton grass *(Eriophorum)* are dominant. There are also some herbaceous undergrowth and meadow along some rivers and streams. High mountains with alpine tundra vegetation are found 10-20km from the lowland lake margins (Røv, personal communication). While trees can grow tall in some protected areas, most of the forest cover is of thin and stunted deciduous trees with high visibility in the colder months. This high visibility, together with the freezing of bogs and other wet open areas, create good conditions for hunting in the colder months.

The general climate is continental with very cold and dry winters and warm and relatively humid summers. Most precipitation in the study area falls as rain during July–September with an annual mean of 300–400 mm. In the high mountains, summer temperatures are considerably lower and precipitation higher. This causes distinct gradients between dry lowland and humid mountains, resulting in favorable conditions for ungulate populations, which undertake short-distance vertical migrations (Røv, personal communication).

The study site is located at latitude 57 52 N, with their main camp (described below) located at an altitude of 560m above sea level. While surrounding areas may experience extremes below minus 50ºC in winter, the presence of the large Lake Nichatka causes winter temperatures to be relatively moderate (Røv, personal communication). In fact, the microclimate around the lake maintains conditions similar to locations a full degree south in latitude, or 300m lower in altitude (Figure 3.2 a, b)[1]. Using weather station data from these locations, the environmental variables for the study site are estimated at 11 for effective temperature (ET) and 22-23 for temperateness (TEMP) (Figure 3.2 c).

3.1.2 Populations in the surrounding area

[1] It should be noted that the climate data for the study site is incomplete (missing summer data), not a yearly average, and was recorded in an amateur fashion.

The study area is located in the Kalarskii Raion of Chitinskaia Oblast', a region rich in mineral resources, including uranium, copper, vanadium, iron, coal, and others (Gron 1999). The immediate area around the study site is a pocket of wilderness, and do not contain major settlements of natives or non-natives (i.e. Russians). However, in a larger sense the study area is surrounded by major industrial arteries. To the north of the study site lies the River Vitim – a navigable tributary to the river Lena which serves as a major shipping lane – and its associated settlements (Utechin 1961). The Baikal-Amur Railway (BAM) – a major railway line in central and Eastern Siberia, second to the Siberian Railroad – has been constructed to the south of the study area in the 1960s. There had been a large influx of non-native workers during the construction of the railway and afterwards. As early as the 1930s and again in the 1960s, efforts were made by local and central authorities to organize and settle the Evenki into reindeer-herding sovkhozes and associated territories, and to bar them from their traditional hunting territories (Gron 1999). Most Evenki in the area are living in villages and had been working in various sovkhozes.

The center of the study group's territory is on the River Cen', about 4km upstream from the river mouth as the river exits north from the northern tip of Lake Nichatka. The study group hunted in at least four additional and adjacent major river systems and their numerous side-valleys during the year (Figure 3.3a). Figure 3.3b shows a conservative territorial estimate – calculated by drawing zones of 10km radius around each campsite used during the field season – of approximately 1,378km^2. A more likely estimate of their core territory, including two other river systems often referred to in conversation, would be approximately 2,700km^2. Two additional areas were accessed annually on long-distance trips (Figure 3.3c).

The settlement the study group most frequently visited was called Perevoz, located in the neighboring Irkutskaia Oblast'. Perevoz lies 145km north of the main study site, and was accessed by the group via a route that included a smaller outlying settlement (Bulbukhta) where they left their domesticated reindeer while visiting Perevoz (Figure 3.4a). Perevoz was reputedly a small gold-mining village, with the main advantage (from the study group's point of view) being their connection to the outside world by a road that is open all year, bringing in commercial goods. Members of the study group had many relatives in this village and they visited at least once a year, usually around New Year, to barter for foodstuffs and other items. The trip to Perevoz normally took 5 to 6 days one way, with pack and riding reindeer or with reindeer sled, and 4 days in conditions with good snow and ice. Being rather isolated and surrounded by good hunting territory, Perevoz was a convenient but rather expensive choice in terms of bartering, as forest products were marked down and commercial items marked up.

The study group's close ties to Perevoz and their family history (described in the following section) suggests a cultural connection to Evenki and Iakutian[2]

[2] The Library of Congress system of transliteration is used for Russian words. Iakut(ian) is commonly spelled Yakut(ian) in English language literature.

(Sakha) groups to the north. Language-wise, group members mainly spoke Russian interspersed with Iakut and Evenki terms, but of the two latter languages, they seemed to be more fluent in Iakut. For example, more Iakutian words (such as '*skala*' for 'cliff') than Evenki were interjected in their otherwise Russian conversations. When I asked them for specific terms describing some of their possessions, they gave three terms that they described as Russian, Evenk, and Iakut. A word commonly heard in conversation, '*sag-dzoi'* (used to indicate wild reindeer, as opposed to domesticated), is close to the term recorded by Lissner (1961:137) among the Orochen (an Evenki subgroup to the immediate west) as well as by Shirokogoroff (1929:30) in the Yenisei, suggesting possible ties to that direction as well.

There were three larger settlements to the south – New (Novaia) Chara, Old (Staraia) Chara, and Chapo-Ologo – about 110km away as the crow flies from the study area (Figure 3.4a). New and Old Chara together served as the regional center. New Chara grew around the (relatively) new BAM railway station. Old Chara had some major administrative buildings, as well as a small airport. Chapo-Ologo had a predominantly Evenki population, and was considered the main Evenki community in the area. Old Chara had also started out as such, where migrating groups were forced to settle in the 1930s (Yates and Zvegintzov 1995). For those traveling on land from the Nichatka area, these three towns were much harder to reach than Perevoz to the north, due to the Kodar mountain range lying immediately north of the three towns and the general lay of the river valleys – an estimated 10 days with pack reindeer one way. Additionally, the study group did not have close ties in these southern communities, and thus did not feel as comfortable or safe visiting there with their herd of domesticated reindeer in tow. Members of the study group thus visited these southern towns occasionally, but not yearly, although these towns offered more favorable prices than Perevoz. When they visited, they stayed in Chapo-Olego, but visited friends and acquaintances in New and Old Chara, as well as towns to the east in adjacent Sakha Iakutia territory.

Up into the mid 1990s, more people lived in the area where the study group lived, offering more interaction and a closer connection to the outside world through two-way radio, helicopter traffic, and a steady stream of visitors. The area around Lake Nichatka had been the subject of various mineralogical, meteorological, and geological surveys by Russian researchers for some time. Until the mid 1990s, there was a large meteorological station operating on the lakeshore, with one office building (cabin), at least four houses or log cabins, and many other permanent wooden structures. The station also had a substation on the opposite shore, as well as other cabins scattered along the lake. Russian researchers lived there year round, and they kept radio contact with the outside world, with the ability to call in helicopters at need (Figure 3.4b). This meteorological station was easily within a day's travel from the study group's main camp locations, even in the summer months when traveling conditions were bad.

Downstream the River Cen' and on a tributary to the north was another small complex built by Russian researchers or prospectors (Uraha), with at least six log cabins, plus many more tents and structures (Figure 3.4b). This area was occupied to ca.1985 then abandoned. Other single-cabin camps belonging to Russian hunters dotted the area, as did at least two multiple-cabin settlements built by geological survey teams. To the south, a bit more distant but still within visiting range, were the summer grounds of a reindeer collective at Malaia Tora (Figure 3.4b). This area also had cabins and tent structures, as well as large-scale corrals for mass herd management. The collective herd was large, numbering in the thousands. Evenki and Russian hunters came into the area as reindeer herders or State-employed hunters, ferried in and out by helicopter. Undoubtedly some hunters visited the study group during their hunting trips. Barter with State-supplied hunters was important, especially for bullets and other hunting related goods. The collective collapsed in the mid 1990s and subsequently the herding camp was abandoned.

The study group is currently the only group living in the area, except for a family of five – parents and three sons – living more than 50km away, on the River El'ger that exits south from Lake Nichatka from its southern tip (Figure 3.4c-A). This family (also Evenki) moved into the area in the mid 1990s, and had worked at the reindeer herding camp in Malaia Tora before that. Members of this southern family hunt and fish on the lake, and thus do visit or encounter the study group from time to time, but the two groups did not seem particularly close in terms of friendship.

There were other Evenki formerly living in the area, but most seem to have pulled out sometime in the 1990s when the communist infrastructure collapsed. There were some relatives of the study group living in a site called Svetoi (Figure 3.4c-B) – this site was occupied as early as 30 years ago and possibly as late as the early 1990s, but with a hiatus in between. In other words, these relatives had moved out of the forest, been assimilated into village society, and then moved back into Svetoi (at least seasonally) after the patriarch's "became a pensioner". The campsite at Svetoi had several permanent structures, including a large raised and roofed storage shed (*saiba*). Some other relatives of the Svetoi patriarch had a camp to the south of the study group's territory. This southern camp had a large area cleared for use, including a helicopter landing field, and was in use from the late 1980s to early 1990s (Figure 3.4c-C). These sites are described only because they were encountered during the field season; there could have been more Evenki in the area. Within living memory, there was – as Vasili put it – a time with "domesticated reindeer everywhere, and lots of reindeer roads".

3.2 Study group

The study group consisted of five 'core members', three of whom were related by blood. I will refer to these three as the 'core *family* members'. The surname of the core family group was Ilidinova. In the text, I will address them in this study by their first names or nicknames[3], and in figures and tables, I will denote each member by a two-letter abbreviation (shown below in parentheses).

Briefly, the five core members were:

<u>Five core group members</u>

Yakov (YA): Male. The patriarch. ~60 years old?
Vasili (VS): Male. The best hunter, and *de facto* leader. 32 years old.
Vadim (VD): Male. Young hunter. 20 years old.
Yulia (YU): Female. Young wife of VS, and new arrival. 17 years old.
Sasha (SA): Male. Hunter and long-term visitor. ~40 years old?

Of these, the core *family* members are Yakov, Vasili, and Vadim. In addition, there was another long-term visitor during the field study:

Misha (MI): Male. Owner of domesticated reindeer and seasonal hunter. 40~50 years old?

There were other short-term visitors to the camp, some of whom were related to the core family group.

In brief, the relationship between these people could be described as the following: Yakov was the patriarch and the father of both Vadim's father and Vasili. Vasili was Vadim's uncle, and also a stepfather, having married Vadim's mother (Anna) after Vadim's father's death. Yulia knew the study group through both Anna and Vasili, who were both her affines on her mother's side. Misha was Vasili's cousin and Yakov's nephew. Sasha was not related to anyone in the group, and was simply a friend of Vasili. Figure 3.5 is an abbreviated family tree.

In terms of group dynamics, Vasili was clearly the practical leader. He made the decisions ranging from moving camp to which part of meat to eat for dinner. Most decisions were reached by a series of open questions, however, and generally an egalitarian mood prevailed. Vasili was the most experienced and active hunter (Vadim being much younger, and Sasha being relatively new to the area). He was intelligent and had strong leadership abilities as well as charisma, but also had a particularly violent streak when drunk, and served jail time for a crime he had committed under the influence of alcohol.

Yakov was deaf, lame and old, but was nevertheless still shown the respect of the patriarch, such as by being served his meals first. He was also respected for his hunting prowess in his youth, his still evident skill in butchery, and his knowledge of the territory. His knowledge was also sought in traditional matters, such as making bait for bear hunting, and in the details of domesticated

---

[3] For names, I detract from the Library of Congress system of Russian transliteration. 'The correct transliteration for Yakov' is Iakov, and 'Yulia' is Iuliia.

reindeer care. Due to his progressive deafness from early adulthood onwards, his speech was not clear to members outside the study group.

Vadim was a young man, just reaching adulthood. He was a skilled hunter, but still in practice apprenticed to his uncle, and sometimes there was tension in the relationship between Vadim and Vasili. He was a good worker, but could also be moody and unpredictable. He was planning to build his own cabin and hoping to find a wife to come live with the group – and the latter was not an easy task.

Yulia was a young woman from a broken family in town. She was new to the forest, and was learning all the skills as fast as she could, but the other members had great advantage over her in this regard. As she was prone to speak exactly what was on her mind, the other members usually retaliated by commenting on her inexperience. Her status rose rapidly when she became the wife of Vasili, but her workload was still heavy, especially since she caused Anna – Vasili's previous wife, Vadim's mother, and only other woman in the group – to move out. She grew increasingly unhappy during the field season as her marital relationship broke down. After signs of domestic violence, we agreed to airlift her out of the study site.

Sasha was a knowledgeable hunter with a cheerful yet quiet demeanor. He was from Chapo-Ologo, had an education, and was versed in the ways of the world compared to the other members of the study group, who were completely illiterate save for Yulia. He had worked in the reindeer herd camp at Malaia Tora as a herder and hunter before the collective collapsed.

Misha was from Perevoz, and was the relative with whom the study group members stayed with on their trading trips. Misha was usually described as 'Iakut', in contrast to his wife who was 'pure Evenki'. He held ownership of more than half of the domesticated reindeer herd that was under the study group's care. Misha visited the group often, and used their camp as a base to go hunting and fishing. Misha never shared his game with the group; he packed it up and took it back to his village and his family. As an elder, richer relative with a lot of power over the group, Misha was always welcomed but privately regarded with some ambiguity.

Family history

In addition to the description above, an abbreviated family history might help situate the group between tradition and change. This account was assembled from various casual conversations.

The core family group has been in the area for at least three generations. Yakov's grandfather was originally "from Iakutia" (and referred to as 'Iakut'), and moved down through Perevoz to the present territory along the River Cen'. Yakov still only spoke Iakut (although his speech was garbled from his long-term deafness) and did not know any Russian. As mentioned earlier, everyone spoke Russian to each other, but the core family members, when left alone, sometimes reverted to Iakut (and were perhaps speaking Russian for the benefit of Sasha and Yulia). At the time of the family's original migration into the area, they were still making and using traditionally made implements instead of commercial items. Vasili could recount tales of Yakov's grandfather making home-made iron tools, such as grappling hooks for meat and pots, and Yakov's grandmother sewing birchbark tent covers. Traditional living continued into the late 1960s to early 1970s; a family photo shows Yakov's mother, Yakov, and Yakov's wife in front of a summer pine-bark covered *chum* (Figure 3.6).

The family frequently moved within a large territory, but their more permanent camps seem to have been made in the same general area as the current camp for some time (Figure 3.4d). Yakov and his wife had six boys, one of whom died young. Some of the sons, such as Vadim's father, lived on and off in settled villages, while others lived most of the year in the study area. In the early to mid-1980s, Anna and Vadim joined the family in the forest, as Vadim's father was in jail. Yulia was also sporadically living in the forest at this time, visiting her aunts and grandfather nearby (Figure 3.4c-B), and recalled visiting Vadim's camp[4]. Sasha was working in the reindeer herding camp (Malaia Tora) to the south of the study area. The small Russian settlement north of the study area and the meteorological station on the lake were occupied, and many family photographs come from this period, taken by Russian researchers.

In the mid to late-1980s, two brothers died and a third went to jail in an unfortunate incident under the influence of alcohol. Vasili became the primary hunter, living with his mother and father in the suddenly small family. At one point, Vasili moved, or at least lived part time in Perevoz and started his own family.

In the mid-1990s, Vasili also went to jail. Shortly after, Yakov's wife died of illness, leaving Yakov and Vadim in the forest camp (Anna had temporarily left the group for the village). According to Vasili, Yakov and Vadim bartered most of the family's old stock of domesticated reindeer during the following years, and "grew thin". Vasili was released from jail in 1998, Anna also came back, and in March of 1999 Yulia joined the group. Thus, the group the Norwegian expedition visited the group for the first time in the summer of 1999 saw Yakov, Vasili, Vadim, Anna, and Yulia living together. In the summer of 2000, Yulia had become the new wife of Vasili and Anna had left again. In 2001, Sasha came and joined the group.

The social change in Russia in the mid 1990s affected the family in that both their Russian and Evenki neighbors moved out, and cut off their easy access to emergency transport and hunting supplies. At about the same time, partly due to Vasili's incarceration, the family group bartered away most of their domesticated reindeer herd and became dependent on their relatives' – specifically Misha's – goodwill. As the almost yearly ethnoarchaeological visits started in 1999, the family and their now nearly empty territory was re-discovered by the new entrepreneurs, including traders and outside hunters. By accepting

[4] Yulia and her family had closer connection to settlements in the south, in contrast to the core family members. Her family probably had been in the area before the study group's family moved in from the north. She once told a story of a great-grandfather who was 'famous for his strength' and for whom a lake nearby was named after.

advanced deliveries of store items and foodstuffs from a certain trader in exchange for forest products (see Chapter 4), the group had entered the capitalist system and, in the words of Vasili, moved “from being *rabochniki* (laborers) of Misha’s, now *rabochiniki* of [the trader’s]”.

While past studies indicate two nuclear families (instead of one) was the norm for group size of Evenki in the area (Shirokogoroff 1929), living in isolated nuclear family unit groups for most of the year was not uncommon among boreal groups, especially among atomistic societies brought on by the fur trade (Honigmann 1968; Munch and Marske 1981). This group’s annual bartering trips to Perevoz and less structured barter with their Russian neighbors and hunters indicate that they were already taking part in the market system and thus atomistic. However, the past two decades seem to have been those of particular upheaval for the core family group. Alcohol consumption was another major cause of tragedy in this family, although this is hardly unique among indigenous communities. Heavy drinking and the polar switch to aggressiveness from peaceful coexistence has been documented in many Subarctic groups (Goulet 2000). The loss of the younger generation due to alcohol-related accidents, combined with the sudden decline of neighbors (both native and Russian) and the support they offered undoubtedly hurt the group, especially as this occurred as the family group size dwindled. This family group had been gradually breaking down, and this current group could likely be the last generation that would permanently live in the study area.[5]

Summary

Does the study group’s pattern fit the ‘typical hunter-gatherer assumption’? One way to investigate this question is through the variables of effective temperature (ET) and group size. Hunter-gatherer societies in ET=11 (the ET calculated for the study area; see Figure 3.2c) have a basal group size of 10 to 25, according to Binford (2001:262). In fact, 11 is the pivotal ET value around which group size decreases in both directions. The ecological gradient around ET=11 creates a condition that either necessitates or allows the formation of some of the largest basal groups surveyed. All but one group in the sample has a major investment in storage and in the duration of its anticipated use, which Binford connects to the sustainability of large groups (2001:263). These overall patterns confirm that the study group’s small size is anomalous, and an example of atomism. There is a possibility that atomism goes back for a long time in this region, as the sable in this region was exploited from early times, as discussed in Chapter 1. A group-specific condition that must be considered in this study is the effect of living in a small group might have, in an environment that would support a larger group with storage.

In any case, the family group had been in the area for some time, and Yakov, Vasili, and Vadim had all spent their childhood and youth as part of a

[5] At the time of writing, Yulia had left in 2002, Vasili had been briefly incarcerated in 2003, and Yakov had died in 2004(?). Vadim had found a wife, and possibly still living in the study area.

hunting family group and had learned the traditional hunting and butchery skills. The skewed male-female ratio and the lack of children made the group structure and dynamics resemble Soviet-era reindeer brigades in some ways (see descriptions in Anderson 2000a; Kerttula 2000; Kwon 1993), but the crucial difference was that this study group was not a group sent to work 'in the bush', but rather, a family in their home environment. Their knowledge of the land, as well as their hunting and butchery skills, were handed down through generations.

3.3 Study area

The study group was based, ten months out of the year, in a campsite (called Main Camp in this study), located on the west bank of River Cen'. The group was based for the rest of the year in the Spring Camp, further south and on the east bank (and upstream) on the same river. From these base camps, all or part of the group moved to temporary camps for various purposes and various durations (for discussion of moves, see Chapter 4). What follows here is a description of the layout of the camps, their buildings and structures.

Main Camp

This camp was located on the west bank of River Cen', about 4km from Lake Nichatka, and along a stretch of deep and quiet water[6] (see Figure 3.7). The immediate area around of the Main Camp was clear of trees, both deliberately cleared and also cleared through continuous use for firewood and building materials. The camp was on a narrow strip of flat land lying north-south, with the river to the east and a hill to the west. There were two log cabins – the largest with a single room and used as the living room-cum-bedroom for the three single men (Yakov, Vadim, and Sasha), and a smaller cabin. The smaller cabin was set aside for the married couple (Vasili and Yulia). The smaller cabin was originally also a one-room cabin, but two additions had been built on, creating a heated bedroom and heated private living/working room, plus a colder storage area (*kholodovka*) that doubled as an entrance. The *kholodovka* was primarily used for food storage for the whole group.

[6] Other abandoned camps have been observed along rapids; thus this does not seem to be a prerequisite for a major campsite.

Attached to each cabin was a large roofed storage platform with open sides, built about a meter off ground. These platforms were primarily for clothes and other personal belongings. The space between ceiling and roof of the cabins was also used for storage, mostly for unused tools and larger items. Additional structures around the two houses were an unroofed storage platform about 1.5m off the ground in height, a small freestanding roofed platform with open sides, and a roofed Russian baking oven constructed of brick[7]. The tall open platform was one of the main meat storage areas, with meat deposited on top and covered with tarp. The smaller platform and Russian oven were covered with pots, pans, and other items, and were also used for meat and bone storage, being close to both the butchery area and the eating/cooking area. The butchery area consisted of a horizontal pole structure, used to support carcasses, meat parts and fur in the colder months, and used as an outdoor kitchen in the warmer months, with the pole supporting pots.

Further out of the central living area and to the south were a bath cabin (for *bania*, or Russian steam bath), a roofed horizontal pole structure, and several doghouses (constructed of logs). The covered pole was used to hang fishing nets and to lean various items against. This area was also used for firewood cutting and chopping, and had several log chopping-blocks, as well as wood chips strewn about. (This was the area in which we two researchers set up our tent). To the west was a storage hole dug into the hillside. Also to the west was a bone disposal box, a rectangular structure with four walls constructed by logs and also covered with logs on the top, already nearly full with discarded bones at the start of the field season (Figure 3.7d). The storage hole was for long-term meat storage, and could serve as cold storage in the summer if it was packed with ice (but it was not prepared during the field season, for the following summer). To the north, a clearing was kept open as a helicopter landing site and also as an area for domesticated reindeer. Long logs to tether reindeer were laid on the ground, and several large tree stumps were used as a salt lick. Nearer to the river was a smoking tent (for curing leather and skin, not smoking meat or fish), built on the slope of the riverbank to take advantage of the draft.

Large wooden items, such as workhorses and large log presses for working skin and fur, workhorses for *pechka* (sheet iron stove) making, sled runner forms, various spare parts of sleds, and old sleds were distributed throughout the above areas.

Further out to the north were a small corral for keeping domesticated reindeer calves in the summer. The corral had an attached roofed area for domesticated reindeer, also used in the summer months, when smudge fires were lighted around the roofed area to keep the mosquitoes away. The current outhouse was located furthest out, and by the river. Beyond the *bania* cabin to the south was a fenced kitchen garden, where the study group had tried to grow potatoes. Up in the hills were several older platform structures that were not in

[7] Bricks, window-glass and frames, roofing material, and many other items were scavenged from abandoned sites.

use at the time of the field study, including a covered box platform for bear bone disposal, and another open platform for ungulate bone disposal.

The study group clearly invested a lot of their time in building up and maintaining this camp. This camp had been used as the main camp for at least five years. Some structures, such as the *bania*, were built in the past year. Future plans for camp expansion and maintenance included an additional house where the researchers' tent stood, and a new box-structure for bone depositing. At that time, the old bone box would be burned to the ground, to avoid attracting scavengers[8].

Spring camp (Figure *3*.8)

The Spring Camp, located on the east side of the river, was primarily a location for the calving of the domesticated reindeer herd. A large corral was built, enclosing an area of varied terrain and large enough for nursing females to graze. Old spring camp locations dotted the eastern bank. This particular Spring Camp had been in use for several years, and the corral was enlarged each year. In the Spring field season, the men commuted to the Spring Camp from the Main Camp for several days to both repair and fix the corral, which used at least 1,500 felled trees and at least 1 km in length.

In the year of this study, the group moved the tent-and-living complex at this Spring Camp to a new location. The old site was to the north of the new location. It had overlooked the river, and was still identifiable by the presence of old tent poles and features. The new campsite was located on a triangular patch between the main river and a small creek. The campsite was not cleared as much as the Main Camp, but trees were gradually cut down for various uses over the course of the stay, both around the living area and in the corral. The tip of the triangle of land was roughly cleared off of taller trees, in order to use as a helicopter landing site.

The campsite had fewer permanent structures than the Main Camp, with only a series of horizontal pole structures for outdoor cooking and general storage and a new 1m high platform for storage of food and clothing immediately across the tents. Three canvas tents were brought in, with the largest used as a living and dining tent, as well as being Vasili and Yulia's sleeping tent. An additional *pechka* stove was set up outside, so all the cooking could be done outdoors when the weather was hot[9]. An area was set up for washing and brushing teeth, but there was no specific toilet. Between the living area and the corral, logs were laid on the ground for reindeer tethering. Further away and in a

---

[8] Observed old bone deposits have all been abandoned, not burned. Their plan to burn the full bone box indicates an intention to stay at a campsite longer than they had ever done previously.

[9] Some things, like bread, were easier to cook on *pechka*s than on open fire. This group cooked their meals over an open fire only when there was a need for speed. Pots over a large open fire boiled much faster, but had to be kept under close watch and ashes flew in the food. Dog food was routinely cooked over open fires.

stand of trees, a platform was made for bone disposal late into the Spring field season.

Other camps (Figure 3.9)

The study group conducted overnight trips to various river tributaries (see figures in Chapter 4). A single canvas tent was taken on trips, with tent size varying according to the number of people making the trip. Tent poles were cut down, used, and left at the site. Old tent poles could be seen in some locations, but they were not re-used. Tent locations were in some cases observed to be re-used, with some change in layout or tent direction. It is not clear if either of these re-using choices had any reason beyond the practical. An outdoor cooking area was created, that consisted of a single slanted pole supported by a shorter pole or a conveniently shaped tree. The slanted pole could be adjusted for height of the pot over the fire. This cooking area was always set up first, to make a cup of tea after setting up the tent. This fire was also used to cook dog food during the duration of the stay. Other structures were rarely made, although branches of convenient height were often cut off to hang things. To me, both slanted pole and hanging area in abandoned sites looked almost naturally formed and were hard to identify at a distance as man-made, but the study group members were quick to note them as signs of human occupation.

3.4 Possessions

The subsistence strategy of the study group depended heavily on having domesticated reindeer for transport, dogs to hunt with, and of course, other hunting gear. In this section, I will discuss these aspects of material culture that are directly relevant to this study.

Domesticated reindeer

Domesticated reindeer were used primarily for transport and minimally for milk products. Domesticated reindeer could be killed and eaten in lean times, but were not kept as a source of meat. The “Evenki breed” of reindeer was bred for transport and were taller and larger than other identified breeds[10] (Dmitriez and Ernst 1989). The domesticated reindeer of this study group was and able to carry up to a 70kg person on its back, and pull over 100kg loads. They were also much larger than some other domesticated reindeer observed during the field season, which was said to be of Iakutian stock.

The domesticated reindeer herd of the study group ranged freely for most of the year, and basic care consisted of searching for the herd every few days, and bringing them back to the Main (or Spring) Camp by enticing them with salt. In some cases the reindeer were tethered for a short period, and in some cases they were left free to roam and scatter once they had come back to the Main Camp. The whole herd seldom stayed in a single herd and formed subgroups, but subgroups usually followed each other. Thus in order to lead a group of reindeer home, only a few reindeer had to be caught (using salt as enticement) in each subgroup and a halter attached. In some cases, group members only collected the animals they set out for – the castrates and males for sled pulling, or females close to calf during calving season – and left the rest in the forest. Once back in camp, each animal was briefly caught, hand-fed salt, and haltered before being released.

During the calving season, females were caught and released into the large corral at the Spring Camp, mostly to protect the newborn calves from predators. They stayed there for about a month and a half. In the following months to late summer, the calves were kept corralled, and the mothers ranged out to forage but returned regularly to give milk. During this period, smudge fires were lighted to provide a smoky haven from mosquitoes for the reindeer, both male and female.

While they were ranging free within the birthing corral, as many females as possible (preferably all) were milked once a day. The number of females milked in a day depended on the time available for this task. Milking was a time-consuming task during this period, as the wary female and her calf had to be caught, taken outside the corral to the milking area, then separated for a few hours (by tying up the calf and constantly chasing the female away) to allow the milk to accumulate. This time consuming method continued while the calf was too small to separate from its mother for a long period of time. In the summer the process took less time, as calves were separated and kept in a smaller enclosure. Females were more easily caught when they returned to nurse their calves with full teats, and every nursing female was usually milked daily. The reindeer produced about 200cc of milk per female per day.

The reindeer were used singly as riding and pack animals, and in pairs for pulling sleds. Pack reindeer were used to travel in early fall and late spring, when the ground had thawed. Sleds were the preferred means of transport and were used when conditions were suitable. In observed cases, riding was not much faster than walking over short distances, but one could go farther by resting on the reindeer instead of taking breaks. In most cases, the study group

---

[10] Note that domesticated breeds are distinguishable from *each other*, but not necessarily from the local wild reindeer population.

members alternated between riding and walking when they set out by riding reindeer. The reindeer were also better than people in finding the way after dark, and if they were caught out after dark, hunters would let the reindeer find the way home. Saddles were used for both riding and for pack loading, tied to the animal by a girth belt. No stirrups were used. A halter[11] with a long lead rope on one side could be looped around and tied to resemble a rein for riding purposes. Castrated male reindeer were the largest[12] and were used for riding. Riding reindeer had to be specially trained for the job.

Females, males, and castrates were all used as pack animals and for sled pulling. Females advanced in their pregnancy were avoided when possible, but used if they must, even when the pregnancy was highly advanced (1-2 weeks from delivery). Castrates were again the choice due to their size and strength, and the lead pair in a sled team was often two castrates, well trained and docile. Young reindeer were first tethered less than a week after birth, and recently weaned animals were broken in for work – in the observed case, by simply being attached to a sled and driven forward – shortly after their mothers gave birth to the next generation. All the hunters had a favorite (or most well-trained) pair that pulled their riding sleds and used as the lead pair in their sled trains. Other pairs were mixed and matched to the amount of weight on the sled they were to pull – reindeer by nature follow the reindeer in front of them, stepping into their footsteps if they can, so if a good pair led the way, the sled train followed smoothly. When going long distances, the hunters switched their reindeer from left to right so that they would not develop harness-burns.

Castration took place in September. Only one or two breeding males were kept from the yearling crowd, and the rest were castrated. The previous year's breeding males could also be castrated. Yakov was said to be skilled in castrating the reindeer, and could also half-castrate[13] if the animal was already docile enough, using his teeth[14]. The animals were closely watched during the

[11] A simple halter was called *uzda*; a halter for lead reindeer in sled teams were called *vozhi*, and differed slightly in construction. Such gear for reindeer also had clear ownership, and each member used his own when he had a choice, but in practice any halter, sled-pulling harness (*liamka*), salt bag (*riukariuk*), or saddle could be used by any member of the group. Sleds came in two types, the wider, larger, lower and more stable cargo-carrying sled (*gruzovaia*) and the faster leading sled (*piridavaia*). *Piridavaia* sleds were customized to the owner's height and leg-length, and were less exchangeable than other gear. It was observed that the width of the *gruzovaia* was designed just right to squeeze through trees and obstacles that a pair of reindeer was able to squeeze through, and a *piridavaia*, being a bit narrower, allowed the rider to have their legs hanging down the sides (to brake, stand up, or otherwise control the sled) through most obstacles.

[12] Castrated reindeer tended to be fatter and stockier than the breeding males, probably because they did not lose weight during the rut.

[13] The point of half-castration was not explained. One possibility is that the practice persisted from times when antler was used as raw material: the antler of castrated reindeer antler was much less dense.

[14] The Evenki considered this method superior to using the knife (Shirkogoroff 1929:35).

breeding season, lest the females leave with wild males. There was no evidence of breeding with the wild population.[15]

Each reindeer had a name, was clearly identified by sight, and had definite ownership (Table 3.10a). For reasons covered in the family history (Section 3.2), Misha was the actual owner of most of the study group's herd. Vasili considered 40 to be the ideal herd size, but the study group's herd did not reach even half that number (Table 3.10b). The study group's own reindeer were too few in castrates and males that were needed for transportation. Small herd size also limited or delayed some activities – for example, when Misha had temporarily took some of his reindeer away, not enough reindeer were found after a search to pull sleds, and a trip was delayed for a day until further searches were successfully conducted.

A few exchanges of reindeer were documented in the Fall and Spring field seasons. Yakov gave Misha his old riding reindeer to be slaughtered in town for meat, and in exchange received a replacement riding reindeer from Misha; Vasili and Vadim exchanged a white female and a white castrate, Yulia received a female calf from Misha for some previous sewing service, and a female reindeer was transferred from Vasili to Yakov for unknown reasons[16]. Reindeer were received and given as payment and as gifts; Yulia received her first reindeer as a payment for boots she had sewn for an Evenki hunter from town, and Vadim had received reindeer on birthdays and other occasions.

Most aspects of Shirokogoroff's description of domesticated reindeer care in the 1910's (1929:28-36) generally agree with what was observed among the study group. For example, the close relationship between reindeer and people as epitomized by the naming of each reindeer; the use of command words; enticement of reindeer with a small bag of salt using the noise of 'trinkets' attached to the bag (1929:35); the free-ranging aspects and seasonal details in care (e.g. smudge-fire burning, milking, and castration)[17] (1929:32-35), the use of reindeer as pack and sled animals and their training methods (1929:30), and the rarity of their slaughter (1929:32).

---

[15] While there was no clear report of breeding with the wild population, there were anecdotal cases where a female reindeer was not seen for a period, returned, and was possibly impregnated by a wild male. Some calves and reindeer were referred to as "wild", both in disposition and in physical characteristics such as a leaner frame and darker color. The deliberate crossing of wild and domesticated populations was not practiced (Shirokogoroff 1935:31). There were no confirmed instances where a wild reindeer was captured and tamed, but one possible method was mentioned during a discussion of reindeer hobbles. The hobble, or *chungai*, was a log that weighed down a reindeer. The hobble was tied to its halter at a length where the reindeer would have to constantly lift its head to move around. The hobble thus did not hinder feeding but served to slow the movement of the herd. It was mentioned that one could tame a wild reindeer by tying it to an extra large *chungai*, almost a whole log. The possibility of taming female moose calves using the same method was also mentioned; moose milk was said to be better (taste- and nutrition-wise) than reindeer milk.

[16] The latter two exchanges seemed to have occurred as a result of a drunken public announcement that nevertheless bound the giver to the act after the party was over.

[17] Reindeer care in the fall breeding season among the study group has been reconstructed from information given in conversations, and have not been directly observed.

An ambiguous case is the use or non-use of the lasso. Shirokogoroff states that it was not used among the Evenki (1929:37), but the study group owned one made of woven leather strips[18]. However, this item was never observed in use during the field season. It could be that the lasso was used for specialized tasks that took place outside the field season (for example castration) but it is also likely that the lasso was directly scavenged or introduced as an idea from the discontinued reindeer herding camp (along with other items such as the reindeer nail-clipper which was identified as a scavenged item). The lasso was in a state of heavy disrepair. One major difference between Shirokogoroff's observations and the present was the effort expended to keep away wolves. The study group did not have a problem with wolves in the immediate area. Another difference was the sexual division of reindeer-care tasks which were rather clear-cut in the study by Shirokogoroff. This division was blurred in the current study, probably simply because there was only one (and at the same time relatively inexperienced) woman in the group.

Dogs

There were eight dogs with the study group. Each man had a favorite, or primary, hunting dog that he took on hunts (Table 3.11), especially for fur animal hunts[19]. Whether the rest of the pack followed, or not, was often up to the dogs. The dogs were free-ranging[20] (tied only as punishment or during a hunt, although the latter was a matter of preference by the hunter) and often left the camp as a pack. Yakov's dog Kobakh in many ways acted as his hearing aid. For hunting methods and prey types using dogs, see Chapter 4.

Dogs were fed each day with specially cooked dog food, often a meaty soup made of old meat, hooves (with tendons attached), and some sort of thickener, such as millet. Table scraps, occasionally including bones, were sometimes fed to dogs, but only the primary hunting dogs were usually allowed into the cabins and near tables. The lesser dogs were rather afraid of people.

---

[18] According to Vasili, the *vodzi* halter (for controlling sled-pulling reindeer) had to be made from specially prepared wild reindeer skin, where the fur around the shoulders had to be removed in cylindrical form (much like removing a shirt from a body) and cutting it up as continuous strips in a spiral. In contrast, the lasso was prepared from skin removed in the normal manner (slit down the belly and removed as a sheet; see Figure 7.26), which was also subsequently cut into strips in a spiral.

[19] The use of dogs in sable hunting has been documented among Evenki (Vasilievich and Smolyak 1956: 626). In the case of this study group, hunters frequently hunted sable without any aid of dogs. Despite the fact that dogs were actively trained for this purpose, they frequently got sidetracked on scents of musk deer and squirrel.

[20] This is a crucial difference, ethnoarchaeologically speaking, from Arctic and Subarctic groups that use dogs for transport, as their dogs were usually kept tied in dog-yards. The study group did build dog houses (low log houses) for the cold months, but these were built within the human activity areas, and dogs were not tied to them. Thus, dog-modified bones were not accumulated in a set area (i.e. the dog-yard). As far as could be observed, the study groups' dogs did not carry large bone parts into their dog houses, but rather scattered away from other dogs.

Dogs were also fed with offal after a successful hunt, and each outdoor butchery event drew a circle of hopeful dogs.

It is not clear if or how the Evenki formally trained their dogs beyond simple obedience, as each hunter already had a prime hunting dog during the period of observation. Breeding was not controlled but puppies were selectively killed after delivery. One dog that was troublesome was also eventually killed in adulthood. In the latter case, the fur was saved, and the meat dumped far away in the forest (to prevent other dogs from eating it), and not in their usual bone disposal areas. Dog meat could be eaten if the puppy was raised specifically for that purpose, and it would be killed and eaten when young. The family also owned a male cat (nominally the property of Vasili).

Hunting gear

Among the study group, the only person without her own hunting gear was Yulia, and it was not clear if this was due to her relatively recent arrival or to her being a female. While it would have been hard for the group to procure an extra gun for her (none of the group members were properly licensed for hunting), Yulia also lacked ownership of other items, such as a good knife, axe, and dog. During the period of observation, Yulia did ask for a dog but was rejected. While there were more taboos for females than males, the females of the study group (Yulia and Anna) both went on hunts. Anna was known as a particularly good shot, and Yulia hunted *kabarga* (musk deer), squirrel, and grouse during the field season.

The main weapon the study group used for hunting was a small caliber rifle, a .22 caliber rimfire (short). All the men had their own rifle, and Yulia borrowed either Vasili or Yakov's. Bullets were procured through barter as a group and distributed by Vasili. There was also one double-barrel shotgun for dealing with bears and used also for waterfowl hunting, and a larger caliber rifle (30.8mm center-fire), engraved with the date 1889, that was suitable for red deer or moose. Shotgun pellets, larger slugs for the shotgun, and the balls for the old rifle were handmade from scrap lead and molds. While the two larger guns were in practice shared, Yakov formally owned the old rifle and Vasili owned the shotgun. Vasili transferred formal ownership of the shotgun to Vadim in the Spring field season.

Men always carried their own knives on their person, and many hours were spent in their sharpening and care. Handles were hand made, as often were the sheaths. Blades were approximately 15 to 20cm long, straight and single-edged. Most knife blades were hand-made by Evenki metal workers from scrap metal, but not by members of the study group. Some knives were acquired recently from visiting researchers and Russians, and were identifiable by their industrial finish. Knives were used for everything, from woodworking to eating. There were also two knives that were called kitchen knives, one of which was a worn knife that got too small for hunting and butchery use. For daily cooking tasks, knives were often borrowed from the men, as their knives were sharper and easier to use, and they were freely loaned.

Axes also had definite ownership, and each man had his own. There was also a wood-chopping axe of unknown ownership, but smaller axes (with smaller axe heads) were individually owned and carried on hunting trips. Like knives, axes were freely loaned at need. Handles were hand-carved from aged birch. The traditional long spear or pike (also described as a large knife on a long handle), famously used by Evenki to cut down trees and combat bears, was no longer used by study group members. Yakov owned one, and kept the metal head of such a weapon stored and wrapped in cloth. He also dried and preserved some burbot skin during the Fall field season, explaining that it would be boiled and used as shafting glue for his spear, but never made the shaft. It is interesting to note that when using the axe to cut down relatively thin trees, study group members still habitually used a single diagonal slashing stroke that seemed more appropriate for spears and machetes, rather than axes.

Other hunting related gear that should be mentioned are backpacks and skis. All men had several backpacks of different sizes. Among these, the smallest was often carried on hunts in the Spring field season, when the days were longer and the hunters preferred to carry pots and cups to have tea on the road. Backpacks were also used when the hunter was after fur animals, in which case an axe needed to be carried. Otherwise, hunters went on hunts with only a gun and a knife[21]. While Sasha and Vasili had canvas backpacks, Vadim and Yakov still used a wooden frame backpack (*talmi*, see Vasilievich and Smolyak 1956:628) – i.e. a board with shoulder straps (Vadim's straps were canvas) and many leather thongs attached. This more traditional backpack was basically a frame where tea gear, axes, and other equipment (as well as game) could be tied and carried, leaving the hands free. Reindeer head fur was attached to the side touching the back as a cushion.

Skis were not necessary in the area around their Main Camp, but some areas within their territory had deep snow in March. The study group used wide and long hunting skis, with fur attached to the sole side as a brake. The study group had two pairs of skis in their possession, but one belonged to Misha and the other was not well maintained. Two more pairs of store-bought skis (of the same style) were brought in by the researchers in the Spring field season. Vasili put on some fur brakes and group members subsequently used it on several occasions. Study group members did not use ski poles, but in some cases did cut down a thin sapling and used it for support.

Game

Ownership of hunted large game (such as reindeer and musk deer) reverted to the hunter who delivered the shot that killed the animal[22]. While the meat was cooked and eaten as a group, certain parts – such as the lower limb

---

[21] They also invariably carried cigarettes and (importantly) matches.

[22] There was never any doubt as to who was the hunter in the observed hunts. More complex cases could exist, as suggested by Evenki common laws dictating how carcasses should be divided among hunters (Riasanovsky 1965).

marrow – commonly went to the hunter, who could eat it or distribute it (see Chapter 6 for details on part use). If hunting alone, the hunter field-butchered his prey by himself. Other members helped if they were around. Someone other than the hunter usually did the main butchery back in camp, often while the hunter rested after his return.

In the case of reindeer, the hunter was entitled to the eyeballs, but otherwise there seem to have been no other prerogative for the hunter. In the case of *kabarga* (musk deer), both marrow and kidneys were commonly eaten or distributed by the hunter/butcher. Fur of these animals was in effect common property, but the permission of the hunter was often verbally sought before use. When using the carcass at a later date, all parts including the different parts of fur and meat were usually identified to correct hunter and hunting date/circumstance by all members of the study group, much as we would know the purchase date of the contents of our refrigerator (but without the aid of printed date). Only during the glut of *kabarga* hunting late in the Spring field season was there any confusion (or rather, contradiction with my notes) of the identity of the numerous partially used carcasses around the camp. Lastly, it is important to note that while ownership was recognized, the use and consumption of game was by the group as a whole and as a *single* unit.

Ownership of pelts from fur animals was more clear-cut. In the case of this study group, the pelts of the most valuable fur animal – the sable – were in effect put into a communal account, and bartered for trade items used by the whole group. Pelts of squirrels and other animals were kept individually, and in some cases were disposed of by the hunter himself (e.g. when they went on bartering trips). For all fur animals, the number of pelts contributed by each hunter was clearly remembered, and in many cases the pelts were also identified to hunter and hunt date by the whole group.

Another explanation for the way pelts were handled is that Vasili was supporting the family group through the complete contribution of his pelts (he hunted the majority of sable), Vadim was still allowed, like a child, to keep what he wanted and to contribute the rest (he hunted a lot of squirrel), and Sasha, as a boarder, was paying his rent in pelts and game (both squirrel and sable). However, this does not explain Yakov's stash of marmot (*tarbagan*) fur under his bed, despite his contribution of sable, so I favor the former explanation.

Fur and skin products, such as hats, mittens, and boots were mostly made by Yulia, although Sasha and Vasili were also competent in sewing. All sewed products made by Yulia produced income for Yulia if bartered outside the group, in the form of domesticated reindeer or hard cash. Vasili did most of the mending of cloth items, and was the only one in the group that knew how to use their foot-pedaled sewing machine.

3.5 Summary

The core family unit of the study group had been in the study area for three generations, and knew their territory like the back of their hand. Their territory was located in a relatively snow-free and mild-wintered microclimate zone, due to the presence of Lake Nichatka. The climatic factors created favorable conditions for hunting by providing good foraging conditions for ungulate prey, easier overland travel, and relatively few days where hunting was impossible due to storms or extremely cold temperatures. Their proximity to waterways provided access to fish in the warmer months and 'winter roads' when everything iced over. Their territory was mostly forested, but with open areas suitable for hunting. The forest itself was also a valuable resource, in terms of building materials and firewood. As mentioned previously, a group-specific condition that must be considered in this study is the effect of living in a small group might have, in an environment that would support a larger group with storage. An additional area-specific clause to that condition would be 'in an environment favorable to hunting, and with abundant aquatic resources'. The general patterns of resource use in this environment will be addressed in the next chapter, and patterns of hunting in Chapter 5.

The study group was left in isolation for some time in the recent past, largely owing to the social and political changes in Russia. Russian researchers and prospectors pulled out of the area, and native (Evenki) hunters that previously relied on the state for transportation in and out of the bush were temporarily left without means to get to their hunting territories – the study group in fact reported that a few years passed without a single passing-by hunter or visitor in the late 1990s. The study group, having kept their domesticated herd of reindeer away from collectivization, was able to stay and live in their territory, unlike many others.

The field observations were thus made among a study group that had been leading, so far, a rather traditional existence in the *taiga* as hunters using domesticated reindeer as transport. Important for this study is the fact that the three related hunters – Yakov, Vasili, and Vadim – were traditional hunters since childhood. At the same time, some aspects of their subsistence activities observed during the field study (discussed in detail later in this dissertation) were undoubtedly affected by recent changes. The decrease in the human population (and thus hunting pressure) in their area is one factor, and the opportunity to scavenge, borrow, or barter for gear that was to be left behind by Russians (especially cabin hardware and boats) is another factor that most likely had a large impact on their hunting and general activity patterns. It should also be remembered that the study group had always bartered forest products for store-bought produce, and their lifestyle could be termed atomistic (or 'not pristine', although this concept is outdated) in terms of their contact with the market economy, small group size and high hunter-to-consumer ratio.

At the time of this study, some traffic into the study area had resumed and seen to be steadily increasing. Seasonal licensed hunters, illegal poachers, fishers, and traders were again active in the territory, as well as researchers. The study group was about to be pulled into a more intense form of barter economy, perhaps most resembling the trader-trapper relationship documented in the Subarctic, as the group increasingly relied on a single outside trader for major foodstuffs and ammunition. There were signs that this relationship could, in the worst-case scenario, turn into an increasingly inescapable cycle of debt.

Chapter 4: Patterns of activity

While a field researcher always hopes for a representative sample, specific events and circumstances do affect behavior, as well as ever-changing factors such as daily weather and seasons. The hunting and butchery behavior of the study group were no exception. In this chapter, I outline the general circumstances leading to this field season, some notable factors that should be kept in mind about the field season, and the overall patterns of activity seen from a timeline view.

4.1 Field season

The field study was conducted in two three-month periods in 2001 and 2002, which, subtracting the time it took to travel to the site to and from Moscow, resulted in a 68-day study for 2001 season (referred to as the Fall field season (or simply as capitalized Fall): 9/18/01-12/17/01) and a 75-day study for the 2002 season (referred to as the Spring field season or Spring: 2/26/02-5/26/02) (Table 4.1). There was a local helicopter fuel shortage when we arrived in September 2001, which caused extra delays and shortened the actual field season.

This dissertation project had three main project members, Dr. Kuznetzov, Dr. Røv and myself. Dr. Kuznetzov was unable to find a Russian researcher to take part in the field study, and as he himself could not take time off, only two researchers were at the study site for both Fall and Spring field seasons. However, Dr. Kuznetzov held an equally important role, providing invaluable logistical support such as hiring the helicopter to take us out of the site on pre-arranged dates.

4.2 Study site living arrangements and possible study bias

On October 6, 2001, together with my field partner Dr. Røv (hereafter Nils)[1] I flew into the study site on a hired helicopter to begin the field study. On the helicopter were also Dr. Kuznetzov and a trader from Chara (the town near the BAM railway line) who occasionally supplied the study group when helicopters were available (usually on the occasion of forest fires). The study group invited everyone, including the helicopter crew, inside their log cabin for refreshments. Group members bartered with the helicopter crew for helicopter fuel (to be used in chainsaws and outboard motors after being mixed with gasoline), and were advanced some goods and foodstuffs from the trader. We unloaded our gear. Then the helicopter flew away, leaving Nils and I on the ground.

We had prepared our tent, gear, and supplies so that we would be completely independent of the study group, save for firewood. We planned to be as unobtrusive as possible, and we thought that would include leaving the study group alone except when some butchering, hunting, or related activity was going on. We were therefore equipped with our own cooking gear and had brought supplies suited for camp life, such as canned meat and instant soup. However, by the time the tent was set up, it was clear that the study group expected us to eat every meal with them, and to spend most if not all of the day with them in the main cabin.

This unexpected living arrangement was a great boon to this study, in that the study group's meals could be observed and the hunting and butchery sequence could now be completely traced from an animal's death to consumption. In hindsight, it was also the only arrangement that made it possible to document hunting and butchery, as group members did not announce their intentions, and rather suddenly started butchery activities or walked away on hunts. However, this living arrangement also resulted in the study group having a very large stash of canned meat in the Fall field season (Table 4.2) as a result of combining our stores of food, and this likely affected their activity pattern for the Fall, specifically by lowering the priority of meat-hunting. Foodstuffs from the trader – especially the substantial quantity of cooking oil and margarine delivered in the beginning of the Fall field season – had the same result.

Moreover, the *scheduled* arrival of the trader was an unusual and new development for the study group (as well as for the trader). Not only were these future visits scheduled, it came with the opportunity to ship bulk items at no cost. They both took advantage – for example, the study group requested an outboard

[1] In figures and tables, the two observers/researchers are abbreviated as YO (myself) and NI (Nils Røv).

motor and barrels of gasoline and partially paid for it in advance by seven carcasses of reindeer, and the trader left some large barrels at the study site with hopes that they would be filled with salted fish. The seven reindeer were hunted in an especially intense hunting schedule in February (Table 4.3); 15 reindeer were killed on three separate trips made within a month, while during the field season I observed that the study group did not hunt large game until they nearly ran out of meat. I therefore suspect that some extra hunting trips might have been made at least partly as a result of the anticipation of our inbound flight. (Other partial reasons include the unusually warm winter and Vadim's illness that prevented the group from making their usual long-term trip to Perevoz for barter and visiting).

Sable fur is a valuable trade item (worth 500 Rubles in their usual trading village, 8-900 Rubles with this trader), and most of the trade goods were paid for in sable. While the fall-winter season is the usual time fur animals are hunted, the Fall field season schedule, so heavily devoted to sable hunting, was likely partly motivated by the looming payment date for the goods they had received from the trader on the date of our arrival, and made possible by the food items that had been brought in.

For the Spring field season, hoping to avoid repeating the situation, we brought in fewer cans of meat. We also brought more flour, other staples, and sugar, as these were the items the study group normally purchased on trading trips. We expected the trader to bring the same complement of foodstuffs as he did in the Fall, but he was caught off guard and his consignment was especially heavy in the easily procured flour, sugar, and salt. This large quantity of sugar, both from our supply and the trader's, was probably one of the main causes of the higher number of days spent consuming alcohol in the Spring field season (Table 4.1), as their home-made brew is made of sugar and yeast. While there is probably no such thing as a 'typical' year (considering the variation elaborated in the family's history in Chapter 3), the overall activity patterns described in the following sections should be interpreted with these various researcher-introduced biases in mind.

In terms of living arrangement, we were thus accommodated into the 'long-term visitor' position in the study group. The group had other long-term visitors as well as other short-term visitors. Misha, the relative and owner of most of the domesticated deer in their herd made frequent and long-term visits, and Sasha, while present for the whole study season, was technically a visiting friend. I woke up and went to their water area to wash my face, and then joined them for breakfast or its preparation. I spent most of my daytime hours with the study group, and only returned to my tent when they were getting ready for bed. On overnight trips, we all lived in a single tent. Both Nils and I had to move into their cabins for a short period in December, after one of the group members had broken our tent zipper door by playing with it too much.

This arrangement allowed for continuous surveillance and observation of the study group, and the benefits were countless. It also meant, however, that we were not able to be solely observers, as we could not in good conscience be part of the group and not participate in the work. Firewood was brought into the camp communally, intermittently (Table 4.5) and in bulk as whole felled trees, then cut into logs. Nils did most of the daily firewood chopping – specifically, he reduced logs by axe to wedges of firewood of proper size for the *pechka* (wood burning stove made of sheet iron). He usually chopped enough firewood for both cabins and our tent. I usually did the dish- and pot-washing for at least one meal of the day, and helped with the cooking and bread baking. We both fetched water, and helped with various other chores when requested. The only activities in which we did not participate were the butchery and hunting, although Nils in rare cases helped transport the prey after the hunt. We ate our share of the food, taking care not to use our knives on the meat with bones.

Additionally, although we took care to not disturb their daily activities as much as possible, large amounts of time was occasionally inevitably taken to assist or to observe the researchers. Examples are when we were setting up or taking down the tents, and when they made a new stove for our tent that was better suited for their kind of firewood than the one we brought in.

4.3 Hunting activities

Weather conditions of the area were very stable, with mostly clear, dry, and cold days punctuated by a few muggier days with precipitation (Table 4.4). Precipitation during the cold season occurred mostly in March and April, in the form of snow. The temperature difference during the day was less than 10ºC for the Fall and the first half of Spring, but fluctuated as much as 30ºC from April 10 and onwards. On some days the temperature dropped below freezing at night but rose to over 20ºC during the day.

Precipitation did not noticeably affect individual hunting activity once the activity was commenced; once on a hunt, the hunter proceeded as usual in the snow (there were no blizzards during the field season). Longer-term plans were affected by the weather – for example, one overnight hunting trip in the Fall field season was cut short for one day, due to the unseasonably warm weather that brought rain. Unseasonable weather was a problem because different footgear had to be selected for wet and freezing conditions. Low temperature did not affect hunting activities, even when it stayed below minus 30ºC all day during the last week of observation in December. Outdoor butchery activity was cut short in one case due to the cold; it caused the butcher to initially produce larger units of meat than those usually observed, which were subsequently separated into its usual components in the following indoors butchery event (Fall K06).

The length of daily activities extended as the daylight hours grew longer – and it varied greatly between the Fall and Spring field seasons (Table 4.4). The procedural details of each day trip did not change, except that tea-break gear (small pot, tea, sugar, and some bread) began to be carried on daily trips in the Spring field season. Hunters did not necessarily come back earlier if they did not have tea gear in the Spring field season; thus tea breaks were not a *necessity* for longer trips. However, the longer days of spring offered a choice to rest, and it was no longer too cold to sit still and rest.

On the surface, the study group practiced both *residential* (i.e. moving their base camp and most of the population to the resource) and *logistic* (i.e. collecting far-away resources on resource-procuring trips by a subset of the group, who brought back at least part of the resources to the base camp) movement patterns, as defined by Binford (1980), although their Main Camp was quite permanent and the validity of their residential move could be argued. The residential move was between the Main Camp and Spring Camp (Table 4.5), with the Main Camp being the base of activities ten months out of the year. The Spring Camp was used for less than two months, when the corralled calving ground for their domesticated reindeer was used. There were only a few other permanent structures in the Spring Camp and the study group lived in tents for the duration of their stay. The Main Camp was about an hour's walk away, and the members of the group casually walked back for various reasons, such as fetching forgotten items.

The argument for considering the Spring Camp as a residential move location is quite simply that the study group members seemed to have considered it as such (as evidenced by the planning, tidying-up[2] and locking up of the Main Camp that occurred prior to the move), and because the Spring Camp site, while having fewer and much less elaborate structures than the Main Camp, still had more permanent items on the site than any other logistical camp observed, such as low bed platforms inside the main tent and an outdoor *labus* (raised platform) for storage. In any case, this study group's mobility pattern was positioned far at the logistical end of the spectrum of hunter-gatherer mobility patterns.

The permanence of their Main Camp might be surprising when considering that their landscape was dotted with old settlement remains which were occupied for shorter periods. The study group gave Yakov's failing health as the reason for keeping a semi-permanent base. Yakov was indeed deaf, lame in one foot and one arm, and spent most of his days lying down. But he had

[2] The move also allowed the group to avoid the period of thaw in the Main Camp. The smell was particularly noticeable during the early warm days for those used to frozen conditions. Before moving out, the camp was thoroughly swept and debris left on the lower river banks, to be swept out by the river when it broke free of ice and swelled. Sawdust and woodchips left over from constant firewood cutting was cleared by burning. Fire was also deliberately set onto old vegetation, to promote fresh growth favored by their domesticated reindeer.

been observed to hunt successfully with the aid of his dog, and went off on hunts on foot, as well as riding reindeer and sled. He went on a 16-day hunting trip for marmot on riding reindeer every year, and on several occasions, on overnight hunts all alone. He also felled trees for firewood, chopped firewood, took part in domesticated reindeer care, and did a lot of the butchery. Therefore his infirmity was at most only a partial reason for maintaining a semi-permanent base camp.

According to what we were told during the field study, the main family core of the group (Yakov, Vasili, and Vadim) had in the past lived in the various settlements in traditional *chum* (tipi) and canvas tents, squatted in abandoned Russian log cabins, and also built their own log cabin in various locations. Unlike the tent poles that were usually left at the site, log cabins were taken apart and recycled in many cases. Most likely, the Main Camp was simply a good location, especially in terms of access to fishing grounds. The study group seemed to have been placing an increased emphasis on fishing activities in recent years. As have been documented among other hunter-gatherers, the increased reliance on aquatic resources has decreased their mobility (Binford 2001; Kelly 1995). I have not specifically asked the study group about this change, but their family history (see Chapter 3) suggests a likely explanation. An educated guess is that they had recently obtained additional boats and other useful gear, which were left behind when nearby settlements were abandoned. The group was still building structures in the Main Camp at the end of the field season and improving the property, also heavily aided by scavenged materials from nearby settlements.

Logistical moves occurred at irregular intervals, and varied in length from overnight trips to trips of two weeks or more (Table 4.3, Table 4.5). The Istok trip in October could in some aspects be considered a residential move, as no one was left at the base (Main Camp) during its occupation. However, as it was a move to procure a certain resource (fish) and the gear taken was the same as other logistical moves, it will be considered in this study as a logistical move. Logistical moves for hunting accounted for 18.6% of the time period during the Fall and 25% of the time period in the Spring (Table 4.1). Some overnight trips in late Spring field season, as well as summer, were taken without tents, but in most cases, a full complement of gear was taken on these trips, including stoves, bedding, and cooking gear[3]. The study group was rather inflexible in gear composition – preferring to postpone a trip rather than carry less gear – in contrast to the situation reported for the Nunamiut (Binford 1977b). Most trips

[3] For example, the gear taken on the November trip to Svetoi for four people included the following: a *pechka* (stove), chimney parts, canvas tent, two-person hand saw, axe, table-board, glass lamp, lamp oil, food (3kg flour, 1kg macaroni, 2kg macaroni, 15kg of oats for dog, 4kg reindeer neck meat, 1-2kg desiccated red deer grease and meat for dogs, 2kg buckwheat, 6 packs soup, 6 cans meat, 2.5kg sugar, 1L cooking oil, 2 tubs margarine, 2-3kg salt, spices, 4 boxes tea), 1 big bowl, 4 cups, 4 plates, 1 large pot, 1 small pot, 5 spoons, 1 fork, 1 ladle, 1 serving spoon, can opener, 5 feeding-pots for dogs, one bucket for dogs, 1 riding-saddle and fur cover, Vasili's personal belongings in small box-bag, Vasili's sleeping fur and bedclothes, axe, gun, Vadim's sleeping fur, Vadim's bedclothes, two guns, my backpack, my sleeping fur, my sleeping bag, Nils' backpack, Nils' sleeping bag, Nils' sleeping fur, extra boots for everyone (rubber or leather), two extra coats.

involved at least two or more members of the group going together, and in some cases, everyone but Yakov took part in these moves.

Past studies of the Evenki (Shirokogoroff 1929; Vasilevich and Smolyak 1956) suggest that this group might be exaggerated in its logistical approach to mobility – keeping a near permanent base camp and smaller groups of hunters splitting off to hunt. Past studies suggest that nuclear family units, while still conducting logistical hunting trips, made more frequent residential moves within their territory. This 'traditional' pattern is evident in the old settlements from the study group's immediate past as well. The study group's current arrangement could be explained by Yakov's infirmity (as group members themselves saw it), through the idea of atomism (as their arrangement allowed a maximum number of hunters to exploit the maximum area of resources), or as an intentional mimicry of modern brigade-style lifestyles, in which the women and children were usually village-bound and the younger men went to work in the forest.

Day trips were made by every member of the group for various reasons – mostly for hunting or searching for domesticated reindeer, but also for fishing, tree scouting for firewood, and other reasons. Most trips were conducted alone. Therefore, when considering all members of the group, many day trips were made per day. Both hunting trips and the search for domesticated reindeer (who were free-ranging and split off into many small groups while grazing) were usually long trips and covered large territories (see Chapter 5). In almost all cases these trips were done on foot, although there were some instances where hunts and searches were done on riding reindeer or sled.

As hunters carried their guns on these trips, all of these trips could result in a hunt. Even fishing trips on boats sometimes resulted in hunted game, such as waterfowl. Except in the case of fishing trips by boat, these trips involved walking over large territories while actively searching the landscape. Both hunt and search trips can thus be considered as hunt activities. On 74 out of 139 days in Fall and Spring field seasons combined, a least one hunt trip by at least one hunter was taken. On 51 out of 139 days, at least one search trip by at least one hunter was taken. Including the days when logistical or residential moves occurred, there were hunt activities on 75%, or 104 of the 139 days of field observation (Table 4.1).

The effects of alcohol consumption on their daily activities must be addressed here. The study group members were all heavy drinkers when the opportunity presented itself, and some showed signs of alcoholism in that they were not able to quit drinking until the drink ran out. The prevalence of alcoholism among indigenous groups has been documented elsewhere (e.g. Ssorin-Chaikov 1998), and this group apparently was no exception. We brought gifts of vodka as a matter of protocol, and these were emptied during the first day of each field season. After the vodka ran out, the study group brewed a homemade brew (*brashka*) for occasions such as national holidays, birthdays, and coming back together after taking overnight trips in smaller groups. Drinking was an all-day activity, and in most cases the food was either cooked in advance or eaten raw, and all normal activities basically ceased save keeping the *pechka* (stove) on. The effect of drinking on the usual daily activities is clear in Table 4.5, where days with alcohol consumption, and in some cases the day following, have a marked absence of activities. If these drinking days are excluded, the percentage of days with some hunting activity climbs from 75% to 87% (Table 4.1).

4.4 Overview of prey type

4.4.1 Prey type and use

The species of animals, birds, fish and trees used by the study group is listed in Table 4.6. The animals regularly procured by the study group can be broadly classified into animals caught primarily for their meat, and animals caught primarily for their pelts. The general use of animals, both as food and as raw material, is discussed below.

Meat animals

Meat animals observed in use during the Fall and Spring seasons were **musk deer**[4] (***kabarga***, *Moschus moschiferus*), **reindeer** (*Rangifer tarandus*), **red deer** (*izubr*; *Cervus elaphus*), and **moose** (*Alces alces*) (Whitehead 1993, Wemmer 1998). While these animals were primarily caught for the exploitation of their meat, other parts, such as fur, were also used (Table 4.7). Meat animals were primarily hunted for the group's own use, although they were also sold to outsiders and some parts were taken on visits as gifts to relatives and for barter. All meat parts were consumed, including the head. Marrow and some internal parts were often eaten raw (Table 4.7), as well as some of the meat, but not as extensively as seen in Inuit groups, and the stomach contents were not eaten unlike Inuit groups (Burch 1972). Fat was rendered from abdominal fat, and in

[4] Species introduced as English (Russian, Latin). Term(s) used in the text or figures are in bold.

the spring, from bone boiling (see Chapter 6). Fat that floated to the top of the soup-pot when boiling the meat was carefully collected and used for dipping.

Meat was stored in frozen form, inside the storage room off the couple's cabin, on top of a platform (usually covered by a cloth), or in the earthen storage hole dug into the side of the hill at the Main Camp. In the warmer days of the Spring field season, the meat was packed into barrels and large pots and anchored in the river or placed into holes dug into the ground and covered by moss. The group did not smoke or dry any meat during the period of observation. They admitted that they used to smoke and dry meat but did not anymore, because it was too labor intensive[5].

The leg furs (*kamus*) of all large ungulates (reindeer, red deer, and moose) were prized for its toughness, and reindeer *kamus* was the preferred material for fur boot (*unti*) and mitten making. Fur from the body of animals was used for bedding and as seat- and saddle-covers. Head fur of reindeer was also considered a tough material, and used for seat- and saddle-covers and to pad the contact side of traditional backpacks (see Chapter 4). All large mammal hides – with the exception of *kabarga* hide, which was too thin – were also regularly processed into rawhide and leather, although the process was not observed during the field season. Fur for bedding was simply scraped, dried and used. *Kamus* for boots were scraped, dried, and scraped again, and softened. Leather and moose *kamus* were also smoked. Smoked moose *kamus* were glued to the back of skis with their fur oriented so that it provided traction when going down the hill.

The study group wore store-bought clothing, but fur hats, fur and leather boots, and fur mittens were regularly made maintained, and used. Two main types of boots were made and used by the study group: the *unti*, or fur boot with ornamental patterning and leather soles; and the *amchur(a)*, a leather hunting boot with ankle laces. Fur mittens (worn with store-bought five-fingered gloves inside) were made from *kamus* and leather, with the palm side being leather. Hats were made from many kinds of fur, and in one case from a complete skin of a waterfowl, feather and all.

Items for domesticated reindeer care were ideally made from wild reindeer. The salt-bag (*riukariuk*) was a bag of salt with a rattle that was used to attract the domesticated reindeer using movement and sound. The bag was made of reindeer fur or leather, and the rattle was made of used wild reindeer incisors taken out as a connected piece held together with mouth membrane (see Figure 6.4.1d) as well as *kabarga* hoof-covers. Reindeer harnesses were supposed to be made from specially processed wild reindeer leather. A male wild reindeer would be killed during the autumn rut and be skinned in a special manner (see Chapter 3, footnote 18). However, in reality, the newer reindeer harnesses

[5] Dried meat could be made by hanging up strips in the Russian steam bath structure (*bania*), which was the method witnessed by Sasha. However, the traditional way followed by the study group involved creating a bed of thin twigs, over which strips of meat would be laid and under which a fire would be made. This method involved a lot of turning of the meat and was thus labor intensive.

during the period of observation were made from canvas straps[6], rope, and moose leather.

Antler was occasionally used as a raw material. It was still seen in use as saddle-horns (reindeer antler), and other possibly improvised but observed uses for antler were axe blade covers (a groove was sawed into a piece of reindeer antler) and door-handles (reindeer antler was nailed to door). Most other likely items, such as knife handles, buttons, etc. were usually made out of wood. However, most antlers were saved and good racks of reindeer and red deer were used to barter with the helicopter crew.

Kabarga do not have antlers, but males have large upper canines, which were sometimes given to visitors as presents, and generally saved by study group members to commemorate the hunt. Once, a canine was attached to a leather thong (*tarugu*), which together was a tool used to tie hunted fur animals to a backpack – the tooth was used to string the thong through the mouth to the eye of the animal. The male *kabarga* also have musk in their preputial glands (Putman 1988), and these were carefully removed and dried. The musk was destined for the traditional Asian medicine market, and the trade was illegal but thriving. Musk from one *kabarga* averaged 25g and was said to be valued at one domesticated reindeer, or around 3,500 Rubles.

Fur animals

Fur animals most commonly hunted during the study period were the **sable** (*Martes zibelina*) and **squirrel** (*Sciurus sp*). The sable was tracked and hunted, as well as trapped. Squirrels were only hunted, and not trapped. Traps were set for mink and ermine as well. The sable (and to a lesser extent these other fur animals) were their main trade item and the source of their income. Special care was taken with the preparation of fur, with each species stretched using differently shaped wooden moulds (*pravilka*) (Figure 4.10) and finished into different shapes – for example, sable was stretched into a thicker, or rounder, shape; squirrel and mink was dried into an elongated shape (but each had a special and separate wooden mould); ermine were folded in two and pressed into a rectangular form. All of the above animals were skinned by making a small incision near the anal region, then peeling off the skin like a sock off the meat and bone, and subsequently dried and stored in a cylinder form. The **marmot** (***tarbagan***, *Marmota sibirica*) fur was slit open and stored; the skinning and drying process was not observed.

There were no sable garments used by the study group, and presumably every sable fur was used for barter. Some squirrel fur was made into hats and one was worn by Yulia. Vadim wore a hat of *tarbagan* fur. *Tarbagan* were hunted during a 16-day period in late August (Table 4.3) for fur and for oil. The oil was eaten, drunk in spoonfuls for medicinal purposes, used as face grease for cold-weather sled travel, and was also a barter item.

[6] The thick canvas straps came from cargo barges plying River Vitim.

Squirrel meat was eaten cooked (boiled or roasted), including the head. In the fall, stomachs of squirrels and their nutty contents would sometimes be eaten raw, as a snack. Mink was never consumed. Sable meat was treated with ceremony and deposited without consumption (see Appendix), although in response to my question, the meat was described as edible.

Bear

Brown bears (*Ursus arctos*) were used for both meat and fur, and the study group gave conflicting accounts on whether bears would be actively sought out as prey. The study group would only initially admit that only hungry bears that came near the camp were tracked down and hunted, for their and their domesticated reindeer herd's safety. The trigger for this kind of hunt could be an actual sighting, or an especially lean footprint. However, a bear-trapping trip was planned and executed in late Spring field season without success. Bear, along with reindeer and sable, was clearly an animal that had to be treated with ceremony and respect – perhaps with more ceremony than the others (see Appendix). As a female, I was not allowed to accompany the bear trapping hunt and was also specifically instructed to stay silent during its preparation.

The use of bear products was not observed during the field season, but a basic description was given. The meat would be eaten, the oil rendered and saved for face grease, and the fur was used to make, among other things, hats, sleeping bags, and sleeping covers. The fur hat that I used during the field study was made in a two-tone pattern using bear fur and lynx fur. Some parts of bear were taboo to eat, such as liver, kidney, and brains (see Appendix). Bones and the uneaten remains of the bear were treated with respect, and placed in a covered platform (Gron, et al. 2002).

Birds

Among the birds, the **capercaille** (***gluhar***, *Tratao urogarus*) and waterfowl were hunted for meat, and especially heavily hunted during their respective peak seasons (Table 4.3, 4.8). Peak *gluhar* hunting season corresponded to their mating season. Like other ground birds, the males congregated at certain locations on the landscape and vied with each other in loud and spectacular display competitions. Males displaying on treetops and on ground were hunted at the mating grounds with relative ease, due to the consistency of location, limited time span (displays occurred dawn and dusk), and to the loudness of the displays, which allowed the hunter to pinpoint the location by ear. Females were also killed during the mating season, although not so many. The *gluhar* mating season, usually in March and April, started earlier in the study year due to the warm winter.

Gluhar were large enough to make a light meal for a group of five to six people, and were always carried back to the camp for cooking (boiling as soup) and consumption. Plucking the bird could happen either near the kill site or back at camp. Study group members held that *gluhar* parts were not to be fed to dogs, and took care to deposit unwanted organs into the fire[7]. Other than the meat, the heart and gizzard were also consumed, and the bag in its throat could be used as a toy balloon. The windpipe was eaten raw, like chewing gum. Tails of males were sometimes cut off and saved as decoration.

Two other species, other than waterfowl, were hunted for their meat – **hazel grouse** (***rapchik***, *Bonasa bonasia*), and **willow grouse** (***krapatka***, *Lagopus lagopus*). These birds were opportunistically hunted on day trips, and often cooked (roasted) and consumed by the hunter during his break. When taken home, these birds were often roasted and eaten as a snack. They were never boiled into soup, although this could be due to the smaller size of these birds. The gizzard of these birds was sometimes eaten raw.

The main waterfowl hunting season was in April and May (Table 4.3, 4.8). All manner of waterfowl were hunted at sight (Table 4.6). The study group identified April 25 through the end of May as their hunting season for waterfowl; the fall migration was not mentioned. There were some previously constructed duck hunting blinds, but they were not used as they were not maintained properly at the time of the field study. Waterfowl were plucked, gutted, and cooked (boiled) before consumption. No part of waterfowl was eaten raw. Oil that floated up during the boiling was carefully collected and used as a dip for bread during other meals.

Down feathers were sporadically collected for pillows. Some parts of different waterfowl were saved consistently but apparently not for any use – for example, beaks of **goldeneye** (*gogol*, *Bucephala clangula*) and **smew** (*Mergus albellus*) and beaks and heads of **gooseander** (*harhal*, *Mergus merganser*) were saved near the *pechka* (stove) during consumption or at butchery and put in high locations; head-skin of certain species (unidentified) were taken off during processing and stuck to trees. Some reasons given for the beak-saving were that it was not good to eat, or not good to give to dogs unlike the other bones. Waterfowl wishbones were used to seal a bet. Wings were cut off and used as brooms or as cooking-brushes (to spread oil on a hot pan). Sometimes the bird was not plucked, and the skin taken whole, and made into hats (unidentified; probably smew or gooseander).

The use of bird eggs was not observed, but group members spoke about a location on the lake where they could collect gull eggs for eating.

Fish

Fish were an important source of food in the warm months, and important as well as a barter item. A barrel of salted fish was often bartered in exchange for a barrel of helicopter fuel. The most numerous of the fish were **whitefish** (*sig, Coregonus*). The whitefish spawned at the river mouth in October (Table 4.3, 4.8), and during the Fall field season over 800 fish (or more than 200kg) of whitefish were caught in a short month (Table 4.9a). The study group moved camp to a location near the spawning grounds for this fishing activity. It is

[7] This could be a measure to prevent the dogs from hunting the birds by themselves.

unclear if they would have made this move or tried to catch as much fish if a helicopter was not due to arrive with the trader (see previous chapter).

Of the other fish caught locally (Table 4.6), **pike** (*shuka, Esox*) and **burbot** (*nalim,* sp. *Lota*) are noteworthy for the size of some of their specimens – some burbot were close to a meter long and over 3kg in weight, and pike, while not so large, were caught more frequently. Most fishing while there was open water was done with nets, although strong lines with bait were set for burbot. Fly-fishing was also observed in the summer (the group owned at least three telescoping fishing poles with nylon lines and reels). Some under-ice netting was seen, with holes cut through the ice for net retrieval, but this form of fishing, together with fly-fishing, was not as serious an activity as net fishing. The study group fished with nylon nets, and had about seventeen three-meter nets in their possession. They also had several rowboats and at least two outboard motors, one of which was in working order, although without much fuel.

Other forms of fishing observed in the study were ice-hole fishing and nighttime open water fishing. **Arctic char** (*gales, Salvelinius*) were caught in quantity by ice-hole fishing during the Spring field season. The local population of Arctic char was limited to one small lake in the area, and was one of the few remnant populations of this species in this area (Røv, personal communication). The population in this lake was unknown and unutilized by the study group until the Spring field season, and the repetitive visit to the fishing location on hunt trips could have been partly due to the novelty, and partly due to the need for barter items – most likely the former, as most of the Arctic char were consumed by the end of the field season. Ice-hole fishing poles were hand-carved out of wood, and a length of nylon fishing line (in some cases with a commercial reel) was attached.

Nighttime open water fishing was done only once, and mainly as a demonstration for the researchers. The equipment included a small trident and a long-poled metal basket to hold a fire to light up the water surface. One person rowed the boat while the other tried to spear the fish seen in the firelight.

Whitefish and Arctic char were gutted, cleaned, and salted, and then placed in big barrels, and weighed down with a stone. Fish eggs were saved and stored in jars, after the membrane was removed by light whisking (using a suitably shaped branch, trimmed, saved and reused as a tool) and lightly salted. Salted fish were then eaten as is, or cooked (boiled). **Grayling** (*harus, Thymallus*) and **perch** (*okon, Perca*) were usually roasted and eaten. Pike and burbot were usually large enough to cut into fillets and roast or fry in a pan. Some Arctic char were smoked after salting for preservation purposes, late in the Spring field season when the weather was warm.

Fish were not used for other purposes than eating, with one exception. One burbot was skinned, and the skin was dried and saved. The skin was later to be torn into pieces, boiled and made into glue. This glue was to be used, together with wild reindeer sinew, in the shafting of a long metal blade of a traditional Evenki spear into the handle.

Table 4.9 summarizes the animals and fish caught during the Fall and Spring field seasons. The general pattern of fishing, together with its importance as a barter item, is similar to that documented among another *taiga*-dwelling Evenki group with an aquatic resource focus (Vorob'ev 2004).

Other foods

To complement the understanding of the above prey species as food, the study group's other sources of food must be mentioned here. Plant food foraging and use was negligible in both Fall and Spring field seasons with the exception of berries. Berries were collected intensively in the summer, with day trips made specifically for this purpose. They were made into jam (with sugar) and were eaten during the fall and winter. Berries (mostly blueberries that still clung to their branches) were foraged during day trips in the fall, and even in winter and spring when possible, but not collected. In the Spring field season, cranberries were collected after the snow cover melted away, and eaten with sugar. Other plants foraged as food include wild garlic, leek, and mushrooms. The study group mentioned that these plants could be salted and stored for the winter, but they had not in the year observed. The study group also collected and used various medicinal plants and flowers, and used a fungus growing on birch to brew tea.

Bread – usually the unleavened kind made of flour, salt, water, and baking soda – were eaten in quantity. Yeast bread was baked on occasion, when the group was at the Main Camp, as they had built a Russian-style brick oven at that location. Tea was also a daily necessity, and the men also brewed a strong caffeinated brew using a large quantity of tea-leaves called *chifir*. Bread and tea was a necessary part of their diet, yet as Vasili put it, "bread is nothing and fish is like water" – the emphasis of their meals was unequivocally and overwhelmingly on meat. Meat was usually eaten boiled. Rice, macaroni, buckwheat or flour was added to the broth. The meat parts were then fished out from the broth and served separately. While these staples were regularly consumed, the amount of additives such as rice to the broth was about 250cc to a 7.5L pot. Compared to the amount of meat – which ranged from 2 to 5kg in such a pot – it was not a lot. Bartered food items were also an important part of the dogs' diet. Dog food was cooked separately once a day, a soup not unlike the human's food, but made of cheaper or older materials – oats, millet, and old meat.

Sugar was taken with tea, and sweets such as candy and chocolate were one of the main luxury items brought back from bartering trips. Salt was a necessity both in cooking, fish preservation, and for the care of domesticated reindeer. Harnessed reindeer were given salt to lick as a reward, and tree stumps in the camp were sprinkled with salt or salt-water to attract the domesticated herd. Urine was also used for this purpose, but only sporadically. The study group also tried to grow potatoes and vegetables (such as carrot, onion, garlic, and beet) using a fenced kitchen garden and containers filled with soil enriched with reindeer-stomach-content manure, but with little success. Vegetables, fruit, and eggs were named as desirable luxury foodstuffs to be brought in when possible.

4.4.2 General hunting pattern

The study group broadly used three methods of hunting: dogs, tracking, and using traps. The observed hunting pattern of *kabarga*, reindeer, and sable will be elaborated in Chapter 4, but the general trends were as follows.

Meat animals

Of the meat animals, reindeer hunting held a special significance for the study group. In the study group, the word ‘meat’ (*miaso*) usually implied reindeer meat. Carcasses were treated with respect, and ceremonial words were spoken and ceremonial acts taken during the butchery process of the head. And while it is unclear if this behavior at butchery is unique to reindeer among the larger ungulates (as hunting and butchery of red deer and moose were not observed during the field season) the hunting of reindeer definitely differed significantly from all other meat animals (red deer, moose, and *kabarga*) in that dogs were not used in the hunt. They could not be used, because the dogs were trained to coexist with the domesticated reindeer herd.

Thus tracking by a single hunter was the main method for hunting reindeer. Forest reindeer were usually found in herds of around ten or less. Tracking was mostly done on foot, although in some cases riding reindeer and sleds were also used. The last part of the hunt was always done on foot, and away from these transportation methods, as domesticated reindeer could snort and/or otherwise alert the wild reindeer herd. Specialized hunting techniques documented among other Siberian groups such as traps, corrals, blinds, or using domesticated reindeer as a decoy during the mating season (Levin and Potapov 1964; Syroechkovskii 1995) were *not* used in the hunting of reindeer by this study group[8]. Tracks were searched for from the distance as well, often with the aid of binoculars.

[8] As mentioned previously, the reindeer hunted by the study group were the woodland species and were not commonly hunted through corrals and blinds, as they did not form mass migratory herds. While cooperative surround hunting of woodland caribou is documented among the Misatassini Cree (Rogers 1972), such a method was not observed or mentioned among the study group. Traps were used for other large game (*kabarga* and red deer) that were territorial and repeatedly used a certain path, but not for the unpredictable reindeer. It was also was highly unlikely that the study group would set traps for reindeer in the same territory where their domesticated reindeer roam. The study group members said they did not use the decoy technique in any season. A possible explanation is that decoy use was relatively unpopular in groups that preferred to avoid breeding between wild and domesticated stock. Shirokogoroff claims that Evenkis disliked cross-breeding to the extent that they killed the offspring (1929:31).

Reindeer hunting commenced in late Fall field season and continued into Spring field season (Table 4.3, 4.8). In the summer, wild reindeer were in higher altitudes, although they occasionally showed up in areas where the rivers were iced over year-round (*naled*). While camp locations often seem to be near known *naled* areas, this was probably more for the convenience and relief from mosquitoes for the domesticated reindeer herd.

In contrast to reindeer, red deer were hunted by dogs and traps, as well as by tracking. Dogs, while being tied to the hunter, would be used for tracking. Then, let loose, they would corner or stall an animal until the hunter arrived. Large wire loop traps were also set along known red deer paths. Natural salt licks (locations with exposed mineral-bearing clay) were noted and often enhanced with hunting blinds. Blinds were made out of logs and were most commonly a platform built high above ground. However, the blinds in the area around the two residential camps were no longer well maintained during the field study. Once a temporary blind was made using a tarp and branches (see Chapter 4). In the case of hunts using blinds, the hunter would stake out the lick locations from around sundown to sunrise. Red deer hunting was most successful during the mating season (Table 4.3, 4.8). A birchbark horn was also used to imitate male red deer mating calls and entice a rival male towards the hunter.

Moose were hunted sporadically and mostly opportunistically. In the summer, there were some bogs in the area where moose came to forage, but these locations were not particularly kept under a close watch. It seemed to be the case that someone (on a fishing trip or a search trip) would notice some fresh signs of moose, after which a closer watch or a stake-out would occur. Not many fresh tracks of moose were seen in the Fall and Spring field seasons, and none were hunted – dogs were let loose on one set of moose tracks without success, and another set of tracks were encountered during a tracking hunt.

Tracking hunts were usually not prey-specific, and the intended prey could switch from one animal to another, depending on the freshness of the tracks encountered. In most of the observed hunts, the tracks the hunter had to choose between were reindeer, red deer, and sable. The hunter usually had an objective in mind (fur or meat procurement), and rarely switched between fur- and meat-hunting. In contrast, the hunters easily switched to fresher tracks if the choice was between reindeer, red deer, or moose[9].

It must be noted here that the study group used small caliber single-shot rifles in their hunts (.22), good for shooting fur mammals but not very suitable to larger game. While the best hunter of the group (Vasili) reliably killed reindeer (and apparently once even a moose) with his small caliber rifle, other hunters sometimes shot dozens of bullets at a herd of reindeer and failed to kill even one. It was not a humane form of hunting, but the study group lacked basic documentation to obtain hunting and gun licenses for new guns and used whatever equipment they had. The larger-caliber rifle (30.8mm) owned by the

[9] Fresh *kabarga* tracks were never encountered during observed hunts, but they would probably have not been tracked as their hunting method was entirely different.

group was occasionally taken on a hunt when the hunter was specifically hoping for red deer or moose. However, as the hunter also had to take his usual small caliber rifle as well (bullets for the larger rifle were home-made and limited to the number of undamaged recycled shells), it was actually taken on only one occasion during the field season, when Nils was available to carry the second gun.

Kabarga were hunted using dogs. Often the dogs would go off on their own from the camp, and the hunters, upon hearing the barking, would set off with his or her gun. *Kabarga* stood still on high cliffs when cornered by wolves or dogs, and this behavior made hunting with guns easy. Suitable cliff locations were limited, and the hunter generally knew where to look from the direction of the barking. Depending on the location and available choices, a hunter could answer the dogs' calls on foot, sled, boat, or riding reindeer. When a hunter specifically wanted to hunt a *kabarga*, he would bring his dogs nearer to the cliff while tethered, release them, and wait for the barking to start. The dogs usually got the offal at the kill site after a successful hunt, and this served to reinforce their behavior. *Kabarga* were an easy and reliable source of meat, as they seemed to be plentiful in the area around the residential camps.

As previously mentioned, the musk glands of male *kabarga* were valuable as a trade item. When the musk glands were in good condition – the peak musk-producing season was in early summer (Putman 1988:160) – traps were used, although not in the area surrounding the residential camps. Traps were made of wire loops and set along known musk deer trails. Traps were only checked after a few weeks, and the meat from trapped animals were often only suitable as dog food. The study group did not set many, but claimed that hunters from outside villages came and set "hundreds" of traps, including areas within their usual territory where their dogs could get caught (one dog did get caught, and was tracked down and rescued by Yakov after sitting three days in a trap).

Kabarga were probably hunted year-round, although less often in the summer when travel conditions worsened (Table 4.3, 4.8). A birchbark whistle that imitates the call of a young *kabarga* was also used to attract *kabarga*, although no successful hunts were observed using this method.

Fur animals

Fur animals were hunted most successfully by a combination of tracking and dogs, and less successfully by trapping, during the field season. Sable was commonly hunted by a hunter and his dog. Unlike the *kabarga*, which the dogs just simply seemed to enjoy and pursue of their own volition, the dogs were specifically trained to obey verbal commands by the hunters and signal the hunters (by different vocalizations, pointing, and sitting) in a fur animal hunt. The hunter and his dog, upon finding fresh tracks, would each set off to track down the daytime lair of the sable. When found, the various entrance holes to the lair would be blocked or filled with smoke save one. When the sable came out, it was shot or grabbed. Both the tracking and smoking out could take a very long time. While technically a dog-based hunt, often the hunter did most if not all of the work by himself when the dog took off on a different scent (such as *kabarga* or squirrel) early in the hunt. Tracking of fur animals did not differ procedurally from that of meat animals, except that the hunter could keep going after a successful hunt, as he could easily transport more than one game.

Squirrels were hunted opportunistically when encountered. They were not tracked at great length, but hunted when possible. Dogs were also used to hunt squirrels (pointing).

Traps for fur animals were usually the commercial spring-loaded metal traps, set with bait. Sometimes more traditional deadfalls were constructed out of logs and branches. The only successful case of fur animal trapping seen in the field season was of a mink (*Mustela vison*). In the winter of 2000, the study group reportedly caught 50 sables, mostly by trapping, because "the sable were hungry and fell for the traps". Sable hunting and fur hunting in general occurred most frequently during the Fall field season (Table 4.3, 4.8). Fur animals could only be tracked on foot, as the tracks were complicated, and often went through the more densely vegetated areas of the landscape. Trap checking was done both on foot and on sled, depending on conditions and available transport.

Birds

As mentioned previously, the *gluhar* and waterfowl were the two bird types that were purposefully hunted, mostly in their respective peak seasons. Aside from that, all birds were opportunistically hunted upon encounter, sometimes with some tracking – if a bird was seen, for example, to land at a distance. Duck blinds were not used at present. Sasha hunted waterfowl with a trap line during the field season – a looped row of nylon fish line set with bait – with no success.

4.5 Summary

During the 143 days at the study site, a variety of hunting and subsistence activities were observed. The cycle of fall game hunting, winter fur hunting, spring game hunting, and summer fishing (Table 4.3) is commonly seen among peoples inhabiting the *taiga* zone (e.g. Tanner 1979:22-3). Among the various species hunted, *kabarga* and reindeer will be discussed in further detail in the following chapters.

The study group's main hunting method was to search and track each animal on foot. They knew their hunting grounds well, often recounting in detail kills that occurred in the area many years ago. Hunters recounted their day's events in detail after a hunt, and old exploits were often recounted as well. While this was, on one level, normal banter between friends and family, it was also clearly intended as an exchange of information, and the audience listened very carefully (and repeated with hand-signals and some shouting for deaf Yakov). This form of information exchange among the Evenki has been noted in other studies (e.g. Anderson 1995:181; Ansimov 1963a:219-20). While on hunts, each hunter hunted alone and took care to cover a different area on their hunting trips, and turned around if they encountered the tracks of the other hunter.

Their knowledge of the area and their understanding of prey behavior, combined with a careful visual search, usually resulted in the discovery and successful pursuit of fresh tracks. Fur animals, other than squirrel, were more often found around small creeks and rivers, and hunters would plan and execute a course that would incorporate several known creek locations in a day's walk. Movements of wild reindeer between adjacent river valleys were estimated fairly accurately from the tracks' direction and freshness, although these successful estimates did not lead to successful hunts in the hunts under observation. Each logistical campsite seemed to be chosen near a 'fallback plan' resource – a lake with Arctic char, a potential *gluhar* mating ground, a high cliff where *kabarga* might be found. However, as it is unknown how evenly, patchily, or frequently these 'fallback' resources are distributed, this remains a qualitative observation.

Weather, location, distance from residential camp, or type of base camp (residential or logistical) did not seem to significantly affect the way each day trip, or potential hunting event, was conducted. The proportion of time spent on hunt vs. search trips was slightly different between base and logistical camps, but this was primarily due to the domesticated reindeer being hobbled or otherwise tied down at logistical camps. The primary intent behind this was to prevent the herd from heading back towards the Main Camp by itself, and not to increase the length of hunting trips, but as a result less time was devoted to domesticated reindeer search and consequently more time to hunting. On a logistic move, hunters moved outside the usual activity diameter and simply re-created the daily activity pattern in a new location (i.e. new river valley).

According to the 'typical hunter-gatherer' test expectation, I expected a reliance on animal and aquatic resources to the exclusion of plants (as cold environment hunter-gatherers), a multiple resource base including hunting, trapping, fishing, and domesticated reindeer use (as Evenki), a greater focus on reindeer herding or use and a focus on trapping (as Transbaikalian Evenki). The general activity patterns of the study group do match the patterns set by high latitude hunter-gatherers, and those of the Evenki. Fur trapping has not abated, and while it is possible that there has been recent renewed intensity in fur trapping due to market demand, it is also true that the study group seem to show strong traditions of fur animal use, as evinced by their species-specific sets of drying-boards. However, unlike what was described for Transbaikalian Evenki in the 1910's (Shirokogoroff 1929), the study group was a hunting group, and was not particularly herding-oriented.

It is interesting to consider this discrepancy between the observed activity pattern and those described in the literature together with another discrepancy: that the study group focused wild reindeer as their large mammal prey. In direct contrast with the observed pattern (see Table 4.3), past studies suggest that red deer was the main and preferred prey species among the *taiga* Evenki (Ansimov 1963a; Lissner 1961; Shirokogoroff 1935), with the exception of Shirkogoroff who calls the Evenki "hunters of the reindeer" (1929:27). The importance of the red deer to the Evenki is evident in their stag cults, red deer deities, and red deer related myths (Ansimov 1963a:164; Lissner 1961:141), while the (wild) reindeer did not seem to merit such cultural attention.

This discrepancy, along with some suspicion about the 'wildness' of the hunted reindeer[10], brings one to question if the area had been recently and temporarily inundated with feral reindeer after the collapse of the reindeer herding camp to the south. This is a real possibility and this issue merits a follow-up study with the future. At the same time, as this is a region noted by Shirokogoroff for having pasture rich enough to support large-scale reindeer herds (1929:27, 46-7), it could have been supporting a thriving population of wild reindeer after the human population (and accompanying domesticated reindeer population) thinned in recent years. Another possible explanation is a population crash of red deer. However, red deer tracks were observed during the field season, and the study group did not seem to think there were less of them around; it is possible that this reindeer-heavy catch was well within their usual range. As a butchery study, the reindeer-heavy pattern does not affect the validity of the analysis presented in subsequent chapters.

Another 'typical hunter-gatherer expectation' was a logistically mobile settlement pattern and a heavy reliance on storage, predicted by a global trend in hunter-gatherer subsistence based on productivity of the environment (Binford 2001; Kelly 1995). The study group fits the "logistically mobile collector" criteria – people that send out task groups to supply themselves with resources (Binford 1980:10) – in fact, they had moved to a more extreme form of logistical mobility, with less moves of the residential camp than observed in the past. One of the reasons for this shift was due to the increased exploitation of aquatic resources, which also conforms to a global pattern.

However, the lack of long-term storage by the study group is a major departure from global hunter-gatherer patterns. The group- and area-specific conditions described in Chapter 3 might be some of the causes – namely, the effect of small group size in an environment that would support a much larger

[10] Questionable cases were as follows: Fall R01 – some discussion about whether it was a lost calf from the previous year arose immediately after the hunt, but the animal was called 'wild' when study group members were questioned in the following Spring field season. Spring R02 – one ear was completely split in half from root to tip, which Vasili and Sasha believed might have been a property mark. However, Røv (personal communication) believed it could have been made by an attacking raptor, perhaps when it was still a calf. Fall R01, Spring R03 and Spring R04 were killed after ambling close to a hunter and/or domesticated reindeer.

group with storage and an environment that is favorable to hunting and abundant in aquatic resources – as can be their reliance on bartered commercial items, and their use of domesticated reindeer. In a rich environment, with good transportation technology, and assured access to secondary sources of food (i.e. aquatic resources and commercial food items, including salt to preserve the fish), it seems that the study group no longer needed to rely on long-term meat storage. The lack of preparations of the cold storage-hole (i.e. saving ice and snow) over the winter, the observed lack of canning wild vegetables, the report that drying and smoking meat was no longer conducted confirm that this pattern is a recent trend.

While the above pattern is interesting anthropologically, it greatly reduces the applicability of this study in an archaeological context. This study cannot be used as an analog of how a cold forest hunter-gatherer exploits their environment as a whole. However, this study is still perfectly able – and as I argue in subsequent chapters, uniquely suited – to provide insight into large mammal procurement and immediate use by a nuclear family unit of hunters. As evidenced by the "bread is nothing and fish is like water" quote of Vasili, the study group identified themselves as large-game hunters, relying on meat as the primary subsistence source. In the next chapter, I will explore their subsistence hunting activities of these hunters in detail, specifically the hunting patterns of *kabarga* and reindeer.

Chapter 5: Hunting and carcass transport

The general activity pattern showed that the study group focused on two main meat species – *kabarga* (musk deer) and reindeer – as their source of food, and that their hunting strategies greatly differed by prey type. This chapter looks at how, specifically, the study group hunted the animals, and in what manner the study group transported these large mammals from kill site to base camp.

Past ethnoarchaeological studies show a variation of hunting methods and transport decisions were employed by hunter-gatherers, and that the decisions stemmed from many factors. Some groups employed multiple hunting strategies for different seasons (the Nunamiut; Binford 1978) – or different prey types (the Okiek; Marshall 1991, 1994). Sub-Saharan African groups (the Hadza, !Kung San and Kua) in contrast pursued a rather uniform strategy of tracking, poisoned arrow use, and further tracking and pursuit (Bartram 1993a; Binford 1978; Bunn, et al. 1988; Monahan 1998; O'Connell, et al. 1988a; Yellen 1977). In terms of transport decisions, the Nunamiut, dealing with extremely seasonally abundant prey, often employed off-site storage (caches) and in some cases discarded edible but less desirable parts outright. They also routinely stripped edible parts (e.g. meat) off bones and discarded the latter. Sub-Saharan African groups in contrast regularly consumed most if not all of the animal, but large-scale consumption occurred both at the kill site and base camp, again resulting in the discard of bones. Both Nunamiut and Sub-Saharan African groups sought to minimize transportation costs by discarding non-edible or less desirable parts. Transport decisions were based on many factors including prey type, season, number of hunters, distance, and the presence/absence of predators (Bartram 1993a; Binford 1978; Bunn, et al. 1988; Monahan 1998; O'Connell, et al. 1988a; Yellen 1977).

Transport decisions are of particular interest to zooarchaeology, as the schlepping of bones between (or discard of bones at) various sites have direct impact on the archaeological record. From the above studies, two behavioral models have emerged and have been widely accepted as being generally applicable to hunter-gatherers – Binford's utility model and the Hadza transport model. The former predicts that the economic utility of parts transported to (or conversely discarded at) a site could be linked to the strategy of the group, namely a gourmet strategy that selectively transports desirable parts (like the Nunamiut), or a bulk strategy that aims to transport all usable parts (Binford 1978:81). The Hadza transport model (O'Connell, et al. 1988a, 1990) additionally consider the costs of field processing and transport, including factors such as distance, carcass size, and risk in the equation. The selection of body parts reflected the group's food-maximizing or weight-minimizing strategies. Dealing with a multiple-prey environment, the Hadza case studies also convincingly showed decreasing completeness of transport with increasing body size of prey (O'Connell, et al. 1988a).

In view of these studies, the ‘typical hunter-gatherer test expectation’ would be that the study group would also exhibit considerations of economic utility and transport efficiency. In particular, the expectation would be that, at the minimum, the two prey species would be treated differently due to their body size.

5.1 General trends in hunting

The summary of the field seasons’ successful hunts can be seen in Table 5.1 (see also Tables 4.3-4.9). From the summer of 2001 to late spring of 2002, in addition to numerous birds, edible small mammals such as squirrel, and fish, the known catch of the study group included one moose, 34 size III (Brain 1981) animals (reindeer and red deer) and 36 size I animals (*kabarga*).

Sex composition varied for seasonal game such as capercaille and waterfowl, but no discernable bias for age or sex was observed in reindeer and *kabarga* (Table 5.1). There were also seasonal variations in prey species as described in Chapter 4, together with researcher-introduced factors that could have highlighted these variations (e.g. the fur animal focus in the Fall field season). Considering just the *kabarga* and reindeer hunted during the period of observation (and ignoring all other sources of meat), a simple calculation shows that the group withstood a lean period of meat consumption for the sake for hunting fur animals. Specifically, in the hunts of the Fall field season where the hunters were focused primarily on fur animals, the reindeer and *kabarga* provided just under 200g of meat per person per day (although the diet was supplemented by canned meat, squirrels, birds, and fish). In comparison, the meat-focused Spring field season (in which capercaille and waterfowl were additional meat sources) resulted in over 500g of meat per person per day from reindeer and *kabarga* (Table 5.2).

Hunting activity, both successful and unsuccessful, was observed for various prey types during the field study. For *kabarga*, 31 purpose-specific hunts occurred during the period of observation. Of these, 30 (97%) were successful. For large mammals such as reindeer, red deer, and moose, 21 purpose-specific hunts occurred during the period of observation. Of these, four (19%) were successful (including a hunt resulting in two reindeer), plus one reindeer killed on a domesticated reindeer search trip. The high success rate of *kabarga* hunts is particularly noteworthy. Through the use of dogs and guns, this animal had become a stable and reliable resource for the study group.

Of the purpose-specific 31 hunts for *kabarga*, 14 (45%) were observed either by Nils or myself. Of the purpose-specific 21 hunts for larger game, eight (38%) were observed by Nils or myself, and together with the circumstances of successful hunts are described later in this chapter (see also Table 5.3). It should also be noted again that all long day trips (e.g. domesticated reindeer searches, trap-setting for fur animals or bears, fur animal hunts, large game hunts) often served multiple purposes and served as scouting trips if not actual hunting trips. Over a hundred such trips were taken during the field season (Table 4.1, 4.5).

5.2 Logistical moves

In order to consider the effort taken to hunt large mammals, logistical hunting trips must first be mentioned. I followed the study group on a total of nine overnight trips away from their residential camp. These overnight trips were made by only a part of the group, and all were for some kind of resource procurement. Trips were planned with specific targets in mind before they moved. The hunters took with them both adequate equipment and food, including ready-baked bread, grains, and meat (see Chapter 4).

Fall

<u>Istok trip 10/11-22 (Figure 5.4)</u>

The Istok trip was a move to procure fish – primarily whitefish (*sig*) – during the spawning season. Five people (Yakov, Vadim, Yulia, plus two researchers) moved to a location overlooking the river mouth at the confluence of River Cen' and Lake Nichatka. The two younger members of the group were assigned to an intensive fishing job while Vasili and Sasha went on a trip to Perevoz on a bartering mission. No one was left at the Main Camp, as Yakov came with the younger members to Istok – as a result, the residential camp was empty but not tidied or closed up as it was for residential moves. The move between camps was made with pack reindeer, with only Yakov riding a reindeer and the rest walking along with the herd. The distance from the residential camp was 4.7km straight-line and 5.1km actual.

Fishing involved at least two trips each day, usually one in the morning and one in the afternoon, to check the nets. Both Vadim and Yulia would be on the boat, with Yulia rowing and Vadim prying the fish free (if the net was full) or taking the net out to re-set it at a different location (if the net was empty). Then the fish would be gutted, salted, and packed in a barrel. The Istok trip covered the spawning season of whitefish and more than a hundred fish were often processed in a day. Still there were eight day trips made by Vadim, Yulia, or Yakov in between all the fishing, plus an additional three trips to the Main Camp for various forgotten items.

Two *kabarga* were killed during this trip, and eaten immediately. Otherwise, larger fish (pike, burbot) that were not suitable for salting formed the main part of the diet.

The trip ended on a prearranged date – a day before the Vasili and Sasha was scheduled to return – so the Main Camp could be set in order before their return. The heavier items, such as barreled fish, tent and stove were left standing for future use, as the spawning season had not ended. The remaining items were transported downstream on boat. The boat had to be forded over some icy patches, as well as walked across rapids without much water, and it was only used because the domesticated reindeer had not been properly collected in advance of the move.

Emnyak trip 11/16-21 (Figure 5.5)

The purpose of the Emnyak trip was fur animal hunting. The members on this trip were Vasili, Vadim and the two researchers. During this period, Sasha and Misha were on a separate hunt, and Yulia and Yakov remained at the Main Camp. By this time the ground had frozen. Sleds were packed for the journey, but the search for domesticated reindeer took longer than expected, and the party left late in the afternoon. Before nightfall the first campsite was reached and set up, 7.0km straight-line from the Main Camp and 7.8km actual. The next morning, the intended campsite was reached, 15.2km straight-line and 18.8km actual from the Main Camp.

The two hunters took one long day trip each, every day, in different parts of the territory. I followed three of these trips, recording their course on GPS (Figure 5.5). All hunts were on foot and the primary target was sable. Birds such as capercaille, hazel grouse, and willow grouse, and squirrels were hunted on the way, but the majority of effort went into hunting sable. Between the two hunters, this trip produced four sables, six squirrels, two capercaille, four hazel grouse, and one willow grouse. All animals but sable were eaten after the hunt, and the sable and squirrel furs were processed the night of the hunt.

Some unseasonable rain fell during the trip, making the leather footgear unsuitable for use. The trip might have been cut short a day for this reason. The move back was also made in two segments, with a stop in a Russian cabin overnight.

Imyak/Svetoi trip 12/2-8 (Figure 5.6)

The purpose of the Imyak/Svetoi trip was fur animal hunting. The members on this trip were Vasili, Vadim, Yulia and the two researchers. During this period, Sasha and Misha were on a separate hunt, and Yakov was on a separate hunt as well for short-term periods. The moves were made by sled, and the hunts on foot. There were two camps on this trip, where we stayed three days each. The first camp was located 9.9km straight-line and 10.8km actual from the Main Camp, and the second 9.5km straight-line and 9.7km actual from the first camp, and 18.3km straight-line from the Main Camp.

Vasili and Vadim took one long day trip each, every day, in different parts of the territory. Two of these trips (followed by myself) were recorded on GPS and the area covered can be seen on Figure 5.6. The hunts around the second camp were not followed or recorded by either researcher, as the outside temperature was too low for us. The trips by the two hunters, however, were not noticeably shorter. All trips were on foot and the primary target was sable. Birds such as capercaille, hazel grouse, and willow grouse, and squirrels were hunted on the way, but most of the effort went into hunting sable. Between the two hunters, this trip produced six sables, two squirrels, three hazel grouse, and one *kabarga*. All animals but sable were eaten after the hunt, and the sable and squirrel furs were processed the night of the hunt. The trip finished on the scheduled date, which was pre-arranged with the other hunting parties.

Spring

Svetoi trip 3/22-25 (Figure 5.7)

The purpose of the Svetoi trip was large game hunting. The members on this trip were Vasili, Vadim, Sasha and the two researchers. During this period, Yulia and Yakov stayed in the Main Camp. The start was delayed for a day as the search for domesticated reindeer was unsuccessful. Starting early in the morning, the first camp in Svetoi was reached, 21.3km straight-line from the Main Camp and 25.6km actual, by approximately four hours of travel on sled. One *kabarga* was retrieved from a wire loop trap on the way. Another *kabarga* was cornered by dogs ten minutes' walk away from the campsite and successfully killed, shortly after arrival.

The first camp was under heavier snow than expected, and the hunters decided to move camp by the end of the next day. Hunters went out hunting on foot with skis, or with sled and skis, but did not find a trace of game in the area. The second camp had been recently visited and confirmed to be an active mating ground for capercaille. The second camp was 7.5km straight-line from the Main Camp, and 14.4km straight-line and 15.6km actual travel from the first camp. On the night of arrival, two capercaille were killed successfully, and two more the next morning. The next day, all three hunters went hunting on sled, but only one hunter was willing to take a researcher on a second sled (as the second sled would have been a slower cargo sled). Vasili killed two reindeer, and brought one back on his sled. The second reindeer was retrieved the next day from the kill site.

Between three hunters, this trip produced two *kabarga*, two reindeer, and four capercaille. The trip ended when one hunter killed reindeer; the trip was cut short and the carcasses transported back to the Main Camp. This trip was planned after Vasili, on 3/20, had scouted the entrance to the area (i.e. the side closer to the Main Camp) by sled, and had seen fresh reindeer tracks heading up this valley. In this case the day's delay caused by the search for domesticated reindeer did not cost them a successful hunt.

<u>Tok trip 4/11-13 (Figure 5.8)</u>

The purpose of the Tok trip was nominally for large game hunting. The members on this trip were Vasili, Vadim, Sasha and the two researchers. During this period, Yulia and Yakov stayed in the Main Camp. The search for domesticated reindeer delayed the start, and the first camp was made at the capercaille mating ground visited approximately three weeks earlier by the same members. The move was made by sled and the trip to the first camp (7.5km straight-line) was10.2km from the Main Camp. The ice on the rivers was almost too slick for the reindeer to get a footing.

Three capercaille were killed that evening and the next morning, and the camp moved to a point further west (see Figure 5.8) where an old Evenki campsite (made by one of their acquaintances) served as a landmark. This was probably the original intended destination for the first night's camp, had the domesticated reindeer not been so hard to find. Due to the lack of tracks encountered along the way, the hunters decided not to camp there, and moved directly to a lake they had heard about, which contained a species of fish (Arctic char) not found in the larger lakes and rivers. This location was intended for a second (or third) stop, as the hunters carried fishing gear. The move between camps was 12.3km straight-line but 29.8km actual.

The activities at the second camp were mostly devoted to ice-hole fishing. Vasili might have gone on one trip by sled, which could have been a large game hunt. The dogs were set free, and two *kabarga* were successfully hunted in a day. An unknown Evenki was encountered on the second trip to retrieve cornered *kabarga*, and the trip was cut short due to make sure all was all right at the Main Camp[1] (the visitors turned out to be their relative Misha and two friends).

[1] While it is certainly possible that they would always immediately return to check their residential camp after encountering strangers in their territory, the motivation in this particular case was clearly Vasili's mistrust and/or protectiveness for his wife Yulia, and his desire to keep her under supervision when there were non-family members present. Their relationship showed increasing signs of strain during the Spring field season.

Between three hunters, this trip produced two *kabarga*, four capercaille, and over 40 fish. The trip back to the main camp was 11.6km straight-line and 13.8km actual.

Garillii trip 4/21-24 (Figure 5.9)

The purpose of the Garillii trip was for large game hunting, and probably specifically for reindeer, as the dogs were left behind. The members on this trip were Vasili, Sasha and I. During this period, Yulia, Vadim and Nils stayed at the Spring Camp and Yakov stayed in the Main Camp. The decision to go hunting was made in the morning. By afternoon, male domesticated reindeer (roaming free but staying close to the females in the corral) were found and harnessed to sleds. Some male yearlings were broken into harness in this trip. The trip to the camp was 15.5km straight-line and 19.0km actual from the Spring Camp, with rotten river ice causing detours.

The campsite was also near a capercaille mating ground, which turned out to be disappointingly inactive. The two hunters went hunting all day, with Vasili on foot the first day and on sled the next, and Sasha on riding reindeer on both days. Fresh tracks of reindeer were seen but the animals never sighted. There were fresher signs of moose but both hunters had missed it. One valley was particularly empty and Sasha switched to hunting for sable, but did not get any. The hunters concluded from tracks that the reindeer had moved northwards to a different river valley, but they had not brought enough sugar and flour to make the longer trip. The hunters discussed whether one should return to the Main Camp for supplies, but they ultimately decided to just return together. A *pechka* (stove) was left on site for future use. The two hunters produced one capercaille on this trip, encountered on a domesticated reindeer search.

Shirik trip 4/26-28 (Figure 5.10)

The purpose of the Shirik trip was for large game hunting. The members on this trip were Vasili, Sasha and I. During this period, Yulia and Yakov stayed at the Spring Camp, and Vadim and Nils went to the ice-fishing camp to fish. It is unknown why the return to Garillii camp was cancelled, but it could be because Shirik was in the right direction to drop off Vadim and Nils (at lake edge) and to pick the fish up afterwards. The camp was 12.2km straight-line and 15.2km actual distance away from the Spring Camp.

This camp was also close to a capercaille mating ground, which they had never visited before but had heard about it from another Evenki. On the night of arrival, four capercaille were killed. The next day, Vasili went out hunting on foot and Sasha on riding reindeer. Sasha killed one reindeer and left it at the kill site for later pickup. On the pickup trip, Vasili went hunting for a short while on riding reindeer, but generally the trip was over as a hunting trip when Sasha made the kill, and the carcass was soon afterwards transported back to the Main Camp. A large canvas bag of fish was picked up by sled on the way back, which Nils and Vadim had left and walked ahead.

Nichatka trip 5/7-9 (Figure 5.11)

The purpose of the Nichatka trip was for *kabarga* hunting. While it was still below freezing at night, the hunters considered the weather mild enough to camp with an open fire and no tent, and went on a more casual hunt with lighter gear. The members on this trip were Vasili and I. Sasha went to the ice-fishing camp to fish, and was dropped off at the edge of the lake. During this period, Yulia, Vadim, Yakov and Nils stayed at the Spring Camp. The camp was 5.8km straight-line and 6.1km actual distance away from the Spring Camp.

The camp was set up near a cliff face where kabarga were often stalled by dogs. Dogs were set loose. Two *kabarga* were killed on this hunt, but only one retrieved. Vasili and I then moved to the ice-fishing camp, leaving the sleds on the lakeshore and taking pack reindeer to retrieve Sasha and the fish. The return journey was made by sled.

Nichatka/Bear trip 5/16-17 (Figure 5.12)

The purpose of the Nichatka/Bear trip was for red deer hunting. The members on this trip were Vasili and I. This overnight trip might have been planned because I was getting desperate – three days before the end of the field season and I had not yet witnessed a large game hunt at that point. Sasha and Vadim were on a separate hunt trip, the purpose of which was to check a bear trap that they had baited five days earlier. As a female I was not able to go on bear hunts, as the study group adhered strictly to taboo rules for this particular prey species (see Appendix). Yulia, Yakov, and Nils stayed in the Spring Camp.

The first leg of the trip was by boat, and nets were set in inlets along the northern shore of the lake, where the larger pike were often caught. The destination was a known salt lick location (an area with exposed salty clay beds). Upon arrival, two red deer were sighted just leaving the salt lick. They were tracked but lost. An overnight watch in a hide and a morning hunt also produced no results. The return journey was also made by boat.

The hunting trip of Sasha and Vadim lasted a day longer (-5/18). The bear trap was untouched, but Vadim successfully hunted two reindeer on this trip.

Discussion

While each logistical hunting trip had some unique circumstances, most hunting trips were planned with a specific purpose (fur hunt, meat hunt), in areas where the hunters were familiar through oral retelling or personal experience as having the desired resource. Trips were likely structured to incorporate a known source of less desirable but more readily available food (e.g. *kabarga,* capercaille, or fish). The presence of fishing poles and ice-drills[2] at the ready on the Tok trip, for example, indicate planning and premeditation regarding these secondary sources.

Most trips took hunters outside the well-covered area of activity around the residential camp. Hunters hunted alone and covered different areas within these less used territories. Each evening the area covered by each hunter was described by oral retelling, and in the morning each hunter mentioned the general direction he intended to cover, before leaving for a hunt. During a hunt, when tracks of another hunter were encountered or a hunter sighted, the other hunter changed course. It must be remembered that Figures 5.4-5.11 only display trips that had been followed by a researcher with a GPS; there were usually twice and sometimes three times that many trips in each area, as every hunter went hunting every day on hunting trips. Each area was thoroughly canvassed by the hunting party as a whole.

Thus, the direction/location of these logistical moves was determined by *expected* resources, and camp distance was determined by how far they expected to be able to travel in a day. Usually there were no hunts on moving days, as the searching for the domesticated reindeer, packing, moving, and unpacking took time. While they did keep an eye out for fresh spoor while on the move, outlying hunters did not canvas the area along the move route while the main party traveled (as documented among Subarctic groups, e.g. Osgood 1936), although there were enough hunters to pursue such tactics on most trips. Sometimes, sled trains were stopped *en route* and one or more hunters briefly (<10 minutes) investigated a promising track that they had spotted from the sled, but in the observed cases, there were no discussion of diverting from their intended course or location. Nor were logistical moves ever made as part of a long-distance pursuit of prey.

The logistical trips of this study group thus should not be really considered 'overnight hunting trips' as they were not really a part of the hunt. These trips basically moved the base of activities to a new location, where the hunters set up camp continued their usual hunting activities, described in the following sections. The main difference, activity-wise, was that hunting activities were more intensive on logistical trips (i.e. each hunter went hunting every day) whereas hunters did not go hunting every day at the residential camp.

5.3 Day trips

[2] The ice-drill was a new acquisition, found or specifically brought back on an overnight scavenging trip to the Meteorological station a week before (4/3-4) the Tok trip.

5.3.1 ***Kabarga*** (Table5.13)

The following are brief descriptions of all *kabarga* hunts that resulted in a kill, and one observed purpose-specific hunt for *kabarga* (see Table 5.6). In this section, areas A1, A2, B, and C refer to those in Figure 5.13. Unless otherwise noted, the hunts were followed and observed by myself. Animals are named by season, species, and two-digit number in this study (e.g. first *kabarga* killed in the Fall field season was called Fall K01, also written as FK01 in figures and tables).

<u>Fall K01</u>

This animal was hunted by Yulia when she was out searching for domesticated reindeer. There was no observer. The search/hunt originated at Istok. She had taken a dog on this search trip but it had run away quite early. She did not find the domesticated reindeer herd. While she was still searching for the herd, she killed a hazel grouse and a squirrel.

After she gave up on finding the herd, she detoured towards the Main Camp to pick up some items that she wanted to bring back to Istok. After she had turned towards the Main Camp, she heard a dog bark, and followed the sound towards area A2, and killed K01. She dragged the carcass back, on foot, to Istok, a distance close to 10km.

<u>Fall K02 (Figure 5.14)</u>

The dogs had been gone over three hours when barking was heard from the direction of area B. An hour of rowing took Vadim near a steep cliff within sight of the dogs. Going ashore, he climbed the cliff for the shot. The carcass was taken back by boat.

<u>Fall K03 (Figure 5.15)</u>

K03 was killed in area A2 by Vadim, although both Vadim and Vasili were present. There was no observer. Dogs cornered the animal. The animal was field-butchered into parts as there were two hunters with backpacks. The offal and fur was left at the kill site, and the rest transported back on foot in the two backpacks. That the animal was field-butchered and carried thus is anomalous for this study group; in other cases with multiple hunters, the animal was simply dragged whole, with hunters taking turns. The probable reason was that they still had other planned activities to do (checking sable traps), and decided to take the butchery an extra step further in order to have more freedom of movement.

The trip was also anomalous in the number of hunters and its mixed purpose (to check traps and to go to the cliff to release dogs for *kabarga*; the trip also resulted in a short and unsuccessful red deer pursuit).

Fall K04

There are no records for this hunt, as Misha and Sasha hunted the animal while they were based in Istok while researchers were in the Main Camp. Only limb parts were brought back and shared with the rest of the study group.

Fall K05

K05 was killed by Vasili on a trip, with Yulia, to fetch/scavenge some items from near Moose Lake (area C). There was no observer present. Barking dogs alerted Vasili to the presence of *kabarga*. The animal had been cornered high up the cliffs, and was killed by a gun with the aid of binoculars from a distance. The animal was taken back whole, on foot.

Fall K06 (Figure 5.16)

K06 was killed on a purpose-specific trip for *kabarga* hunting. Nils accompanied Vasili and Vadim – this was another trip where there was more than one hunter. The hunters took the dogs to areas A1 and A2, released the dogs, and waited. The dogs failed but Vasili spotted and killed a *kabarga* by himself. The animal was taken back whole, on foot.

Fall K07

There are no records for this hunt, as Yakov was the hunter. He hunted with a dog, on foot, and carried the carcass back, minus the offal. The kill location was generally identified as area C.

Fall K08

There are no records for this hunt, as Yakov hunted the animal while the researchers were in Emnyak.

Fall K09

The group that went on the Emnyak hunting trip had just returned when the barking was heard in the direction of area A1. Vasili took off on his riding sled before unpacking. There was no accompanying observer. Vasili was back in one hour with K09.

Fall K10 (Figure 5.17)

K10 was killed by Vasili on the return leg of an unsuccessful sable hunt. Passing a cliff, Vasili released his dog, which stopped K10. Vasili killed K10, and started to head back to the camp when he saw tracks of the sable that had gotten away earlier. He stashed the carcass of K10 and successfully hunted the sable as well. There was no observer on this hunt.

Figure 5.17 shows the location of the stashed carcass (close to actual kill site) in relation to the campsite. The carcass was brought back on foot on a separate trip, shortly after Vasili had returned to the camp after successfully hunting the sable.

Fall K11 (Figure 5.18)

K11 was killed on the lake cliff (area B) during a trip to the Shirik area where a moose carcass was cached, by Vasili, Vadim and I. While loading the moose carcass onto sleds, dogs left on their own for hunting. Barking was heard on the way back. The sleds were reconfigured so Vadim could go hunt without pulling a train behind him, while Vasili and I went on ahead. K11 was successfully killed by Vadim and transported by sled to the Main Camp.

Spring K01

K01 was killed by Vadim, probably at area A2, on the day of our arrival for the Spring field season. There was no observer. The hunt was on foot and with dogs, and the offal was given to the dogs on site before transporting the carcass back to the Main Camp.

Spring K02

Dogs barked early in the morning, and Yulia left on foot to the cliffs (areas A1 and A2), but the dogs had stopped barking by the time she arrived so she headed back. Heading back, she heard them bark again and turned around, and killed K02. The carcass was transported back whole, on foot. There was no observer.

Spring K03

Dogs barked early in the morning, and Sasha went on foot to the cliffs (A2) and killed K02. The dogs were fed on the offal and the carcass was transported back on foot. There was no observer.

Spring K04 (Figure 5.19)

K04 was caught in a wire loop trap, most likely in the location shown in Figure 5.19. There was no observer on this trip. The carcass was picked up by Vasili on the way back from a large animal hunt, or possibly a scouting trip, on sled. He saw several reindeer tracks heading up a valley to Svetoi, and a hunting trip of Svetoi occurred two days afterwards.

Spring K05 (Figure 5.20)

On arrival at the Svetoi camp, the dogs started barking. As the sound was near, everyone (Vasili, Vadim, Sasha, Nils and I) walked over. Vasili made the kill. The animal was transported back whole, on foot.

Spring K06, K07

There are no records for these animals, except that Sasha brought it back on March 25 from his wire loop traps. He had set at least six *kabarga* traps and some sable traps in the area northwest of the Main Camp. Three *kabarga* were caught in the traps, including K06, which was a recent catch as it was still unfrozen. K07 was taken back to the Main Camp completely frozen. The third *kabarga* was reportedly completely eaten by ravens. The latter two could have been dead in the traps since March 7, when Sasha checked his traps and saw two females (but did not bring them back).

Two *kabarga* traps were kept open while others were taken down. It is obvious from this hunt that the purpose of the traps was for musk, not meat. Sasha's trip on March 7 was on riding reindeer, and on March 25 was on sled.

Spring K08

There are no records for this hunt, as Yakov hunted the animal while the researchers were in Svetoi.

Spring K09 (Figure 5.21)

K09 was killed by Vasili. The hunt was on foot and with dogs, and the offal was given to the dogs on site before transporting the carcass back to the Main Camp. In terms of the route and time taken, this hunt is typical of *kabarga* hunts in area A1.

Spring K10 (Figure 5.22)

K10 was killed by Yulia. The hunt was observed by Nils. The hunt was on foot and with dogs, and the offal was given to the dogs on site before transporting the carcass back to the Main Camp. In terms of route, this hunt is typical of *kabarga* hunts in Area A2, although the kill procedure seemed to have been anomalously inefficient.

Spring K11

Yakov killed K11 on a purpose-specific hunt for *kabarga*. The hunt took approximately four hours. Yakov went down with two dogs to area A1 and set them free, and people at the Main Camp heard the dogs barking approximately one hour into the hunt. Being deaf, Yakov did not know the dogs were barking at area A2 until he went over to area A2 a few hours later. Yakov traveled on riding reindeer, and dragged the *kabarga* back to the Main Camp behind his riding reindeer. Dragging is the most common method of transport when on frozen ground, where the rope is usually tied to the walking hunter's waist. In this case, it was tied to the saddle. There were no observers on this hunt.

<u>Spring K12</u>

Yakov killed K12 on a purpose-specific hunt for *kabarga*. The hunt took approximately six hours. Yakov went down to the cliffs on a sled, with two dogs, and set them free. Again, he did not hear the dogs barking and had tea while waiting under the cliff. When he shot K12 in area A1, it fell down but was alive, and the dogs and Yakov had to chase the animal down. The backside of K12 was considerably damaged by dogs, as they ravaged the animal during the chase. Yakov returned tired from the chase and cut some corners in the subsequent butchery process. There were no observers on this hunt.

<u>Spring K13</u>

Barking was heard in the Main Camp, and Yakov set off on foot to the cliff indicated by other hunters. Yakov killed the animal in area A1, and eviscerated, skinned, and took the musk gland out of the animal in the field. There were no observers on this hunt.

Yakov only brought back the musk gland after the hunt, leaving the meat high up on a tree. The meat was retrieved later – perhaps as early as that afternoon.

<u>Spring K14 (Figure 5.23)</u>

K14 was killed by Vasili while on the Tok trip. Vasili followed the barking on foot, and shot the animal successfully. The offal was fed to dogs at the kill site. As the kill site was located up a steep ravine, the fur was plucked (it was already coming out in molt) and the carcass tied over Vasili's backpack for transport. The dogs left on another chase while the carcass was being secured. The way back took considerably longer due to the weight, and also because Vasili chose to wait to see if the dogs would corner another animal.

In most cases the hunters knew which dog(s) had been hard-working (i.e. left camp early, and actually searched for and cornered the animal) and which had just been following (i.e. disappeared from camp sometime afterwards, often shortly before the hunters themselves heard the barking). However, the dogs were most often rewarded as a group with offal, with the hard-working dog(s) receiving some choicer parts, but basically the same amount as others. The case of K14 was unusual in that Vasili selectively fed the offal to the dogs, with some dogs getting none at all. It was thus the only clear example of training dogs by reward and reinforcement. It is unclear why this happened on this hunt, and not on others.

<u>Spring K15 (Figure 5.24)</u>

K14 was killed by Vadim while on the Tok trip. Vadim followed the barking on foot, but did not know the area well and had to climb straight down the steep cliff face onto the lake, which took some time. After K15 was killed, dogs were fed the offal and the meat hidden among loose boulders, for pickup by sled on the way back to Main Camp. An easier foot route was found by Vadim on the way back, following a creek to the ice-fishing camp. This route was used for all later travel to and from the Arctic char fishing location.

Some unknown dogs took part in the K15 hunt, and alerted Vadim to the presence of strangers. An Evenki who was a friend of Misha was encountered soon after the kill, and the Tok trip was abruptly shortened and the hunters hurried back to their Main Camp (see Footnote 1, this chapter).

<u>Spring K16</u>

There are no records for this hunt, as Yakov killed K16 while staying alone in the Main Camp. This female *kabarga* reportedly had four fetuses. This was previously unheard of by this study group – usually *kabarga* had twins or occasionally triplets – and some expressions of regret were heard for killing an animal that could have increased their prey population.

<u>Spring K17 (Figure 5.25)</u>

Sasha killed K17 in an area identified as 'near the waterfalls' – shown approximately in Figure 5.25. There were no observers on this hunt. The dogs were heard barking from early morning until noon. While Sasha left shortly after the dogs started barking, his primary goal was to search for domesticated reindeer that had been neglected for a few days during a drinking binge, and he most likely left the *kabarga* hunt until last. Sasha came back approximately two hours after the dogs stopped barking, with K17, but without any domesticated reindeer.

<u>Kabarga hunt on Nichatka trip, 5/7 (Figure 5.26)</u>

The Nichatka trip was a purpose-specific hunt for *kabarga*. Dogs were released on arrival at area B, but all of them came back shortly afterwards. A short (20 minute) attempt was made to make the dogs hunt, by taking the dogs to a likely location where *kabarga* tracks could be seen. While there were tracks on the ground, the dogs did not start a hunt, and Vasili gave up shortly afterwards for that evening. The following morning the dogs stopped two animals, K18 and K19.

Spring K18 (Figure 5.27)

K18 was cornered by dogs and killed by Vasili. The animal was field-butchered so the parts would fit in a backpack for transport, as the kill site was high up in the cliffs and footing was treacherous on the way back. For the field butchery, some branches were cut so the animal could be hung up for a proper butchery. Such preparations were not made if the hunter was only eviscerating the animal. The fur was left on site and all other parts transported back to camp, where the carcass was again hung on a tree (prepared for the purpose) to keep away from the dogs.

Spring K19 (Figure 5.28)

K19 was cornered by dogs and killed by Vasili. This was the only animal not successfully retrieved after the kill. The animal had been cornered extremely high up a cliff, and while Vasili climbed up the cliff halfway, he did not have a clear shot. The animal fell down alive and was chased further by dogs, and died in an inaccessible spot. The animal was left on the cliff. More effort might have been expended to recover it had it been a musk-bearing male. The hunting dog was rewarded with meat back at camp, as there was no offal to give.

Discussion

In most cases, *kabarga* were searched for and flushed out by hunting dogs. The hunter started the hunt after hearing the dogs bark, thus completely eliminating the searching and tracking phases of the hunt. The *kabarga* hunts were thus very short in duration, usually less than two hours including transit time (Table 5.29). In a few instances, *kabarga* were trapped. In one case, the hunter was led to the cliffs by the barking of dogs, but subsequently spotted and killed a separate *kabarga* in the area on his own.

There were three cliff areas around the Main Camp (< 5km in distance) where *kabarga* were often cornered by dogs (Figure 5.13 A1, A2, and C). The cliff where the *kabarga* were most commonly killed was about a half hour to 45 minutes away on foot from the Main Camp. The hunters always walked more or less directly to the correct cliff following the direction of the barking. There were only a few cases where the hunter had to spend any significant amount of time at or around the cliff (excluding Yakov's hunts, whose cause for the wait was deafness). One case was when the hunter had to search for the dogs themselves when they stopped barking for some reason, and in another case, the hunter waited while the dogs, deliberately led to the cliff to flush out the *kabarga*, did their job. In the former case, the hunter waited for an hour, and in the latter, two.

Another location on the shores of Lake Nichatka (Figure 5.13 B) was considered too far when there was still open water – it would take over one hour rowing and about an hour's foot travel from the Main Camp. Hunts on this cliff occurred when the hunter was passing by the area, was already in the area for fishing or other purposes, or when conditions were right to use sled transport on short notice (i.e. domesticated reindeer in campsite and ground frozen). In one case, when a *kabarga*-specific overnight hunting trip was made, the hunter camped near this cliff location.

Sometimes the owner of the dog (determined by the barking) insisted on his right to be the hunter, but in most cases the person who followed the bark and thus became the hunter was on a first-volunteered, first-served basis. In some cases the hunters were actually unwilling to make the effort and younger members such as Yulia were involuntarily pushed into the role. Hunter's prerogatives such as eating or distributing lower limb marrow was conferred upon the successful hunter whatever the circumstances of choosing[3].

Once in the correct area, it usually only took the hunter five to ten minutes to sight the prey, position her- or himself, and kill the animal. Often the dogs were sighted first, and the position of the animal deduced. Rarely was a hunter unable to get a clear shot, and only once was a *kabarga* stuck on a cliff where it could not be retrieved after the kill, and lost.

Transportation of the carcass was invariably complete, excepting the fur and the viscera in some cases. In most cases the carcass was transported whole, regardless of transportation method (foot, riding reindeer, or sled). This pattern was redundant and consistent, with variation occurring rarely and in extenuating circumstances. Further butchery at the kill site occurred only in cases of bad footing, or when some additional activity in the area had to be done and the hunter, on foot, needed freedom of movement.

The variation in hunt time, ranging from around half hour to little less than four hours, was almost completely dependent on the location of the base camp in relationship to the kill site. The sex and age distribution of *kabarga* was dependent on the dogs' selection, and show a larger number of juveniles and young adult deaths than adult deaths (Table 5.30). This pattern is especially prominent in the spring, when the yearlings had just left their mothers. The hunters preferred to hunt males due to the value of the musk gland, but did not refrain from shooting even when the sighted animal was clearly a female (male *kabarga* have large upper canines visible from a distance). Some of the carcasses were used as dog food, instead of being consumed by people (see Chapter 5). Musk gland drying was more often witnessed in the Spring field season.

---

[3] When the butcher was different from the hunter (for details see next chapter), the butcher offered the marrow bones to the hunter before eating them his/herself or distributing them his/herself. If the hunter was well into his/her post-hunt snack (tea, bread, etc.) when the marrow bones were offered, *kabarga* marrow eating could be postponed, offered to others by the hunter, or entirely forgotten (and thrown away later).

5.3.2 Reindeer and large game (Table 5.47)

The following are brief descriptions of the hunts that resulted in a kill, and observed purpose-specific hunts (see Table 5.29). Unless otherwise noted, the hunts were followed and observed by myself.

Fall R01 (Figure 5.31)

R01 was killed by Vasili or Sasha while they were searching for domesticated reindeer, on foot. There were no observers on this trip. They covered the area northwest of the Main Camp, and found a large portion of their herd (over 30 reindeer). A wild young male reindeer was standing near the domesticated herd, and was killed. Their search trip lasted 11 hours, including the initial kill site butchery where the animal was eviscerated, skinned, and parts hidden under snow. Vasili and Sasha returned to the Main Camp with the domesticated reindeer but no R01 parts.

R01 was retrieved by Vasili and Vadim the next day, on riding reindeer with pack reindeer for the meat. Nils went along on this trip, on foot. The trip took approximately six hours (see Figure 5.31), including the field butchery, where the animal was cut into parts. The study group rode and led their riding reindeer alternately, instead of riding continuously for long periods and distances.

Red deer hunt on 11/10 (Figure 5.32)

This hunt is classified as a large game hunt as the hunter took a large caliber gun, as well as his usual small caliber gun on the hunt. Vasili had also taken his dog which he kept tethered to his waist. Nils followed this hunt, and carried the second gun.

Vasili was following fresh tracks of a red deer when dogs that went with Vadim on a separate hunt appeared nearby and started to bark at a squirrel. Due to this interruption, Vasili gave up on the red deer and switched to hunting sable. The hunt took approximately four hours.

Red deer hunt on 11/11 (Figure 5.33)

This hunt is classified as a large game hunt as the hunter ended up tracking a red deer. Vasili had taken his dog, tethered to his waist. Nils followed this hunt. Vasili only took his small gun, and tracked sable for the first 2.5 hours. As the tracks lead further away from camp, Vasili turned back, and encountered fresh red deer tracks. The red deer was tracked for 1.5 hours, but the hunt was ultimately abandoned as it was getting dark. The hunt took over seven hours.

Hunt on 3/23 (Figure 5.34)

This hunt was purpose-specific for reindeer and other large game. Vasili hunted on skis and without dogs, and Nils followed on skis. No large animal tracks were encountered on this hunt, and the camp was moved to a new site later that afternoon. A fresh track of sable was seen on this hunt but ignored. The hunt took six hours.

Hunt on 3/24 (Figure 5.35)

This hunt was purpose-specific for reindeer and other large game. Vadim hunted on sled, with Nils' sled pulled in train. No fresh tracks were seen, and the tracking phase of the hunt was never initiated. Vadim had been ill earlier in the year and took long breaks as he was still easily tired. The hunt took over seven hours.

Spring R01 and R02 (Figure 5.36)

The original purpose of the trip on which R01 and R02 were killed might have been to hunt fur animals, as Vasili took his dog. There were no observers on this trip. His transportation method was by sled. He had tracked down a sable and spent some time smoking it out, but the sable escaped in deep snow, where the dog could not follow fast enough. Without his dog (which went after the escaped sable), Vasili proceeded further, and after hunting a capercaille, spotted a herd of 11 reindeer. The herd ran away and Vasili pursued on sled for approximately an hour and a half. After sighting the stationary herd at a distance, he proceeded on foot and shot two reindeer (on a different retelling, the time between parking the sled and the herd being alerted to his presence was very short, and he was about five meters away from his sled when he killed the animals). The reindeer ran about 50km and died. The hunt took eight hours, including butchery time (most likely an hour).

R02 was eviscerated and skinned, and the parts were hidden under snow[4]. R01 was transported back whole to the camp on Vasili's sled, with Vasili sitting atop the carcass. The carrying back of the animal whole was (according to their conversation) an anomalous event. The partial cause was the kill site being sufficiently close to the camp, but mainly it was because I had expressed an

[4] Reindeer carcasses were usually hidden under snow or brush while the hunter went to fetch transport (and/or help). In observed cases, the carcass was retrieved the next day at the latest. Carcasses would probably have been hidden better had there been cause to leave them for a longer period – for example, a moose carcass had been cached in a sturdy log box (on the ground) for several months, and Yakov hid a *kabarga* carcass on a makeshift platform (off the ground). Apparently they were not too worried that carnivores and scavengers would stumble across their kill on the short term. Carnivores and scavengers in the area included wolves, bears, ravens, wolverines, and the various 'fur mammals' such as sable and mink, as well as their own dogs.

interest in completely documenting the butchery process. Thus Vasili specially brought the animal back whole so the skinning and evisceration could be observed (i.e. kill butchery and field butchery, see Chapter 7). R02 was transported back to the camp the next day. Figure 5.36 shows the transportation route and the approximate kill location. Both animals were transported back to the Main Camp, and then butchered further into parts.

Hunt on 4/20 (Figure 5.37)

This hunt was purpose-specific for reindeer, as Vasili did not take any dogs. Vasili and Nils went on foot. Vasili found fresh tracks about four hours into the hunt. After 1.5 hours of tracking, the prints showed that the reindeer were aware of pursuit, and the hunt was abandoned. Vasili encountered at least six sable tracks, four *kabarga* tracks, and sighted capercaille, hazel grouse, and willow grouse on this trip as well, but only the fresh reindeer track was followed. The trip took about nine hours.

Hunt on 4/22 by Vasili (Figure 5.38)

This hunt was purpose-specific for reindeer, with Vasili traveling on foot. A rather flat and open territory was chosen for this day's hunt, and binoculars were used to scan for tracks as well as reindeer. Some fresh tracks were found and pursued, but the reindeer seemed to be aware of pursuit, possibly by Sasha (from whose hunting grounds the reindeer were traveling from). After giving up on the tracks, time was taken for a capercaille hunt, tea break, a trip to a known red deer blind, and a search for mummified hamsters, which was supposedly marketable as (Chinese?) medicine (although the study group had never found nor sold one). On the way back, a Russian cabin was scavenged for useful items. The hunt lasted over seven hours.

An account of Sasha's day, unaccompanied by observers, is given in Figure 5.39. His hunt lasted close to 12 hours (on riding reindeer) and his position agreed with Vasili's guesswork of reindeer behavior during the hunt.

Hunt on 4/23 (Figure 5.40)

This hunt was purpose-specific for reindeer, and Vasili went on the hunt on sled, with me on a sled in train. The hunt was a continuation of the hunt of the previous day, where Sasha encountered a herd of nine reindeer. The objective was the part of the herd that had split off into a direction not covered by either hunter the previous day. While a likely track was spotted and followed up a river valley, further tracks indicated that the herd had all headed away from the immediate area, most likely to one river valley north (and beyond the range of pursuit from this logistical camp location). Some abandoned Russian cabins were scavenged on the way back.

After giving up on the reindeer, fresh moose tracks were found but not followed, possibly because the wind direction was wrong. The hunt lasted a little less than six hours.

Hunt on 4/27 (Figure 5.41)

This hunt was for large game but not specifically for reindeer, as Vasili took his dog, tied to his waist. The hunt was conducted on foot. Fresh tracks of reindeer were found about three hours into the hunt, but then Vasili took over an hour out for tea. Due to this delay, when Vasili tracked the reindeer to their midday resting location the reindeer had already left (Vasili knew that reindeer rested during the day in spring when the glare of snow was great; so he took an intentionally long break, in hindsight too long). The tracks were followed through deep snow, but lost when the reindeer traveled over bare ice. The track was subsequently recovered but as they headed over into Sasha's hunting area, and as the tracks had also led Vasili back near the camp, the hunt was abandoned. The hunt lasted over eight hours.

Fresh bear tracks were seen and noted, and bear hunting was discussed on this hunt and later in the season.

Spring R03 (Figure 5.42)

R03 was killed by Sasha near the end of his hunting trip, which he made with the purpose of hunting large game. Sasha took a riding reindeer. While resting (lying on the ground with riding reindeer nearby), a lone reindeer wandered close, which Sasha noticed because his riding reindeer noticed the animal. The animal was shot, skinned, and eviscerated and hidden in snow, for retrieval the next day (see Footnote 4, this chapter). The hunt lasted over eight hours.

The carcass was picked up by sled the next day. On the way back to the camp, a short detour was made (first by sled and then by Vasili alone on riding reindeer) for signs of the reindeer herd that got away from Vasili the previous day. No further fresh tracks were found. R03 was transported back to the Main Camp and butchered into parts.

Hunt on 5/14 (Figure 5.43)

This hunt was for large game but not specifically for reindeer, as Vasili had his dog tethered to his waist. The hunt was conducted on foot. Fresh tracks of reindeer and red deer were briefly investigated, but none were tracked very seriously. A carcass of a lost domesticated reindeer was found on this trip. The hunt lasted for eight hours.

Hunt on 5/16-17 (Figure 5.44)

This hunt was specifically for red deer. Vasili visited a known area with exposed salt-bearing clay, timing the arrival at late afternoon. The trip was made on boat, and then on foot. Vasili just missed red deer leaving the salt lick area – the animal(s) were barely sighted. After approximately ten minutes of pursuit, he chose to set up a hide (of tarp and branches) and watched the original salt lick area until darkness fell, and also at dawn. No further signs of deer were seen, and after a short trip to a second salt lick area in the morning, Vasili left the site on boat.

Spring R04 and R05 (Figure 5.45)

R04 and R05 were both killed by Vadim, on the hunting trip with the main purpose of bear trap checking. No observers accompanied this hunt. R05 was killed first (numbers were assigned to the carcasses before the hunts were recounted). The trip was made with riding reindeer and a train of pack reindeer.

R05 was killed on the first night of the hunt, when both Vadim and Sasha were already camped by an open fire.[5] A small lone female wandered close to their camp, and was shot. The animal was butchered that night.

R04 was killed the next day, on a hunt on foot by Vadim. Vadim had spotted a herd of eight reindeer through binoculars after several hours of search. Tracking the herd, Vadim came across a clearing and shot at the herd. The herd ran away, but Vadim was able to come into position to shoot again, and killed R04.

R04 was field butchered immediately following the kill. Vadim hid the meat of R04 at the kill site and returned to camp. Later, he returned to the R04 kill site with Sasha for further butchery and pickup. After camping one more night, Sasha and Vadim returned to Spring Camp, closing the bear trap (which was empty) on the way. The approximate kill locations of both reindeer can be seen in Figure 5.46.

Discussion

The observed hunting trips for large meat animals, none of which were successful, were pretty uniform in structure – the hunter searched for good fresh tracks, and tracked them until he had some cause to quit. Hunters seemed to equally weigh reindeer, red deer, and moose tracks when encountered: freshness of the tracks counted above the type of prey or the number of animals in the herd. Most of the hunts observed became reindeer hunts after this track-choosing process. Exceptions were two trips made in the Fall field season

[5] Campfires for overnight camping were typically made from three large logs arranged in a starburst pattern, with logs pushed progressively into the center for a continual burn. This method was used as early as mid-April and into September-October. The study group no longer had tents designed to use with open fires within – if they wanted to use a tent, they carried a metal *pechka*, or stove.

(November 10, November 11) where Vasili specifically intended to track red deer, and a trip made on May 16 specifically to a red deer blind.

Hunts for large game were considerably longer than *kabarga* hunts, ranging from four to almost nine hours in length and covered a larger area (Figure 5.46). In most cases these long hunts were on foot, and done without the aid of free-ranging dogs. Tracks that were old were noted but not followed. Search time (Table 5.47), or the time until a good fresh track is found were typically an hour or two, and then the tracks were followed for hours. Tracks were followed until something went wrong, for example the reindeer speeded up, indicating they were aware of pursuit, or in the case of the November 10 hunt (tracking time 28 minutes), dogs from another hunting party (Vadim's) burst in and alerted the prey with barking and noise.

Of hunts observed in the field season, the actual hunts where reindeer were killed seemed to involve a fair portion of luck rather than hard work. In three out of six cases (Fall R01, Spring R03, R05), a lone reindeer had wandered close to the domesticated herd or the resting hunter, and was spotted and killed.[6] In another case a herd was sighted by chance (Spring R01, R02) without any tracking. Unfortunately, none of the observed 'hard work' hunts resulted in a kill. This is not to say that the hunters were poor hunters; in February 2002 (between field seasons) the hunters reportedly tracked, pursued, and killed reindeer with the 'hard work' approach on three consecutive hunts, as well as once in January (see Table 3.3).

The high failure rate of their large game hunts puzzled the hunters during the field season. They did not think the cause was the presence of observers accompanying the hunters. However, they did start to wonder, late in the Spring field season, if bad luck was incurred in general by the group due to females touching and polluting their hunting-related gear. The hunters conducted some ceremonial smoking of apparatus (weapons, saddles, bags) to ward against these possibilities (see Appendix)[7], and were more successful in their subsequent hunt attempts (i.e. R04 and R05 were killed). In any case, it is likely that the field season results were anomalous in its high failure rate.

The area covered during long large mammal hunts varied by transportation method (Table 5.48). On average, walking speed was about 4km/h, and the average walking or riding reindeer hunt trip covered about 15-25km in four to six hours (riding reindeer traveled at about walking speed). Sleds traveled at twice that speed, and could travel over 30km in a day.[8] In addition, the length of daylight hours limited the distance a hunter could cover (see Table 5.4).

---

[6] This again brings to question whether the wild reindeer in this area are feral domesticated reindeer.

[7] The same explanation (female pollution) was also given for bad sable hunting in the Fall field season, and ceremonial precautions were also taken during that event.

[8] If domesticated reindeer were used in a hunt, they were tied up and left at a distance in the final stalking and kill, as their presence could alert the prey.

The reindeer sample size was small and not much can be said from the age and sex distribution (Table 5.49). There was anecdotal evidence that the hunters would aim for the lead female of the herd, or the biggest in the herd, if there was time for thought (e.g. Spring R01 R02). On chance encounters (e.g. Fall R01, Spring R05) smaller animals were also taken. Transportation of the reindeer carcass was invariably complete, except for leaving behind some internal organs and occasionally the fur. Reindeer carcasses were usually abandoned after the initial field butchery without any lookouts, while the hunter went back to camp to fetch a means of transport – it is interesting to note that carnivore density in the area was so low that such a strategy would not lead to disastrous results. The degree of butchery done before transport varied by transportation method, namely pack reindeer or sled. Differences in butchery pattern are discussed in Chapter 6.

5.3.3 Sable

Sable hunting was the other major hunting activity of the study group. One example of sable hunting is illustrated in Figure 5.50 as a comparative sample to reindeer and *kabarga* hunts. Sable hunting involves searching and tracking the sable to their lair, in which they rest during the day. The animals were of course smaller and their territory also correspondingly smaller, and they were usually stationary (and sleeping) at the time of the hunt. Nevertheless sable tracking sometimes lasted for several hours, with the hunter following the crisscrossing tracks like unraveling a thread. As an economically important resource in terms of market value, every effort was made for their capture, from kindling multiple smudge-fires to close all the exits to their lairs, to felling a tree if a sable died in the top limbs. The hunter usually continued the hunt after a successful kill (although depending on the time of day) as the animal was light enough to carry.

The hunters' search for sable took them to various creeks and waterways where they hunt during the night. The hunter's circuit was somewhat more restricted to waterways especially in the search phase (Figure 5.51) but nevertheless expanded into territory also suitable for large game. However, fresh large game tracks were ignored during most fur mammal hunts. The somewhat shorter distance covered in sable hunts (compared to large mammal hunts) were due mostly to the shorter daylight hours, and due partly to the more intense and overlapping search conducted in a small area after a fresh track was spotted.

5.4 Summary

The study group's hunting activity was based on their extensive knowledge of their territory. Their logistical hunting trips for large game were initiated when food reserves ran low, and they returned from these trips immediately following a successful kill, or at a prearranged date if unsuccessful. The latter decision (to return after an unsuccessful hunt) was possible because they had an easily obtainable back-up resource, the *kabarga*. This regrouping after the hunt allowed the hunters to exchange information (if there were multiple parties) and plan their next logistical trip accordingly.

Logistical moves were planned with some backup resources in mind, and located in areas with previous success for the particular prey type and particular time of year. The area to be covered in a day's hunt was roughly thought out and communicated between different hunters. The study group's selection of logistical camp sites fits the 'point-to-point' mobility pattern found commonly in hunter-gatherers living in low biomass settings (Binford 1982:9-10). This type of mobility moves camps (logistical camps in the case of the study group) to places prejudged to have good access to resources.

The study group heavily used the area west and northwest of their Main Camp (Figure 5.52), flanked by two major rivers and dotted with numerous lakes, some large. This central territory was accessed from their residential camps and even during their logistical moves. The area was within the 5km radius of both residential camps and of seven out of eleven of their logistical camps (64%), and thus technically available to the study group 128 out of 143 days (90%). While there were only three major hunts recorded by GPS that was based in this central territory, day trips from residential camps (for domesticated reindeer searches, as well as for hunting) led the hunters into this area much more frequently than Figure 5.52 suggests[9]. Usually a logistical move situated the hunters within a relatively unused territory. The study group hunted intensely on

[9] Quantification of data about non-observed hunts and trips are difficult, as the quality of data changed over time (i.e. I got better at finding out details as the field season progressed) and also depended upon the study group member, and how much s/he wanted to tell me.

logistical trips (compared to their time at the Main Camp), and canvassed each new area before moving to a new location.

Models show that some basic patterns of camp placement and patterns of hunting for each prey species exist in relationship to the environment. (It should be remembered that models in Figure 5.52-57 only cover trips and locations accompanied by a GPS-bearing observer). The study group mainly stayed in elevations lower than 1,000m, both for camping and on hunting trips, over 99.9% of the time (Figure 5.53). Waterways and flatter areas were heavily favored for inter-camp movement (Figure 5.54; 99.9% in areas under 16 degrees incline) and also preferred for day trips, until the hunter diverted after the tracks of prey. Camps were placed close to waterways as well, both for water and for ease of travel (Figure 5.55; 100% in areas under 16 degrees incline, and basically located on waterway). It should be noted that open river ice was often slippery and not favored for sled or foot travel, but open areas suitable for travel were often found near the banks.

Kabarga were mostly killed in cliff locations, and were the one prey type whose location might be predictable by geography (Figure 5.56; 100% of kill sites in areas over 16 degrees incline). While more than a steep cliff is needed for *kabarga* hunting – for example, another variable would be rocky outcrops that deter the pursuit of dogs – cliff locations did correlate with *kabarga* kill sites. Neither the kill locations of sable and reindeer, nor the mating grounds of capercaille correlate with any large-scale geographical or vegetational variation (Figure 5.57), except proximity to waterways. This correlation however, is likely due to the hunter preferentially traveling and searching these grounds. From Figure 5.57, it can be observed that the territory of this study group is centered on a convergence of waterways, and in an area with a higher frequency of cliffs than the surrounding area.

To reiterate, among the larger mammals, *kabarga* and reindeer were hunted in a strikingly different manner. *Kabarga* were a reliable and easy resource, and opportunistically taken in most cases (Table 5.58; 70%). Opportunistic or not, most *kabarga* hunts used free-ranging hunting dogs to stall the deer (Table 5.58, 90%). Reindeer hunting, on the other hand, was more of a planned activity and relied on the hunter's skills and knowledge of the territory. Only one out of six successful kills (17%; Spring R01) was entirely opportunistic (i.e. on a non-hunting trip). Reindeer hunting was a high-priority activity, on par with hunting for cash-market game such as sable, while *kabarga* hunting was sometimes perceived as a chore.

Despite these differences between prey species, there was a striking redundancy in the study group's hunting and transportation pattern, in that a single hunter hunted and killed the animal by himself, with little to no variance in hunting strategy or technique, and invariably transported the carcass back whole. Even the reindeer – which were butchered to a degree in the field – were transported completely. This redundancy is highlighted when contrasting the study group to other ethnoarchaeologically studied groups.

Binford's Nunamiut study (1978) highlighted the seasonal variability of hunting and butchery among the Nunamiut, dictated by the ecology and behavior of tundra caribou and their tundra environment. The Nunamiut hunting strategy adapted to the seasonal migration and aggregation of caribou, making ambush hunting and mass kills possible and necessary during the fall and spring. It had been described in Chapter 1 that the ecology of reindeer differs greatly in the tundra and forest species. In contrast, the study group hunted more solitary species, and the forested and hilly environment (plus their antiquated guns) made long-range ambush hunting impossible and large catches difficult. The Nunamiut hunting grounds were further away from the residential camp, and due to the distance and the mass kill strategy, they commonly cached and/or abandoned some meat at the kill site. Although they used sleds and transport animals like the study group, they were not able to bring back all the carcasses completely.

The Nunamiut lived in aggregations of at least several families including many non-hunting members and many dogs, reducing the ratio of hunters per group and accentuating the lean/glut variability brought on by mass hunting. This, plus the seasonal availability of the caribou, necessitated efforts to be put into storage, such as processing meat for drying. These characteristics of life were rather typical among tundra groups exploiting land mammals. The study group, in contrast, had a high ratio of hunters and comfortably lived on one reindeer for days due to their small group size before having to go hunt again. They thus lived essentially on fresh (frozen) meat, procured reliably at need. In fact, the case in which Nunamiut hunting and transport is most comparable to that of the study group is the summer sheep hunt, where individual sheep were brought back and consumed fresh at the residential camp. It should be remembered that the study group’s group composition and size was atypical, as was their non-reliance on storage.

The Hadza, !Kung, and Kua (Bartram 1993a, 1999; Bunn, et al. 1988; Monahan 1998; O'Connell, et al. 1988a; Yellen 1977) hunted game in a relatively open environment, exploited migratory large game as well as various small game, and lived in large groups. In contrast to the study group, these groups hunted on foot, their main weapon was the poisoned arrow – and thus their hunting strategy fundamentally differed from the study group in that the wounded animal had to be tracked for a rather long time. To effectively hunt with poisoned arrow, multiple hunters often hunted together, with one going back to camp to fetch carriers and lead them back after the animal was successfully wounded, while the other(s) tracked the animal. Their hunting method was constant and redundant but fundamentally different than that of the study group.

While the hunting method remained constant, the variability of prey size, distance, the number of carriers, and the presence of predators introduced variability into carcass transportation. The carcass was consumed in the field to varying degrees depending on factors such as prey species and size, distance to residential camp, and the number of people present at the field butchery. This was very different from the study group, who in most cases did not consume any part of their kill until they returned to their residential camp (and they were able to return immediately after a kill).

Among the abovementioned African groups, smaller animals and some specific species (e.g. zebra) were transported whole or nearly whole to the camp (Monahan 1998), but unlike the study group, these were the exceptions to the rule.

The Okiek was unique among African ethnoarchaeological case studies in their forested environment and smaller group size (Marshall 1994). Their prey species were non-migratory and abundant. They had an important non-meat resource (honey) and they kept domesticated animals and practiced some horticulture. As they engaged in various subsistence activities, hunting did not seem to be a round-the-clock occupation, and animals seemed to be brought back rather sporadically (compared to above African groups). Their hunting strategy was varied and included bow and arrow, spear, hunting dogs, and snares. However, their hunting strategies for each species were consistent. This group transported most of their prey whole back to their immediate consumer group (the nuclear family), after which the carcass was distributed further. This group's strategy of transporting back the whole carcass is interestingly similar to the study group. Parallels between the two groups include solitary forest prey species, their sporadic hunting schedule, and their small group size.

These comparisons help bring to light the reasons behind the study group's redundancy in hunting and transportation pattern. The study group's prey species did not exhibit seasonal behavioral differences, and they were distributed relatively randomly and evenly within their territory (*kabarga* were also distributed relatively evenly, although they were flushed out at certain points in the landscape). The study group had no major vantage points or ambush points (except for red deer blinds) that they could exploit. Their weapons, in contrast to poisoned arrows, were immediately lethal and did not require overnight pursuit of wounded prey. Climate and the lack of predators allowed the hunter to hunt alone, and to leave the carcass alone while he fetched his sled or other means of transport. Due to these combined factors, the hunters of the study group were able to pursue a highly efficient exploitation strategy of their territory: single hunters canvassing different areas on their own, maximizing the search range without compromising the ability to hunt or successfully bring back the kill.

Unlike what was predicted by Binford's utility model and the Hadza transport model (Binford 1978; O'Connell, et al. 1988a, 1990), the study group did not discard low-utility parts nor non-edible parts to reduce transportation costs, but invariably transported both their small and large prey whole. I believe there is no single reason behind this unique pattern. This pattern of complete transportation was *not* simply the product of the advantage given by the reindeer as pack animal – the Nunamiut also traditionally had forms of aided transportation – although it is undoubtedly a factor. Ecological conditions and hunting pattern described in the paragraph above also guaranteed that the catch per hunt would be small enough to transport back completely (which was what other groups did as well when they had the ability to do so, as can be seen with the Okiek, and with smaller sized prey of the Hadza). And importantly, as a circumpolar group, their beliefs in animal ceremonialism (see Chapter 1) dictated the respectful treatment of carcasses (unlike sub-Saharan groups), and unlike the Inuit who had cultural allowances for the expediencies of mass kills[10], complete transport was a necessary part of Evenki ceremonialism.

Thus, the study group's hunting and transportation pattern did not meet the 'typical hunter-gatherer' test expectation, especially in transport strategies. The data on hunting in this study nevertheless are a good ethnographic sample on boreal forest hunters (with hunting dogs and projectile weapons). The study group's transport decisions, although influenced by many factors, were heavily affected by their adherence to circumpolar religious beliefs. This study is thus an example of an (ethno)archaeological collection that reflects the intent of their actor(s), rather than pure functionality (Hodder 1987).

The complete transport of both *kabarga* and reindeer and the consistent hunt procedure within each species become highly useful as a backdrop for subsequent chapters, providing an almost controlled set of initial conditions for the study of butchery and surface modification. The next chapter describes the process of complete exploitation of a carcass following whole carcass transport, which, one could argue, is what the typical hunter-gatherer strives for but hardly ever gets to do as various considerations get in the way.

[10] Inuit groups also practiced animal ceremonialism, but their customs did not require the complete skeleton to be kept or assembled to show respect to the dead animal For example, seal bladders are returned to the sea'.

Chapter 6: Butchery and use

As described in previous chapters, the key characteristic of the study group's large mammal acquisition strategy was their redundancy in carcass treatment. *Kabarga* and reindeer are distinct in size and were hunted in a different manner – *kabarga* in casual, close distance and usually successful hunts, and reindeer in long and intensive hunting trips that were less often successful. However, when it came to carcass treatment, the study group never left any meaty part behind at the kill site, for both of these prey species. All body parts (except for rare cases when there was *in situ* consumption) were transported back to the logistical camp and from there to the residential camp. The only discarded items seen, if any, were innards and/or fur. In other words, there were no differential transport decisions made in terms of archaeologically visible parts – everything was carried back, all the way. As such, the group did not really meet expectations of Binford's utility model (Binford 1978) nor the Hadza transport model (O'Connell, et al. 1988a, 1990)

With these characteristics in mind, this chapter discusses the butchery process, and the subsequent use of the butchered parts. These topics will first be described in length for each prey species then discussed in a comparative manner between the two prey species. Of the test expectations iterated in Chapter 1, this chapter specifically tests the 'uniformitarian assumption'. If anatomy is the main determinant of butchery procedures, the butchery procedures should be similar between *kabarga* and reindeer, as they are both ungulates and have similar anatomy, and there should also be minimal variation in butchery procedure between individuals.

6.1. *Kabarga*

6.1.1 Butchery pattern

Kabarga butchery happened in three stages, which I will call *kill butchery*, *parts butchery*, and *cooking butchery*. *Kill butchery* is defined as the immediate processing of the carcass at the kill site, which in the case of *kabarga* sometimes never happened (if the animal was transported back whole), and at most included the step of evisceration. The usual procedure was to cut through the fur and abdominal meat and to remove the stomach and intestines by hand – the animal was never skinned first (Figure 6.1). No skeletal elements were ever left behind at the kill site as a result of *kabarga* kill butchery.

The decision to eviscerate the animal (or not) seemed in some cases to be based on the transportation method, but not entirely. For example, Yakov carried one animal back whole on sled, while in other cases he always eviscerated first. This was an example of transportation-based variation in butchery that reduced weight before the more labor-intensive method of transport. However, there were opposing evidence as well; Vadim eviscerated an animal when he was traveling by boat, even when he carried many other animals back whole on foot. The decision to eviscerate also occasionally came from a desire to reward dogs on the spot and to reinforce their good hunting behavior, but again this did not consistently happen. The decision did not depend on the size of the animal; some of the larger *kabarga* were carried back whole. Distance also was not a major factor; many animals were killed in the same location (see Figure 5.13) but of these only some were eviscerated.

Rarely for *kabarga* did kill butchery involve more than evisceration. In two cases the animal was skinned, eviscerated, and disarticulated into parts and carried in backpacks. In the first case (Fall K03, hunt not observed), there were two hunters at the scene (Vasili and Vadim) – itself an anomalous event – and they apparently decided to split the load so they could finish their planned activities (checking traps) in the area after the hunt. The second case was on the one and only purposeful logistical trip for *kabarga*, the Nichatka trip (Spring K18). Vasili killed one animal early in the morning, and expecting the dogs to corner another *kabarga* before reaching camp, cut the animal into parts and put them in his backpack. In both these cases, the fur was discarded at the site.

Fur was discarded in two more cases. In the observed case (Spring K14), Vasili plucked the already shedding fur from the carcass to make it easier to tie to a backpack, as the kill site was in a particularly inaccessible location and he could not drag the animal out. In another case (Spring K13), Yakov apparently killed, skinned, and eviscerated the animal, and took only the musk gland back to camp. Yakov had been going on hunting day trips for four days in a row (a rare occurrence for Yakov), and had killed this animal while on a hunt on foot. Apparently too tired to bring it back, he later took his sled back to the site and retrieved the carcass that was hidden in a tree. This was the only case where a form of differential transport was practiced, but in the end all parts were retrieved (a strategy similar to that for reindeer, see Section 6.2). It should be noted that *kabarga* fur might have been used more extensively in times past when the group wore skin clothing, and discarded less often. The fur had no apparent use now, except occasionally as a cushion.

While all *kabarga* meat was invariably transported back to camp, there was variation in the next process – the *parts butchery*. Parts butchery was a process of disarticulation of the carcass into major anatomical parts – parts as defined by this study group. These parts were not always equivalent to a skeletal element, and were in most cases a grouping of elements. Each part had a name (Russian or Evenki) and carcasses were consistently disarticulated into these same parts.

The parts as defined by this study group, unlike meat in the American supermarket, always included a bone. They in fact preferred to cook and eat meat still attached to the bone (and cooked by boiling), rather than eat meat alone. Filleting – removing meat completely from a bone – was never observed during the parts butchery process. In this way this study group significantly differs from all other ethnoarchaeological case studies; filleting for dried meat making and use was always a step in the butchery process for the Nunamiut, Hadza, !Kung, Kua, Dassanetch, and Okiek, although these groups also regularly cooked by boiling (Bartram 1993a; Binford 1978; Marshall 1991, 1994; O'Connell, et al. 1988a; Yellen 1977). A strong preference for boiling was also documented ethnographically among North American Subarctic groups, but even these groups practiced some amount of dried (and powdered) meat storage (Osgood 1936; Tanner 1978).

Vasili once mentioned that the group smoked meat in the recent past, but did not currently do it as it took too much time and effort. While I have not explicitly asked them, I feel I could safely assume that, if faced with a glut of meat in the warmer season, they would still prefer to eat the meat around bone as soup and would only process the larger chunks of meat, perhaps from the femur of reindeer and other large animals as smoked meat.[1] The study group's form of filleting (i.e. removing excess meat from a meat-and-bone package) would not leave a distinct filleting signature on the bone as a layer of meat was always left around the bone and the bone-and-meat part cooked in soup as usual. Zooarchaeologically speaking, such bones would be indistinguishable from bones processed exclusively for boiling (further discussion in Chapter 6). Unlike the American way of cutting and identifying meat, which names the different parts of meat (e.g. shank, sirloin), the study group identified meat parts only when associated with the bone, and if meat was separated from the bone, it was stored, used, and consumed without differentiation

In any case, the parts butchery of *kabarga* was a series of disarticulation events, preceded by skinning and evisceration if these steps had not already

[1] In fact, once during the Norwegian-Russian summer expedition a moose hunt took place, and at least on the days that we were able to observe, the parts were put in cold storage and consumed as boiled meat and soup. Vasili referred to this moose hunt during our field season, noting that when he offered to share a part of the moose, we (the expedition members) asked for the femur which had the largest amount of meat. Vasili recalled that he (and the study group) considered this a poor choice as the part was the least tastiest, but did not say anything at that time. During his recollection he also noted that all Russians (by which he meant all non-Evenki) seemed to have this strange preference for meaty parts.

happened during kill butchery. The butcher was usually someone other than the hunter; someone usually silently volunteered and went outside to work on the carcass while the hunter rested after his/her return. In other cases, the hunter did the butchery him/herself. These decisions seemed arbitrary and situational. The parts butchery of *kabarga* was almost always done with the animal hung up at its hindlimbs (using the triangular gap between the tibia, tip of calcaneus, and the tendon of the gastrocnemius muscle). Only once was *kabarga* butchered while laid out on a floor (see next section), and only twice with the carcass hung on one hindlimb. In all but one case, the butcher worked alone.

Parts butchery happened in two major forms: *normal butchery* and butchery for consumption by dogs (referred to in this study as *dog butchery*). In the former, the carcass was disarticulated into parts by knife with care, and in the latter, the carcass was left whole or nearly whole after skinning and evisceration, and the body part was later chopped up into parts by axe without regard to anatomical part or position, whenever meat was needed to feed the dogs. One *kabarga* typically became three days' worth of dog food for the whole pack. The decision between normal or dog butchery was dependent on the availability of fresh meat, and the freshness of the carcass. If there was a glut of fresh meat, or if the carcass had lain in a trap for a long time, dog butchery was performed. The former happened when a *kabarga* was killed just because the dogs had already cornered the animal, and during the Spring field season when *kabarga* was hunted for their musk glands.

The parts created in parts butchery (hereafter referred to as parts, parts units, or units) were cut into smaller units prior to cooking, during the *cooking butchery*. Cooking butchery is defined basically as a process of disarticulating each or nearly each skeletal element from the neighboring unit, and the removal of excess meat if any (excess, as in too much meat for that particular meal, as determined by Yulia).

All members of the study group took part in butchery. Yakov was the main butcher, volunteering to be the butcher for many *kabarga* parts butchery events, as well as many of the cooking butchery events. It was his way of contributing to the group, as he hunted relatively infrequently due to his age and infirmity. Yakov was acknowledged by all as being the most knowledgeable and skilled in butchery, enjoyed butchery tasks, and clearly took pride in his skill.[2] Vasili also butchered frequently, especially the cooking butchery, giving his wife Yulia a hand. Yulia also did much of the cooking butchery herself. Sasha did parts butchery for animals that he killed, and occasionally butchered on other instances. Vadim was capable but rarely volunteered.

In the following section, I focus on the main butchery event, the *parts butchery*. I first discuss general butchery patterns and then individual variations in sequence, parts created, and time. I also consider the factors that affect the pattern of butchery in parts butchery. Cooking butchery (and processing time) will be discussed in a separate section, except when the first cooking butchery event happened immediately after the parts butchery event and was processed

[2] This became more evident after he noticed my interest in butchery and bones.

by the same butcher. In that case, I have included the sequence and times of cooking butchery in the descriptions of parts butchery, although clearly marked as such (see Tables 6.2 and 6.3). Analyses of parts butchery do not include data from these conjoined cooking butchery sequences.

6.1.2 Parts butchery

All observed parts butchery sequences are shown in Table 6.2, as well as Vasili's butchery of Spring K18 (kill butchery for backpack-carrying, which followed the same steps as parts butchery). All study group members followed the same general sequence for parts butchery of *kabarga*.

The general sequence was as follows: First the animal was laid on its back on the floor, and the fur was slit in a starburst pattern (Figure 6.4), with the central line of the body cut on the ventral, and the posterior-medial sides of the limbs cut to join the central cut at the chest and anus. Then the fur on the hindlimb was peeled off (sometimes partly, sometimes completely) to expose the tendon of the gastrocnemius, on which a rope was looped through, tying the legs together. This loop of rope (or sometimes directly the tendon, in the absence of rope) was hung on a pole or branch, suspending the animal head-down with the abdomen around eye-height (Figure 6.5). The fur was then peeled off, first at the hindlimb and then working downwards (i.e. towards the head on the upside-down carcass), using the butcher's body weight to pull the fur off the body and limbs. Rarely was a knife used during the skinning of the body, except to separate the fur from the hooves and to aid the separation of meat and fur around the hole in the abdomen, if the animal was eviscerated prior to skinning.

The fur was peeled as one piece down the front limbs, neck, and also the head. The fur was forced, with no use of knife, past the ears, which stayed attached to the cranium with cartilage, and popped off the fur. Still using body weight, the butcher forced the fur down as far as the eyes, at which point a knife was used to separate the fur from bone around the eye, and then on the superior cranial surface to the nose, working towards the nose and lips (Figure 6.6). Usually the fur was ripped off or roughly cut off without much care for the fur itself. There was somewhat more care taken about getting every scrap of fur off the head, so smaller bits of fur were peeled and cut off from the cranium and mandible after the fur was ripped off. Fur was hung up on nearby poles, away from dogs, but most were not used during observation and eventually ended up in the garbage-storage-box with bone fragments – only in one case was a fur used as a seating-mat for a sled.

While *kabarga* meat was treated casually (or one could almost say callously, in dog butchery), a gesture of care was made at this stage of butchery. The eyes of the *kabarga* were stabbed from the posterior, one quick stab at each eye, so that "the animal could not see" (Yulia) (Figure 6.7). This gesture was observed in *kabarga* butchery events by Yakov, Vasili, Vadim, and Yulia, but not by Sasha, who was not a member of the core family group.

After the animal was skinned, it was eviscerated if it hadn't been already. The abdominal cavity was carefully cut open with a knife, and intestines and stomach pulled out by hand. If the animal was eviscerated during parts butchery, a cranial-caudal cut along one side of the sternum, cutting through rib cartilage, was made to facilitate the removal of these organs (Figure 6.8a). The colon was followed up and pinched shut with fingers and pulled off. Sometimes the knife was inserted into the body cavity during this process, but there was no indication of force being applied, and the knife was probably just used to cut off membranous attachments to the ribcage. The kidneys, liver, heart and lungs were left inside the body cavity, and everything else came out. These innards were either immediately split among the dogs, or saved in a bucket to be cooked (boiled) as dog food at a later time.

Regardless of when evisceration took place (during the kill butchery or parts butchery), some blood and fluids were inevitably left in the cavity. These were drained by poking a hole by knife in the meaty area at the base of the throat, i.e. at the downward facing end of the ribcage. A bucket used to feed dogs was positioned under the carcass to catch the fluids. If there was little fluid in the body, the butcher usually removed the sternum first. While s/he waited for the fluid to drain, the butcher usually proceeded to cut the metacarpals and hooves off (as one unit) roughly around the carpal joint, and/or cutting the forelimbs off (either all forelimb elements from scapula downwards; or if the metacarpals were cut off, the scapula, humerus, and radioulna together). The metacarpals were often given to the dogs (Figure 6.8b). If the dog to be rewarded (usually the butcher's dog or the dog who was in charge of the hunt) was not present, the metacarpals were not cut off during parts butchery (i.e. left together with forelimb).

After the body cavity had drained, the sternum was taken off as a unit, and a side of rib each as one unit. The thin abdominal meat that covered the ventral side of the animal was cut off to hang as sheets from the sternum, and became associated with the sternum part unit. The most cranially positioned (short) ribs were always left attached to the thoracic vertebrae, to form a thoracic-rib unit referred to as the '*dramah*'[3]. In some cases, the last few ribs were also left with the vertebrae, creating a second, lower *dramah* unit. The sternum and ribs were usually disarticulated by a single forceful movement of the knife, again using

[3] Evenki word; this word also denoted thoracic vertebrae in general. I have written this word with an 'h' as there was an expiration at the end, and because it was easier to read.

body weight, to push the knife from the caudal direction to the cranial (Figure 6.8c). In other words, there was no careful disarticulation of rib-vertebra joints.

The head was taken off usually after the sternum unit was completely off, and before the ribs. The head was always taken off together with the heart and lungs, which were attached to the head via the windpipe (and thus the sternum had to be out of the way first). First the esophagus was removed after slitting the ventral side of the neck to expose the windpipe. The head was then detached from the neck by cutting the meat all around the base of the skull with a knife, and then twisting or snapping the head off. In most cases the head was removed from the atlas, but in some cases an extra vertebra or two became associated with the head unit (Figure 6.8d). In dog butchery events, the skinning, evisceration, and draining was usually followed by the removal of the head, and then the butchery was over. The heart and lungs were saved for human consumption, together with the head.

The liver and kidneys were also consistently saved for human consumption. The liver was usually cut off when the heart and lungs were cut free to hang from the head. The kidneys were cut out (by slitting the fat casing along the long axis of the organ) anytime between innards removal to hip unit removal, and was usually immediately eaten by the butcher (and also by myself, as I was the person standing close by, filming). The kidneys were always slit in half along the long axis prior to consumption, with the two halves attached to each other butterfly fashion.

After the sternum, head, and ribs, the rest of the body was basically processed from bottom up as it hung upside-down – cervical, *dramah*, and thoracic, followed by hips and hindlimb. The vertebrae parts created in this butchery event (parts butchery) were: neck unit (cervical vertebrae, with axis and/or atlas), *dramah* (upper thoracic and upper ribs), and thoracic (those disassociated from ribs earlier). Some lumbar vertebrae usually remained attached to the hips (Figure 6.8e). There were some individual and circumstantial variations here, with some butchers preferring to cut the vertebrae into smaller cooking units at this stage, if meal preparation was expected or imminent. In other cases, some carcasses were left in larger pieces (e.g. the *dramah* and thoracic together) because the carcass was small or because the butcher knew he had to do the cooking butchery immediately afterwards and left the units larger so he could butcher them indoors while sitting down.

Hindlimb and hip were the last parts hanging. One hindlimb was released from the rope by cutting the tendon. The hindlimb (from femur downwards) was removed from the hanging hip-hindlimb by slicing through the meat with the knife, and forcing the acetabular joint apart by applying force to the leg and forcing it outwards. Usually the femur head came out of the acetabulum with little or no use of the knife (Figure 6.8f). The process was repeated in removing the hip unit (lumbar, sacrum, and two pelves) from the remaining hindlimb, with force being applied to the unit to be removed (the hip). Finally the other hindlimb was taken down, and parts butchery was over.

The parts created (forelimb, sternum, head unit, rib, neck, *dramah*, thoracic, hip, and hindlimb) were not processed further until they had to be for cooking. In the Fall field season when meat was scarce, this need often came immediately after the parts butchery, and disarticulation into smaller units (i.e. cooking butchery) happened after a brief rest. Otherwise, the parts were stored in the indoor storage area within the couple's house, on the roof (in the case of dog butchery), or on the meat platform. In all of these locations, the parts froze and were well preserved until use.

Table 6.2 lists the observed parts butchery events for Yulia, Vadim, Vasili and Yakov, together with the time it took to disarticulate each parts unit. Disarticulation time was measured from the video record, and is the time from grabbing the unit to its complete disarticulation. False starts (i.e. grabbing the unit as if to butcher the unit, then releasing; or cutting the meat a little bit, then releasing) and other events (e.g. fetching buckets and basins, dropping the knife, cleaning shedded fur from the meat by rubbing with the back of the knife, and feeding bits to dogs) are excluded from disarticulation time, but included, in addition to the disarticulation time, in the total elapsed time of the butchery event. It should be noted that while the dismemberment itself was done with high concentration and the least amount of wasted movement, all butchers were casual about preparing for future events, such as the need for a bucket or basin, and spent some time walking around in the midst of a butchery procedure looking for these items. Table 6.3 summarizes the time record of parts butchery events listed in Table 6.2.

As might be expected, the two types of parts butchery (dog butchery and normal butchery for people) were considerably different in terms of time (Table 6.3). Normal butchery took around 21-23 minutes including fur removal, and dog butchery took about 17 minutes including fur removal (20-30% increase in time). The dog butchery pattern simply truncated the butchery to minimum processing that would allow full use of meat at a later time (i.e. removal of fur while fresh, and removing innards to prevent spoilage). The normal- to dog-butchery variation could have been directly or indirectly caused by the *kabarga*'s status as an easily caught and casually used low priority prey type compared to reindeer.

Among normal butchery events, there was one case (Fall K07) where the animal was butchered on the floor by two butchers (Vasili and Vadim). This butchery actually took longer than the usual hanging-style butchery, even with the two butchers, possibly because they got in each other's way, or because the position on the floor did not allow them to use leverage in disarticulation. One of Yakov's butchery events (Fall K11) was a truncated event, with the hindlimbs and hip being removed as one unit after the first hindlimb got stuck in the rope, and Yakov got fed up during its removal. This truncated butchery was also the second longest parts butchery event.

As a qualitative assessment, study group members did show individual variation in their technique, sequence, and speed of parts butchery. First of all, there was a difference between Sasha and the core family unit in the style of hanging, which was a difference in technique that resulted in a difference of sequence. Sasha used only one limb to hang, even when he had access to rope. The one-foot hang was used only in field situations by the members of the core family unit, when they had no rope and had to hang the carcass upside-down by putting a short, cut length of the root of the branch of convenient height through one tendon. This difference in hanging style necessitated the early removal of the free-hanging hindlimb, which made the carcass swing and was generally in the way. In addition to this difference, Sasha also skipped the eye-poking step. Sasha only did dog butchery under observation, and it is possible that there would be other differences in technique observed in his normal butchery of *kabarga*. There were also differences between Sasha and the rest of the group in reindeer disarticulation (described in section 6.2).

The variation between Sasha and the core family unit members could imply that the butchery style reported in this study was one handed down in the family and unique to this small group alone. It was also possible that Sasha knew relatively little about traditional butchery procedures, as there was some indication that he wished to learn (especially from Yakov) the 'correct' procedure.

While the process of butchery differed somewhat between Sasha and the family unit, the end result of the butchery – the parts created – was basically common to all. This facet of butchery might have been more fully examined had Sasha, the non-family member, taken part in more butchery activities, but unfortunately this did not happen. The role of learned and culturally transmitted ideas or mental templates as determinants of the actual butchery procedure thus cannot be investigated further in this study. From this field season, it can only be said that there is possibly a cultural norm for *kabarga* part butchery (i.e. single-person, hanging parts butchery, aimed for human consumption of parts), but deviation from the norm – in the form of multiple butchers, variation in parts created, and dog butchery – did occur.

There were individual differences, especially in the speed of butchery, within the core family unit. The one parts butchery recorded for Yulia was her first *kabarga* parts butchery ever. Yulia's butchery was therefore the slowest, as she had trouble remembering what part should come off next, and the least efficient. Yulia also had a smaller knife, less force, and had not yet figured out how to put her body weight behind her cutting action. Thus some of the actions, such as peeling the fur, took a lot longer.

Yakov was also relatively slow, compared to Vasili and Vadim, who were at the height of their physical strength. These three members understood the butchery process well, and basically followed identical procedures. Where Vasili and Vadim relied on pure strength, Yakov made up by using his extensive anatomical knowledge to full effect. For example, Yakov cut the meat off the surface of the neck, thinly, to hang at the head – this removed the stringiest parts of the meat and facilitated the disarticulation of the head unit and the neck unit. Yakov also began peeling the fur off the hindlimb at the tarsal joint instead of the hoof, so that he would not have to peel the entire hindlimb fur off before the animal was hung. By doing this, Yakov could use leverage to peel the fur off the hindlimb as well as the body. Some individual differences that could affect surface modification will be discussed further in section 6.1.3.

These individual differences, however, did not show up as significant quantitative differences. Quantitatively, normal parts butcheries for human consumption were highly uniform in terms of procedure (i.e. the sequence of events within the butchery, or '*chaine operatoire*': Table 6.9). A pairwise, non-parametric rank order correlation test was conducted on the order in which the parts were processed[4]. Two different rank orders were used to assess the correlation: one with sided elements entered separately (Table 6.9a, b, c) and one with sided elements combined (Table 6.9d, e, f), in case that two closely repeating sided elements could give a false positive for correlation.

There was significant linear correlation among all pairs for butcheries with a *single butcher*, and all butcheries in the *hanging by two feet upside-down* position (Table 6.9c, f). In other words, all 'normal' parts butchery events were statistically indistinguishable from each other, including Yulia's relatively inexperienced attempt. The 'unifomitarian assumption' that anatomy dictates butchery was thus supported for *kabarga* parts butchery. The hanging of the animal by one foot reduced the correlation, but the relationship was still significant. In both the two-person butchery and the one-foot-hang butchery, a hindlimb was removed early on in the sequence, which is the action that sets them apart from the norm.

The distribution of time along the sequence of parts butchery events (i.e. what parts took the longest to process, and what parts took the shortest) was similar between individuals, as previously shown in Table 6.3. This similarity is schematically shown in Figure 6.10. Vasili, Vadim, and Yakov show a nearly identical pattern across the butchery sequence. Yulia's relative inexperience and lack of strength is evident in the extra time it took her to disarticulate the rib, although it should be noted that there is only one sample of her butchery.

Processing time for parts butchery is *de facto* disarticulation time, and it was briefly examined to see if there was any relationship between sequence and processing time (in this case, the time taken to separate one part from the rest of the carcass), and sequence and economic utility (GUI or General Utility Index[5], a combined value of meat, marrow, and fat utility: Binford 1978) (Figure 6.11, 6.12, Table 6.13). There was no significant linear relationship between either pair (i.e. they did not cut off parts in the order of longest, or the shortest, time; nor did they

---

[4] Note on rank: if there were three parts with the rank of 1, the next ranked item received the rank of 4, and all parts not used received the lowest rank

[5] Utility indices provide a scale that is used to predict which anatomical parts would more likely be removed after a kill (Binford 1978:74; Metcalfe and Jones 1988:488). Various *modified* utility indices (e.g. MGUI, (S)FUI) have been created to take the "rider" effect into account, where low-utility parts "ride" with high-utility parts that are preferentially transported. An *unmodified* utility index, expressing the economic value of individual elements or portions of elements, is more appropriate for this study, as differential transportation did not occur and "rider" effects do not need to be considered. Among unmodified indices are the GUI (Binford 1978) and FUI, or Food Utility Index (Metcalfe and Jones 1988). While the FUI has been calculated for complete bones and more appropriate to this study in that respect, it is only based on meat utility values. I chose to use the GUI as it combined meat, marrow, and white grease utility values; the latter two are important when cooking by boiling, and cannot be separated from the meat utility value. Additionally, as the utility index is used in this study to rank economic value *within a single carcass*, the shortcomings of GUI pointed out by Metcalfe and Barlow (1988) did not come into play. When calculating the GUI for multiple element parts or a complete bone, a simple addition of GUI from Binford's table 2.6 (1978:73) was used (see Table 6.13).

cut off parts in order of high or low utility). It seems that the parts were simply being removed bottom-up, the sequence being determined by the 'head-down and both-limbs-tied' position the *kabarga* carcasses were hung in. Processing time would be discussed further in the following section.

Thus, as a whole, *kabarga* parts butchery among the study group was conducted in a specific and uniform manner. The 'uniformitarian assumption' – that if anatomy dictates butchery, there would be no difference between individual butchers – was not contradicted in terms of the sequence, speed, and technique of disarticulation, which did not statistically differ between individual butchers. Some individual variations could have been due to non-anatomical factors (such as different cultural traditions between Sasha and the core family unit) but overall, variations in methodology was explained by anatomy, i.e. it depended on the initial position of the carcass. The differing techniques of fur removal (especially how they skinned the hindlimbs) were the only aspect of parts butchery that could have left a zooarchaeological trace of individuality. However, *kabarga* skinning was accomplished with minimal knife use, and the subsequent surface modification intensive disarticulation of the lower limbs drowned out this individual signature (see Chapter 7).

Lastly, it should be noted that aside from these major variations, there was also some minor unintentional variations in the parts units created in the vertebrae (Figure 6.14). While the mental construct of each part unit was common among study group members, the actual points of disarticulation for vertebral parts (cervical, thoracic, and lumbar) varied in detail.

6.1.3 Cooking butchery and processing time

Cooking butchery – or the articulation of parts into further cooking units – occurred as the need arose. In some cases, especially in the meat-lean Fall field season, cooking butchery occurred immediately after parts butchery. At other times the parts were not used for several weeks after parts butchery. Data gathered about cooking butchery is presented here in the context of processing time by skeletal element.

The disarticulation time (a continuous sequence from grabbing a unit for removal to its complete disarticulation) of *kabarga* into different body parts and skeletal elements are listed in Table 6.15, and their variation in Figure 6.16. I briefly discuss the disarticulation procedure of each part, focusing on procedures

that would modify the surface of the bone (see Chapter 7) and individual variation if any. The order of parts follows the order in the tables and figures.
Soft parts (Table 6.15a, Figure 6.16a, g)

<u>Innards</u>

The removal of unwanted internal organs took on average two minutes, in both kill butchery and parts butchery. The intestines, stomach, and uterus were the major organs removed. These were all fed to dogs, but the uterus (with fetus) could only be fed to older female dogs. If there was no old dog present, the uterus was placed somewhere beyond the dogs' reach.

<u>Kidneys</u>

The removal of kidneys was a short and quick step, taking around ten seconds per kidney (or even less; some observations included eating). Using the knife, the bag of fur around the kidney was slit, and the kidney was popped out.

<u>Liver</u>

The liver was taken out at the same time as the heart and lungs, during the disarticulation of the head part. In Sasha's case, the liver remained attached to the heart and lungs until the head unit was off, and was subsequently removed from the head part. For other butchers, the liver was removed from the body cavity while membranous material was being cut from all three organs.

<u>Fur</u>

Fur processing occurred in two stages: 1) cutting slits in the fur while the animal was on the floor, and 2) peeling off the fur. The carcass was usually hung up in between the two stages. A large variation in total fur processing time can be seen in Figure 6.16a, from four to over fifteen minutes. The procedure took a lot of strength, with the fur being peeled off by leverage and force. For the younger male hunters (Vasili, Vadim and Sasha), the process normally took less than ten minutes, and for Yulia and Yakov, around fifteen minutes.

The slitting procedure (the first step) differed slightly among all observed events, although the positioning of the slits did not differ in the end – the central axis went from chin to anus, and the limbs were slit up on the medial-posterior side. Yakov always slit the central axis first (with the starting point of this slit varying between chin, chest, and anus), and Vasili slit from the center first 75% of the time. The others started with the limbs. Yakov slit the hindlimb fur from inner thigh (or anus) to hoof, while the others slit all limb fur from hoof down. This latter could possibly make a difference in the surface modification of distal metatarsals, as there was a greater probability to nick the bone at the start of the slitting process when the process is started at the hoof. Yakov (after slitting from the inner thigh) peeled off the fur only up to the tarsals before hanging the carcass up. Vasili, Vadim and Sasha peeled off the complete hindlimb fur, and Yulia, not remembering the procedure well, peeled both hind and forelimb furs before proceeding to the next stage.

The peeling off of the fur from the body and head (the second step) has been described in the previous section and will not be repeated here. In general, knife use was limited at the head (snout) and hooves. Sasha differed slightly from the rest of the group, in that he removed the ears with the fur, using the knife to cut them off the skull while they were still attached to the fur. For everyone else, the ears remained attached to the exposed crania, from which they were subsequently cut off and fed to waiting dogs. Vadim ceremonially stabbed the back of the eyes as he exposed them when removing fur, as did Vasili, who forgot to do this in 40% of the parts butchery observed. Yakov and Yulia first removed the fur completely, and then stabbed behind the eyes.

Ribs and sternum (Table 6.15b, Figure 6.16b)

<u>Ribs</u>

Individual ribs were included in rib parts (left or right), upper *dramah*, or lower *dramah*. In part butchery, the disarticulation of the rib part (either left or right) started with cutting the meat between the ribs at both cranial and caudal ends (or near the ends) of the ribcage and taking about 8-10 ribs connected in between as a whole. By the time the rib parts were to be removed, the distal ends of the ribs had already been disarticulated from the sternum and were hanging free. After cutting the meat between ribs at both ends, the rib-thoracic joint was disarticulated by forcefully cutting through with the knife while forcing and holding open the rib cage with the other hand. This cut often resulted in slicing off entire rib heads or rib head facets. For cooking butchery, the rib parts were cut into smaller units, often groups of 2 to 4 ribs.

Lower *dramah* parts were created in roughly a quarter of the *kabarga* sample. The reason why in some cases the lower ribs were left on the thoracic (i.e. the creation of the lower *dramah* unit), and in some cases were not, is unclear.

<u>Sternum</u>

The processing time for the sternum is an estimate at best, as one side of rib- sternum articulation was cut off early in the parts butchery during the process of evisceration, head removal, or draining, and the other side was cut off much later. Table 6.15b gives the summed time of sternum related butchery events for each animal, including slicing off the abdominal meat, disarticulation of the sternum from the ribs (for both sides, in both events described above), and the cutting of the meat at the base of the throat which was usually the last part attaching the sternum to the carcass.

The disarticulation of the sternum-rib joint was done by a forceful cut with the knife, aimed roughly at the joint but often leaving pieces of rib cartilage attached to the sternum. In most cases the knife was forced downwards on an upside-down carcass from the caudal end of the ribcage, but in some cases, the knife was inserted between ribs around the midpoint of the length of the ribcage, and the cut made with an upwards pulling movement (cutting through the caudal) and then a downwards pushing movement (cutting through to cranial).

Forelimb (Table 6.15c, Figure 6.16c)

The forelimb part (whole forelimb to scapula and minus the metacarpal and hooves) was taken off during parts butchery, and then disarticulated into each skeletal element for use during cooking butchery. Some forelimb parts that were left attached to the body in dog butchery were also subsequently disarticulated and used.

The disarticulation of the scapula from the body was a quick and easy procedure, done with a single or at most a few strokes of the knife, slashing through the meat while holding the limb away from the body. The procedure took less than five seconds in most cases.

The disarticulation of the scapula-humerus joint took a little longer, but usually under twenty seconds. The meat was cut through, from either the posterior or anterior side, until the meat could be forced apart so that the humeral head was visible. The cut was then continued on the other side under visual supervision, with minimal contact with bone.

The disarticulation of the humerus-radioulna joint took 44 seconds on average. The meat was cut all around the joint, with the joint being bent and unbent to pinpoint the location of articulation. After the meat was cut sufficiently to free the joint, the joint was snapped backwards. Then the disarticulation was completed by a cut between the articular surfaces with a knife. In one case, Yulia separated the unfused distal epiphyseal end from the shaft, but in all other cases the disarticulation went smoothly and accurately at the articular surface.

The scapula and humerus were usually cooked in a soup or in a half-boiled half-fried dish, with both bones being thrown in whole for both kinds of cuisine. The humerus was cracked for marrow by whoever ate that element, usually with a blow to the midshaft with the back of the knife after the meat was consumed. The forelimb (scapula and humerus) was also the preferred part for a light roasted snack, and a forelimb was taken on some of the longer day trips to be consumed en route.

The radioulna and the metacarpals, if they were not given to dogs, were cracked for marrow. Marrow from these lower limb bones were always eaten raw, and thus these parts were never cooked. To prepare the element for marrow-cracking, soft parts such as the periosteum, tendons, and cartilage were removed as much as possible. The tendons were often removed at disarticulation and eaten immediately while disarticulation was going on, and contributed to slowing down the disarticulation process. Thus some of the variation in humerus-radioulna disarticulation time was caused by whether the butcher was disarticulating to prepare the humerus for cooking, or to eat the marrow of the radioulna – the latter was accompanied by tendon-snacking.

The variation in disarticulation time for the radioulna-metacarpal joint stems from the same reason as above: either the butcher was disarticulating for marrow and eating tendons while at it (in which case it took over ten seconds), or s/he was disarticulating this joint to feed the metacarpal-hoof to the dogs, in which case it was a quick event (as short as two seconds). Unlike in reindeer, this joint in the *kabarga* was cut without careful anatomical consideration. The joint was generally cut all around with a knife using a rough sawing movement (parallel to the joint surfaces of distal radioulna, carpals, or proximal metacarpal), and then snapped apart by force at whatever joint surface that happened to snap first.

Vertebrae (Table 6.15d, Figure 6.16d)

Cervical (atlas, axis, cervical)

The neck (cervical vertebrae) was cut off as one unit in parts butchery. In most cases the atlas and axis were attached to the neck unit. Occasionally there was a thoracic vertebrae attached to the neck unit as well.

The neck unit was usually cooked (boiled) as one unit and eaten by one person, and at most cut in half at cooking butchery. There was some variation in cervical vertebrae disarticulation time, but the process was uniform – the meat was cut all around a joint, and then the unit was snapped by force, after which the joint was cut through with a knife, which completed the separation. The average time taken to separate a cervical joint – including disarticulation from the *dramah* unit during parts butchery and the cervical-cervical joint disarticulation in cooking butchery – was 20 seconds. Vasili and Vadim disarticulated faster, having more power in the snap, and Yakov disarticulated faster when the stringy neck meat was cut off prior to disarticulation during the parts butchery. Yulia had a lot of trouble with cervical joint separation, and sawed a lot with her knife both at and around the joint.

Disarticulation at the time of eating was not filmed nor timed. Cervical vertebrae were separated from each other in order to eat the meat off more cleanly, and to gain access to the spinal cord which was also consumed.

Thoracic

The disarticulation of thoracic vertebrae occurred during parts butchery when disarticulating the *dramah* or thoracic part. The thoracic unit consisted of all thorasic vertebrae with the ribs already removed, and usually formed a single part unit, but was sometimes split into two units. Cooking butchery split the thoracic into two or three parts if it had not been already, and further disarticulation occurred while eating. The standard disarticulation procedure for thoracic vertebrae was to insert the knife point between the two adjoining vertebral bodies from the ventral side, and at the same time snap one of the vertebrae towards the dorsal using force. The cut was finished by continuing the cut from the ventral towards the dorsal and through the meat between spinous processes.

Thoracic vertebrae nearer to the lumbar area were harder to cut, as more meat surrounded each element. One *kabarga* was particularly fat (Fall K11) and its lower thoracic took a longer time to disarticulate. In most cases, disarticulation of the thoracic vertebrae took around the same time as cervical vertebrae. Yulia had trouble with thoracic joint separation, as was the case with the cervical.

<u>Lumbar</u>

The lumbar vertebrae were usually kept together with the hip unit (sacrum, left, and right innominate) until cooking butchery, although in some cases the lumbar alone formed a separate parts unit. At cooking butchery, each lumbar vertebra (or sometimes two vertebrae) was disarticulated to form cooking units. In some cases, a thoracic vertebra remained attached to the lumbar unit.

The disarticulation of the lumbar vertebrae began by cutting the meat all around, parallel to the joint surface and aiming at where the joint should be. The location of the joint was determined by palpation of the spinous and lateral processes after these shallow cuts were made in the meat, and also through educated guessing. After locating the joint, the meat was cut deeper from the ventral surface and the point of a knife was inserted between the two vertebral bodies.

When disarticulating individual lumbar vertebrae, Vasili snapped each one towards the dorsal with one hand while the knife was inserted, and twisted the knife between the two vertebral bodies. Yakov also opened up the joint this way, but used table-edges and knees to lever the joint open, in addition to using his hand. The lumbar vertebrae took the longest time among the vertebrae to separate, taking, on average, around or over a minute. There was substantial variation between experienced butchers, with Vasili being considerably faster than the others.

Head unit (Table 6.15e, Figure 6.16e)

<u>Head unit (cranium, mandibles, heart, lung, and windpipe)</u>

The head unit was taken off in all normal parts butchery events and in some dog butchery events as well. The head was treated with special care, as seen in the eye-stabbing at parts butchery. The head unit was almost always eaten by the oldest member, Yakov (although it is possible that this was simply his favorite food, and perhaps too much significance has been read into this fact). The head units were consumed by humans whenever possible, even if the rest of the carcass was to be dog food.

After eating the head unit, the cranium was often left by the window-sill by the table (in the main cabin in the Main Camp) before being taken away. The window-sill was the part of the cabin furthest from and opposite to the doorway, traditionally a place of honor and for guests (Service 1971; Vasilevich and Smolyak 1956). The atlas bone was left there as well, if Yakov ate the neck unit. It is interesting to note that the atlas bone has been described as "resembling the head" in its shape and features, although this description has only been given for reindeer atlases and not for *kabarga*.

Often the cranium and jaw were not disposed within the bucket of bones destined for bone box deposition, but on a roof or a platform structure. Again, the significance of this act should not be blown out of proportion, as a lot of other things – such as colorful duck-skins – were also collected on roofs in a seemingly whimsical manner. It should be noted, however, that these bones were definitely treated separately than the postcrania. The Evenki theoretically deposited all the bones of their prey onto bone disposal platforms, which was a form of burial and a way to show respect to the deceased prey (Vasilevich and Smolyak 1956). In the case of *kabarga*, a lot of the bones (especially axial elements and articular ends) were in fact given to dogs, but the head was the consistent exception[6].

As described previously, the head unit was taken off with the heart and lungs, connected to the head via windpipe. The technique for disarticulating the the head from the neck was by twisting (Vadim) and by snapping back the head (Yakov, Sasha and Vasili). Both actions were accompanied by some cutting with the knife. When snapping, the knife was often used as a point of leverage which was opposite to the use seen in the separation of vertebrae (where it was inserted into the opening side). In the case of Yakov's parts butchery, the stringy neck meat removed from the cervical vertebrae also hung from the head unit.

Cooking butchery for the head was simply the act of forcing the jaw open, so that the mandibles hung loosely, still attached to the head by muscle. The heart was sliced into two pieces so that they hung, still attached to the windpipe. These actions were sometimes accomplished during parts butchery, especially when soup was on the menu for the next meal. There was no knife use at mandibular joint separation; the meat around the mouth was slit open on both sides with the knife pointing lingually and occipitally, and then the jaw was forced open by hand. The jaw-opening allowed the thorough cleaning of the tongue and mouth and the heart-slitting allowed for the cleaning of clotted blood. Thus these actions were functional, but were also stylized in that they were how the end product 'was supposed to look'. The cranial vault was cracked open at meals, and the brain was eaten by whoever got the crania to eat – usually Yakov.

The processing times recorded for the disarticulation of the head and/or jaw are scattered across a wide range for each individual. This scatter simply reflects the difficulty in recording the disarticulation time, as actual disarticulation might or might not have been accompanied by the processing of various soft parts, such as (in the case of head unit disarticulation) slicing of the heart, the disposal of the esophagus after removal from the windpipe, the removal of bits of fur and lips left over from skinning, and (in the case of jaw disarticulation) the

[6] Having said that, there was one observed instance where a very old and desiccated *kabarga* head was thrown to a dog. However, the actor then reconsidered took the head back from the dog.

cleaning of the tongue and mouth cavity. The best estimate for average disarticulation time of the head unit would be around 40 seconds, which is where most data points cluster (Figure 6.16e), and the disarticulation of the jaw probably averaged around a minute.

Hindlimb (Table 6.15f, Figure 6.16f, g)

The hindlimb part (femur, tibia, metatarsals and hoof) was taken off as a single unit in parts butchery, and then disarticulated into meaty (femur) versus marrow-bearing (tibia-metatarsal) at the time of marrow consumption. Like the forelimb, the hindlimb was occasionally taken on day trips as a light snack to be roasted while away from camp. Limbs were occasionally taken off dog-butchered carcasses at a later date for this purpose. The femur was never cooked in soup without cutting off some of the meat first. The meat was used to cook quick boiled-and-fried dishes, as was the case with the humerus. The femur bone, left with a thin coating of meat, was used both in soup or included in the boiled-and-fried dish, as was the case with the humerus.

The lower limb bones (tibia and metatarsal) were first disarticulated into individual skeletal elements and subsequently cracked for marrow. The tibia, metatarsal, and radioulna were often consumed by the hunter or butcher following the hunt and parts butchery; marrow consumption seemed to be a prerogative for having worked on the animal. If these lower limb elements were left on the animal without being consumed (this was usually the case after dog butchery), they were taken by anyone who wanted them on a first-come first-served basis.

The disarticulation of the femur-pelvis joint was accomplished by a quick cut with the knife through the meat, starting from the inner thigh near the anus while the leg was held out laterally with one hand. As the meat separated, the femoral joint often simply popped out of the socket, after which the meat on the other side of the joint was cut through with the knife by continuing the original cutting motion. The first leg was usually cut from ventral to dorsal, with the blade facing upwards. The other leg was removed by holding the hip unit away from the remaining limb, and repeating the procedure. The average processing time of the hindlimb was between 30 and 40 seconds, with Vasili being considerably faster than the norm. The variation mostly came from the butchers' efficiency in taking the tendon off the rope, rather than any significant differences between actual disarticulation time. Only Yulia failed to locate the joint and make a clean cut.

The hindlimb was processed last, except when the carcass was hung on one leg. This was Sasha's style of butchery, and Vasili's (and or family unit's) style of butchery when there was a lack of rope or a good location for a two-foot hang. In the one-foot hang butchery, one femur was removed after both forelimbs were removed and before starting on the ribs (Table 6.9).

Lower limb marrow bones were disarticulated completely. Tarsals and hooves were removed from the long bones, as well as soft parts and periosteum. In the case of the radioulna/metacarpal, they were not too strict about removing the carpals from whatever long bone they were attached to (i.e. they could be left on), but the tarsals were in most cases separated from both long bones. The hooves were always removed from the metatarsal, except when dogs were given these bones. There was no functional reason for removing the tarsals or the hooves, as they were not in the way of marrow-cracking. This seemed to be the way things *had* to be done – possibly as an expression of circumpolar ritual respect – and everyone in the study group was careful about cleaning a long lower limb bone of extra parts before cracking for marrow.

The disarticulation of the femur from the tibia was relatively quick, and completed in about 30 seconds. The tendon attaching the gastrocnemius muscle (the large muscle bundle to the posterior of proximal tibia) to the tibia was cut through from the posterior so that the bulk of the meat was left attached to the meat around the femur. This cut exposed the femur-tibia joint from the posterior, and the joint was then cut all around with knife and separated. The tibia, metatarsal, and hoof were together always taken off first, i.e. femur-tibia disarticulation was never preceded by tibia-metatarsal disarticulation. The actual disarticulation of the tibia from the femur took a short time, but disarticulation was almost always accompanied by the cutting and eating of the tendons which added to the time. The lower range of Vasili's disarticulation time (under 20 seconds, Figure 6.16f) represents the butcheries with minimal tendon-cutting and -eating complications.

The tibia-metatarsal disarticulation was similar in technique to the femur-tibia disarticulation. The joint around the tarsals were cut all around with the knife, and snapped open. Tarsals were in most cases left attached to the tibia at this stage. This disarticulation was quick, an average of 11 seconds. The tarsals were then taken off the tibia (or if attached to the metatarsal, the metatarsal), and subsequently the phalanges were disarticulated off the metatarsal. The phalanges were left as an articulated unit, with hoof covers on. Some sample times for these actions can be seen in the 'marrow' section of Table 6.15f and Figure 6.16g. The disarticulation activities of these parts were heavily interspersed with eating and tendon removal, even more so than the femur-tibia joint, and thus processing time varies greatly. These joints were also harder to disarticulate, and even Yakov had a hard time in one case of hoof removal. The tibia and metatarsal were both marrow-eating bones and were never cooked.

Hip (Table 6.15g, Figure 6.16b)

The disarticulation of the hip as a parts unit has been discussed above in the section on lumbar vertebrae and hindlimb, and will not be repeated here. The sacrum, left, and right innominate was split apart in cooking butchery. This was the only part of normal *kabarga* butchery where the axe was used. Excessive use of axes in butchery was considered, by members of the study group, as a sign of ignorance (of traditions in general and butchery in particular) and a sign of sloppiness, especially if disarticulation with hand and knife was an option. The hip parts (in both *kabarga* and reindeer), the reindeer cervical and reindeer sternum were the exceptions to this rule, and were commonly disarticulated by axe.

In the cooking butchery of the hip part, first the colon and stray feces were carefully removed, and most caudal vertebrae were cut off together with the tuft of tail that remained on the carcass. The sacro-iliac joint was traced from the dorsal side with a knife, cutting the meat in an approximate outline of the sacrum. Then an axe (or sometimes a knife) was used to chop the sacrum off the innominate on both sides, with the chops landing on the cranial joint surface. A few chops dislodged the sacrum, which was then wedged out from between the two innominates by hand. Then the two sides of innominate were split, usually with a single blow of the axe at the joint from the medial surface. While the actual chopping took less than ten seconds each, the disarticulation sequence of the hip part into its separate units ranged from 40 seconds to close to three minutes, mostly depending on the amount of cleaning that had to be done first.

Discussion

The *kabarga* was butchered in three discrete butchery events: kill butchery (at kill site), parts butchery (in camp, usually outside), and cooking butchery (in camp, indoors). In some cases the first phase was skipped, and some elements of the second and third interchanged. Disarticulation and processing of *kabarga* was on the whole a very quick process, with most meaty elements being taken off the body (in parts butchery) and further cut into elements (in cooking butchery) in less than one minute (Figure 6.17a), although skinning was not. Parts butchery, the main butchery event, followed a specific pattern that was anatomically determined from the position the carcass was set up for the butchery, thus supporting the 'uniformitarian assumption'. The parts created were consistent and conformed to a cultural or group norm, and in general did not vary by event-specific factors. Some parts, such as lower limb bones, were butchered meticulously and leisurely, interspersed with eating and other activities.

Processing time is important in calculating post-procurement return rates of a carcass. While the study group transported the whole carcass and butchered back at their camp, selective transport in the face of competitors such as other groups or carnivores are an important point to consider in hunter-gatherer studies (Madrigal and Holt 2002). To address this (academic) problem, *kabarga* processing time was plotted against GUI to see if economic value of the part being removed had any visible effect on the effort spent – for example, if more time was spent processing parts of higher economic utility. Parts removal time (from parts butchery) and disarticulation time (from cooking butchery) was plotted against caribou GUI (Binford 1978, see Footnote 5 in this chapter for discussion of GUI). Disarticulation time was plotted against the sum of GUI of parts distal to that joint (e.g. for the humerus-radioulna joint, GUI would be the sum of the parts that came off from that disarticulation, or radioulna and metacarpal) (Figure 6.17b). The disarticulation time for sternum and individual hip bones were difficult to determine and are not included.

There was no significant correlation between processing time and GUI. However, there was a scattered but positive linear relationship if the data are separated into limb elements and axial elements (gray and black, respectively, in Figure 6.17b), indicating that more time was spent processing higher utility parts in each group. This positive relationship is clearer, especially among the axial elements, when parts removal and individual disarticulation time is summed into total processing time (Figure 6.17c), which represents the total time spent for processing of each part, although there still was no statistically significant correlation.

I believe that this weak positive relationship does not indicate a conscious decision to spend more time for high-utility parts. Processing time was primarily determined by mechanics of the joint, i.e. the complexity of the shape of the joint, and the strength of the joint that comes from joint shape as well as attached tendons and ligaments. Nor was it simply that the parts with more meat on them (i.e. the high-utlity parts) took more time to cut through, although this was a factor. For *kabarga* butchery, force was used to disarticulate the less meaty parts (e.g. cervical disarticulation or forelimb disarticulation), while the meatier high-utility parts had to be cut with a knife (e.g. lumbar disarticulation or hindlimb disarticulation), and this difference in approach, caused by the mechanics of the joint, automatically caused the positive correlation between processing time and utility within each group of elements (axial or non-axial). Processing time for *kabarga* and reindeer will be further discussed in section 6.2.8.

6.1.4 Use pattern

Kabarga parts were consumed raw, boiled or fried-boiled when there was access to a *pechka* and more than one pot (the first pot was for boiling water and tea), which was most of the time. *Kabarga* parts were roasted only when there was no access to a *pechka* or pot. There were specific uses (or cooking methods) that were thought appropriate for each part. The head unit, axial elements, ribs, sternum, and the hip unit were always boiled in a large pot of water for several hours, flavored with salt. A very small amount of grains or staples (buckwheat, rice, macaroni) was added near the end – usually a cup of grains to an 7.5L pot of soup. The meat was taken out and eaten as boiled meat, while the broth and grains were served as soup. This was the usual and preferred dish for their main meals, which were made twice or three times daily.

In this form of cooking, the elements were not processed beyond disarticulation at cooking butchery (except for the femur). No meat was cut off from the bone, and no vertebrae were pulverized prior to boiling, as was the case with African groups[7]. The Nunamiut also boiled some parts but these parts were, like the case of African groups, stripped of most meat prior to boiling (Binford 1978:149).

Boiling was documented as the main method of cooking for the Transbaikalian Evenki in the 1910's (Shirkogoroff 1929). Boiling was the major form of cooking for Subarctic groups such as the Kuchin (Osgood 1936), Micmac (Martin 1978), and the Misatassini Cree (Tanner 1979) as well. Osgood documents that "[m]eat, according to the natives, tastes best when boiled, although the notable advantage of this method of cooking is that there is always soup remaining which is greatly relished" (1936:30). The preference for this cooking method among the study group was thus probably not a recent development or a family quirk. Boiling is also more nutritionally effective compared to roasting, as fat inevitably drips off the meat in the latter case.

Forelimb elements (scapula and humerus) and femur were also made into soup, but the humerus and especially femur was also considered suitable for a fried-boiled dish, where the meat was cut off and chopped into small cubes. The chopped meat cubes and the meat-reduced limb bone was then thrown into a shallow pan while half frozen (as the meat was cut up while half frozen)[8], flavored with salt and perhaps bay leaves, and allowed to boil in its own juice. The bone was in some cases saved to go in a soup later. After the meat was cooked through, some macaroni or rice was thrown in to cook in the juice, or some flour was added to thicken the gravy (in the latter case creating a Yakutian dish called *hakkoi*). Finally, some oil was added at the end[9]. Fried-boiled dishes could also be served as the main meal, but these dishes were often deemed unsatisfactory and soup had to be cooked as an additional meal later in the day, on some days bringing the meal count per day to four or five. Meat removal from long bones for fried-boiled dishes was not thorough, as the bone (and the meat around it) was to be cooked as well, and the knife minimally touched the bone if at all.

Scapula, humerus, and femur were also roasted over an open fire, after being skewered on a stick (in the case of femur, some meat chunks were cut off and skewered separately). In this capacity, limb parts of old carcasses were often taken on trips and consumed, especially in the Spring field season when days were long and snacks desirable. Roasting was never observed when there was access to a *pechka*. Marrow of the tibia, metatarsal, and radioulna (and

---

[7] Vertebrae were pulverized before transportation among South African groups, to make them flexible and easier to carry (Bartram 1993; Yellen 1977). The vertebrae were also pulverized by the Hadza before boiling, to release grease and marrow into the soup (O'Connell et al. 1988a).

[8] Parts units were always thawed for a few hours before cooking, but the preferred thawed state was not a complete thaw, but a partial thaw, which made cutting easier. Cooking butchery and/or use of completely frozen carcasses were never observed among the study group, and in this way sharply differ from the Nunamiut case (Binford 1978).

[9] Commecial cooking oil, fat skimmed off soup dishes and saved in congealed form, specially rendered fat from fat sheets found around the intestine, or bone grease.

occasionally metacarpal) was eaten raw. The liver and kidneys were also eaten raw, although the liver was occasionally grilled on the *pechka*. These parts were never cooked together with meat.

Not only was there regularity in how the parts were cooked, there was a regular pattern in the order of the parts consumed. Vasili decided the menu for each meal (although Yulia also did have some say). Observing their decision-making process, a qualitative assessment was that they did not seem to be thinking 'what do I want to eat today?' but rather, 'what parts of which animal are available today? If there are x, y, and z, then the choice is obviously x'. Therefore, I would like to discuss the order of cooking and use. This order could be seen as a rank order of preference for parts, and possibly a proxy rank for economic utility as understood by the study group.

To obtain this rank order, the order in which the parts appeared in meals was tallied only for carcasses that had been observed in parts butchery and then subsequently used to its fullest extent – i.e. for all *kabarga* consumed from the beginning to end. Additionally, some dog-butchered animals were included for comparison. Among the dog-butchered specimens, there could be some error in the records of Spring K11 and K14, as these two animals and K13 were confused in the records. These animals are included in this rank order analysis as limbs of these animals were definitely consumed, but it should be noted that there is some confusion as to which limb from which animal.

The animal, part, type of dish (soup, fried, *hakkoi*, etc.) and additional ingredients were recorded for each meal eaten in the field season. If several parts of an animal were eaten in a meal, they got the same rank. Most *kabarga* were consumed in less than four meals, spread over three or four days, if they were consumed at the residential camp. If a part was eaten over several meals (e.g. femur meat and bone could be separated and one or other used in a separate meal, if there were enough pieces in the first meal), the rank of the first meal was used. The raw rank order for each *kabarga* tallied in this manner is shown in Table 6.18. To make comparison possible between *kabarga* butchered into different parts in the initial parts butchery, the ranking was then generalized (Table 6.19). As marrow consumption did not occur for all animals (and their rank was usually the same – the first), a second rank order was created in which marrow parts were excluded, to get a better picture of the ranking of meaty parts (Table 6.19).

The generalized rank order of each *kabarga* was tested against others in pairs, using a non-parametric rank order test. The same procedure was repeated after removing parts used for marrow, leaving only the meaty parts. The results are shown in Table 6.20a and b. Use order was much less uniform than parts butchery order. The variety comes from factors such as the time of day (specifically how close it was to mealtime) influencing what dish was cooked – soup takes a long time to boil, while fried-boiled dishes are faster – and thus the part used (limb elements were preferred for the latter method). For the limb parts, the picture was further complicated by the different uses possible (soup, fried-boiled, or taken on a day trip to be roasted). Another major factor was the number of people consuming the meal, which caused elements to be bunched together in a single meal/rank (e.g. Fall K09, where all axial elements, head, and hip were cooked together for one meal) or over several meals/ranks.

Nevertheless, two general groups with similar use patterns could be discerned (groups a and c, Table 6.20a), with one sample being associated to neither (b, Table 6.20a). These groups are associations of significantly correlated pairs of animals, e.g. if the use rank of animal x and animal y are significantly correlated, and for animal x and animal z are significantly correlated, animals x, y, and z were grouped together. If (in the above example) y and z were each associated with separate groups that did not correlate in any other way (i.e. the x, y, and z link was the only association), y and z were left with their associated groups and x was left without a group – i.e. mutual association was emphasized, instead of selecting for highest correlation coefficient.

A common pattern emerged from the four tested sets of rank order. The pattern is presented in four sets of rank orders: the generalized rank order – with and without sided elements separately ranked; and meaty part rank order (i.e. without bones only used for marrow consumption) – with and without sided elements separately ranked (see Table 6.20a and b). The combined results from the four show that the use pattern of *kabarga* splits into two groups: 'Head eaten, axial elements eaten before limbs', and 'Limbs and marrow eaten before axial elements'. One animal that was almost completely eaten save for the head unit separated out from both these categories. In the generalized rank order set without marrow bones included, a further distinction between 'forelimbs eaten before hindlimbs' and 'hindlimbs eaten before forelimbs' emerged.

Discussion

The order of parts use was not uniform among all *kabarga*. The main factor that distinguished the two groupings of use patterns were the use they were first put to – a main meal (soup) or a smaller meal (fried-boiled or roasting using limbs). This factor overrode other variables such as type of parts butchery (human butchery or dog butchery), metacarpals given to dogs or not, and marrow eaten or not. I will refer to these two groupings of use pattern as the *soup* use pattern and the *snack* use pattern.

While only weakly linked, statistically speaking, the carcasses used in the soup pattern (the largest category) were used in a consistent and particular order. Considering that soup was the preferred and main meal, and would have been made if there were no time constraints, the soup pattern can be considered the normal pattern of use for *kabarga*. The snack pattern showed more variation within its grouping, reflecting the different uses grouped within the snack category. Further analyses of these two groups are shown in Table 6.21a and b respectively.

In the soup use pattern, so many elements were combined in one soup meal that the %total GUI (proxy value for amount of useful parts, used instead of actual meat weight which valued with the weight of the carcass)[10] of axial meals were equal to or usually larger in the amount of food than limb meals. The sum weight of parts (where known) agrees with the pattern in %total GUI. At the same time, the average rank GUI shows that lower-utility-ranked items, specifically the head and axial elements, were consumed first (Table 6.21a).

Thus, in the most commonly seen pattern, axial elements were used earlier than limb elements, although there was variation. The variability of *kabarga* use order was partly due to the casualness of *kabarga* use – being easily hunted, this species could be used (apart from the head) as dog food, and caused periods where there were a glut of carcasses which disrupted the usual sequence of consumption. When there was a glut, the usually preferred parts were not used (as the carcass was not used for major meals) but parts suitable for snacking were used as occasion arose. The smaller size of the *kabarga* meant that their limb units were convenient in size for single-person snacks and for carrying on day trips.

If the order of use can be considered a rank order of preference of various parts, and thus possibly a proxy rank for subjective economic utility, then the Evenki's utility ranking does not match the economical utility rankings such as Binford's GUI. In fact, the order of preference (subjective economic utility) showed a negative linear relationship to GUI (anatomical economic utility) (Figure 6.22a – shown with higher rank on the left). The subjective economic utility is could be closely related to the *quality* of parts, not quantity, and this would be a topic for future research. Lastly, to re-investigate a question posed earlier about processing time – whether extra effort and time would be spent on higher-ranked parts (that is, higher-ranked by the Evenki) – the rank order was also plotted against total processing time (Figure 6.22b – shown with higher rank on the left). There is no clear relationship, indicating that the main and probably only factor affecting processing time is the mechanical/anatomical constraints of the shape and meatiness of the joint.

There are several interesting zooarchaeological points to be made about *kabarga* butchery and use. First, the study group's subjective utility ranking (i.e. rank order of use) might provide an alternative model for zooarchaeological comparison in carcass use among cultures with boiling technology. Secondly, the soup-snack dichotomy of this smaller animal indicates that different site types might be inferred from the type of bone discard of small sized prey, with transit camps (day-trip snacking sites) only having limb bone fragments, and major camps (logistical and residential camps) having a fuller complement of bones, including the axial, head, and hip bones. Of course, the problem remains in identifying these ephemeral sites, and the added complication of dog-feeding. *Kabarga* bones were more commonly given to dogs than reindeer bones (except for long bone midshafts that were preventively thrown into the fire) and a full

[10] While the actual weight would have been significant had many carcasses been obtained and used simultaneously (as in the case of a mass kill), the study group killed and used animals sequentially and thus this substitution is appropriate. Use of actual weight would have reduced the sample size, as not all animals and parts were weighed.

complement could be rare even in larger camps. A possibly useful sign of a non-transit camp could be the presence of cranial fragments, as they were always eaten as soup.

Thirdly, an interesting observation was that meat parts were transported between residential and logistical camps. In their carefully planned logistical trips, food (including meat parts) was carried in and all their large mammal prey was carried out. Disposed bones (if any) at a given site thus did not necessarily reflect the hunting results from that location. However, as most animals were consumed completely in a few days, the seasonality would at least be correctly reflected. Lastly, the presence of cracked lower limb bones could be the best indicator, in the case of this study group, of a recent hunt in a logistical camp and of a butchery taking place, as marrow consumption consistently ranked high (i.e. eaten early) and was usually the prerogative of the butcher or the hunter. The midshafts of *kabarga* marrow bones cracked at logistical camps were thrown into the fire and away from dogs, and would be possibly preserved archaeologically.

6.2 Reindeer

6.2.1 Butchery pattern

Reindeer butchery involved several more steps than *kabarga* butchery, with five discrete stages of butchery that I will call kill butchery, field butchery, parts butchery, *kamus* butchery, and cooking butchery. The first four stages together completed the disarticulation of parts, after which the parts were butchered further in cooking butchery like the *kabarga*. The data on cooking butchery will be presented in the next section in the context of processing time. While technically a part of cooking butchery, the head butchery deserves special mention and will be described in this section.

The reindeer sample size is small, with only one reindeer killed in the Fall field season and five in the Spring field season. None of the hunts were observed, and there are different sample sizes for the four main butchery stages (Table 6.23).

6.2.2 Kill butchery

Kill butchery is defined as the immediate processing of the carcass at the kill site. In the case of reindeer, the body of the animal was skinned, leaving the head and lower limbs covered in fur, after which the animal was eviscerated (Figure 6.24). In the case of Spring R03, Sasha also disarticulated the head from the body at kill butchery, instead of in the subsequent field butchery. Most if not all of the eviscerated intestines and stomach were saved, separately, under snow. The carcass was left lying on its side, with other edible organs left inside the body cavity. In four out of six cases, the carcass was left overnight at this stage, covered in fur and hidden by snow or brush. Covered in fur, the carcass did not freeze. In two cases (Spring R04 and R05), the carcasses seem to have been processed further after a shorter waiting period.

While a 'genuine' kill butchery was not observed (as none of the accompanied hunts resulted in success), Spring R01 was specially brought back whole to the logistical camp by Vasili, who knew that I would be interested in observing this process. It must be stressed that reindeer were never (according to the study group members) brought back whole this way. A detailed description of this kill butchery is given in Table 6.25. This kill butchery was a combination of kill butchery and field butchery (described below) – this kill butchery has some extra steps that in other reindeer were covered in the field butchery, as the carcass was already brought to the logistical camp where field butchery would be conducted.

The kill butchery procedure was as follows. The animal was flipped on its back, and the skin slit prior to peeling. The skinning process differed from that of the *kabarga* in its cut, with the head and lower limb fur being separated from the body fur (Figure 6.26). The body fur was peeled by using a knife around the neck and limbs, and by fisting on the body. For evisceration, a cut was made slightly off-center in the abdominal meat, as the animal was lying on its side. After the removal of the stomach and intestines, one side of the sternum was completely disarticulated from ribs, with the knife forced through the rib cartilage from the caudal to cranial (Figure 6.27). Blood was allowed to pool in the body cavity. In the description in Table 6.25, some organs, the head, and lower limbs are removed, but these were processes that occurred in the next step for other two reindeer.

The reasons for leaving the reindeer carcass after initial evisceration and skinning were multiple. Most importantly, the hunter went back to camp to arrange for transport. In three cases, the transport method was a string of pack reindeer, with two hunter/butchers on riding reindeer. In the other three, sleds were used, with two hunter/butchers on riding sleds and a cargo sled for the reindeer carcass (plus a sled for the observer)[11]. In addition to sleds and pack reindeer, containers and bags were also carried to the site. Only the butcheries that involved sled transport was observed in the field season (Table 6.23). Another reason the hunter left the kill site seems to be to get a second person, as all field butchery involved two butchers. A third reason might be to allow the blood to pool inside the body cavity. The blood was used (cooked and eaten) in reindeer, in contrast to the *kabarga*.

6.2.3 Field butchery

Field butchery differed by transport method. *Field butchery* can be defined as the butchery done to get the carcass ready for transport. In the case of pack reindeer transport, the carcass was completely disarticulated into parts, as in parts butchery. In the case of sled transport, the fur-covered lower limbs were disarticulated from the body, and the body transported whole. Two descriptions of field butchery for sled transport are given in Table 6.28.

Briefly, the process started by some preliminary emptying and cleaning of the stomach and intestines (in some cases this was done during kill butchery, but in other cases these organs were simply buried under snow until the hunter returned with transport). Then the reticulum and the ventral (?) sac of the rumen were cut off from the stomach to be used for bags for blood. The blood bags were made by twisting the opening around a sharpened stick which effectively sewed the bags closed (Figure 6.29)[12]. Plastic bottles were used in lieu of blood bags in some cases. The smaller reticulum was used as a bag for blood that would be cooked and consumed by humans, and the blood was skimmed and

[11] Each sled was pulled by a pair of reindeer, attached in train so that only the lead pair had to be controlled.
[12] The procedure is the same as observed among the !Kung (Yellen 1978:283).

scooped from the body cavity into this bag with great care. The larger ventral (?) sac was filled with blood for the dogs, and most of the remainder of the blood, clots and all, were scooped into this bag. Blood that did not fit into bags was dumped out of the body cavity at the kill site.

The next step was the disarticulation of the fur-covered head and fur-covered lower limbs. The head was cut off, separate from windpipe, lungs, or heart (unlike the *kabarga*). The cut was made at the atlas-axis joint (except for Sasha, who cut off the head at the cranial-atlas joint, and also disarticulated the head and two limb parts at kill butchery) (Figure 6.29). Two methods of head disarticulation were observed. In one case, a cut at the joint was made from both ventral and dorsal sides, then the meat was cut parallel to the joint all around, and then the head was forced backwards until the joint separated. In another case, the head was twisted a full circle to break the joint.

The lower limbs were disarticulated from the body at the femur-tibia joint and the humerus-radioulna joint (Figure 6. 29). For the femur-tibia joint, most of the gastrocnemius muscle mass was left attached to the meat of the femur, then the joint was exposed from the posterior and snapped by force – a process identical to the disarticulation of this joint in *kabarga*. The procedure for the humerus-radioulna joint was also identical to that of *kabarga*, with the joint being cut from anterior then snapped back.

As a final step, the genitals and colon were taken off of the body part, if still attached. In the case of pack reindeer transport, the body part was further disarticulated in to parts (see parts butchery, below). Disarticulation went fast with two butchers, and most of the time in field butchery was spent in blood collection.

The final step was sorting what to transport back. In the case of sled transport, everything was taken back except the stomach contents, spilled blood, the genitals and colon, and uterus/fetus (if any). The stomach contents and blood were left on the ground, the genitals and colon were deposited on a tree, and the uterus/fetus (in observed cases) was buried under snow, at the foot of a tree. The disposal of genitals and uterus/fetus probably had some cultural meaning, although the execution of these acts was casual[13]. Dogs were strictly kept away from these parts if they were present. Women were not allowed to step near or over any part of the reindeer, including spilled blood (see Appendix). While the same rule generally applied to *kabarga* as well, I was more strictly and repeatedly cautioned of these taboos while filming around reindeer.

In the case of pack reindeer transport, the body fur was also discarded in some cases. This was not surprising in the case of the Spring R04 and R05 hunt, as the skin of reindeer in the spring were in bad condition, riddled with holes where warble fly (*Oestridae*) and gadfly (*Oedemagena tarandi*) larvae (Syroechkovskii 1995:162) had bored through. However, the fur was also

[13] As mentioned before, the fetus was among the first tokens of the hunt to be brought back, and subsequently eaten, by the hunter among North American Subarctic groups (Osgood 1936; Tanner 1979). While the treatment is opposite, both the study group treat the fetus in a special way.

discarded in the case of Fall R01. This may have been due to Fall R01 being a small animal – reindeer body fur was mainly used as a sleeping mat, and one lacking in length was perhaps not so desirable. As previously mentioned, there was also a lesser demand for fur as the study group did not use skin garments or bedclothes anymore. However, reindeer hides were still made into leather and used for soles of footgear, leather thongs, and other items. In the case of Spring R04 and R05, the stomach, intestines, and blood were also discarded, while in the case of Fall R01 they were carried back.

What would, or would not have been further left behind if there were fewer pack reindeer available or another reindeer killed on the same trip? The question is of course academic, but an example of a cached moose, killed in September 2001 and fetched on December 10, might shed some light on this issue (Table 6.30). This moose was killed on a foot hunt by Vasili and Sasha, and cached in a box with walls and lid constructed of sturdy logs until the parts could be transported by sled. The cache (when visited in December) included a stomach bag of blood, lungs, windpipe, and heart in addition to the meaty parts, but was missing the lower limb bones. The lower limb bones were brought back to camp for marrow and *kamus* fur. It is not known for sure if any other soft part was brought back, but it is likely that at least the kidneys and liver, and perhaps some of the blood, intestines, and edible stomach parts were transported. Thus, what would *not* have been left behind, in this case, were the lower limbs. This interesting point will be discussed in detail later.

The leaving behind of edible blood, intestines and stomach of Spring R04 and R05 was rather anomalous in comparison to the use pattern of other reindeer, especially as they had the bags and plastic bottles for this purpose. One possible explanation is that with two carcasses to carry back, and still on the way to check the bear trap, space was judged to be tight. However, I do not believe this is the complete story. Although the weather was warm, it was still possible to cache the meat (as they did for the moose) and bring back the easily spoiled items first. Most likely, among a combination of reasons, the main one was the impending arrival of the helicopter and the trader (they came the next day), and the wish to bring back as many meat parts as possible for use in barter – a researcher-induced bias.

In any case, the field butchery (with sled transport) concluded by loading the carcass on the sled or pack reindeer. The body part was loaded, and the body cavity was stuffed with bags of intestines, blood-bags, and other smaller items. The lower limbs were packed away in a canvas bag, and the head was wedged in at one end. The whole reindeer was thus packed onto one sled. In the case of Spring R04 and R05, the parts of two reindeer were packed onto five pack reindeer (i.e. ten saddle bags). In the case of Fall R01, four pack reindeer were taken from the Main Camp, and all were presumably used.

6.2.4 Parts butchery

Parts butchery was observed for the three sled-transported reindeer. All three processes are described in Table 6.31 and will not be detailed in this text. (Note: in the following description, the parts that are made up of a single skeletal element are simply referred to by element, and not called a 'part').

Parts butchery was always done at the residential camp, immediately after transporting the carcasses back, on the same day as arrival back to the camp. The general pattern was that a single butcher did the parts butchery. Yakov and Sasha worked on Spring R03 together, but this was done in the context of Sasha getting instruction from Yakov. The butcher worked with the reindeer body lying on its side. As a general sequence, first the forelimb part and hindlimb part (scapula-humerus and femur) on the upper side were removed from the body. Then the other upper forelimb part was removed, freeing the ribs and sternum for disarticulation. As the carcass had to be flipped over on the other side to cut off the second forelimb, the second femur followed in close succession, although sometimes after sternum, and sometimes after rib parts (Table 6.32).

The procedure for the removal of the femur, forelimb part, and sternum was identical to that of *kabarga* hindlimb, forelimb, and sternum part removal. Rib part removal in reindeer was more carefully done, with the articular joint between each rib and thoracic separated by knife point while forcing the rib outwards (see Table 6.31). In the case of reindeer, eight middle ribs were counted off on each side for the rib part, always leaving some upper and lower ribs with the vertebrae (Figure 6.33).

Aside from the order of limb removal and the lack of the head, the parts butchery sequence of reindeer from this point onwards resembled that of the *kabarga*, with the sternum being removed first, then the windpipe, lungs and heart[14], then ribs, and then the axial elements from cranial to caudal. There were of course differences. The windpipe, lungs and heart was not attached to the head. Instead, these three soft parts were taken off at field butchery first as a unit, and then the heart was taken off the windpipe-lung unit immediately after. While the axial elements were generally disarticulated from cranial to caudal, the neck unit was kept attached to the upper *dramah* (vertebrae-rib combination unit) until the last phase of the butchery, when the axe was used to disarticulate these two parts. There were variations in parts created from the lower thoracic, lower ribs, and lumbar; they could form a single unit, or could be separated into two units (Figure 6.33). As the sample size is small, it is not clear if these were the result of individual variation, or of another cause, such as carcass size/body weight (see Table 6.32, 6.34a). The disarticulation method of vertebrae will be

[14] These three organs also form a unit for the Nunamiut (Binford 1978:48-49).

discussed in the section on processing time. At the end of the parts butchery, the neck was chopped off from the upper *dramah* by axe. The axe was then used to separate the sacrum from innominate, and the two sides of innominate (Figure 6.33).

The parts created in parts butchery for carcasses transported by sled were roughly equivalent to the parts created in field butchery for carcasses transported by pack reindeer (Table 6.34a and b). One difference was that the axial elements of Spring R05 (transported by pack reindeer) were only separated into two large units. This was most likely due to the small size of Spring R05, not transport method (Table 6.35). Table 6.36 compares the parts at the end of parts butchery for five reindeer (the record for Fall R01 is incomplete), and the similarity is clear.

To summarize the butchery process thus far, there was a series of butcheries with some variation due to transportation method, starting from the kill and field butchery at the kill site and ending with parts butchery at the residential camp. By the end of this sequence, the carcasses were disarticulated into identical parts regardless of transport method, and all meaty parts were transported back to the residential camp. Thus, there was no differential transport in the archaeological sense of the word (although soft parts were left behind), and the difference in butchery was a difference in *timing*, rather than a different butchery pattern – the butchery sequence for pack reindeer transport simply skipped ahead and completed the parts butchery that would have been conducted in the residential camp in the field, instead of creating a completely different set of parts[15]. This supports the notion that the study group is rigid in their mental template of how a carcass should be butchered, and do not vary from this norm[16].

As a side note, the carcasses of reindeer bartered with the trader at the beginning of the Spring field season (hunted in January-February between two field seasons) were only butchered to the field butchery stage, i.e. into headless and lower limb-less bodies. The study group kept the heads and lower limbs and bartered only the body parts. This was a case of stopping short in the process of butchery, stopped at the stage where it would normally be stopped during field butchery, again supporting the notion of a mental template or norm.

The adherence of the study group to basically a single style of butchery sharply contrasts with the Nunamiut study where carcasses were flexibly disarticulated according to functional reasons ranging from transportation decisions (e.g. if parts such as the vertebrae were being left behind, they were left articulated), intended use (e.g. if large parts with meat and bone had to be dried on a rack, parts were created accordingly), to butchery conditions (e.g. frozen long bones were chopped midshaft, but if butchered in fresh conditions,

---

[15] The difference in vertebrae unit part mentioned in the paragraph above could, of course, contradict this hypothesis.

[16] D. Anderson, who studied the Evenki and Dolgans in the Taimyr Peninsula, has also noted that the Evenki have a very structured way of handling and distributing carcasses (personal communication).

were disarticulated into whole elements) (Binford 1978:48-52, 62, 149). In fact, the Nunamiut study stands out in its diversity in butchery patterns among ethnoarchaeological studies; even the African case studies show more uniformity in butchery procedure, especially within a body size category or species (e.g. see Yellen 1977).

6.2.5 *Kamus* butchery

Kamus butchery is defined as the removal of *kamus* (lower limb fur) and the disarticulation of lower limb bones in preparation for marrow cracking. Marrow cracking directly followed this butchery event, although rarely a few marrow bones were saved for later use. *Kamus* fur was a necessary item for their survival, as it was the raw material for footgear, mittens, and other fur items[17]. These fur products could also be bartered. *Kamus* butchery seemed to occur as soon as possible after the disarticulation of the hindlimb, presumably to prevent the drying out of this piece of fur.

Table 6.37 gives a general outline of the *kamus* butchery process for each reindeer. There was always more than one butcher in *kamus* butchery (Table 6.37 shows a separate timeline for each butcher). In general, the butchery proceeded in five steps: 1) the removal of fur, 2) the separation of bones (radioulna, carpal, and metacarpal, or tibia, tarsal, and metatarsal) from tendons and the taking off of the hoof/phalanges as a pack, 3) disarticulation of the two long bones, 4) cutting off the meat-tendon-hoof pack (here referred to as *chachaki*, which was the Evenki name for the muscles around radioulna or tibia and also the name of this unit) and freeing the bone to which they were attached to, and then 5) the disarticulation of the carpal or tarsal from the long bone they were attached to. The three middle steps (which were, as a whole, a process of disarticulation) were generally done by one butcher in a continuous sequence, but separate butchers could do the skinning and disarticulation of one limb, and also take over for the last step, which was often done together with periosteum cleaning. All four limbs (of one animal) were skinned first, and disarticulated

[17] The use of *kamus* for manufacturing footgear is widespread in Siberian groups (Oakes and Riewe 1998).

later. All lower limb bones (radioulna, metacarpal, tibia, and metatarsal) were periosteum cleaned.

Skinning

The skinning was carefully done with liberal use of knife, unlike the skinning of reindeer body fur or *kabarga* fur. The hindlimb *kamus* was cut at kill butchery so that they started halfway down the tibia, while that of the forelimb extended to just below the proximal radial articulation surface. All *kamus* were slit by knifepoint on the posterior, and carefully removed from the hoof, meticulously following the outline of the skin at the hoof. There were individual differences observed in the details such as the starting point of the posterior slit, and the direction of peeling. A noteworthy difference was seen in the peeling of the hindlimb *kamus* by Yakov, who started his posterior slit with the limb bent at the ankle and peeled from the posterior extremity of the calcaneus. The others started at one end or the other of the kamus, and spent more time trying to start the slit. This was another example of Yakov's superior knowledge of anatomy and butchery (Figure 6.38).

The removed *kamus* were pasted against each other in pairs (e.g. forelimb to forelimb), fur-side out, to keep them moist until they could be cleaned, stretched and dried.

Tendon removal

The tendons on the forelimbs and hindlimbs were each taken off in one long piece when possible, leaving the small amount of meat remaining on these lower limbs connected to the hooves. While some tendons were cut off at the carpal or tarsal and dealt with later, at least two or three long tendons were separated from the bones as long strands, especially along the anterior of the limb.

When all tendons were loosely hanging, the phalanges (with the hoof covers attached) were disarticulated from the metapodial. The disarticulation of the metapodial-phalange joint was done by cutting all around the joint, and then snapping or using leverage to open up the joint. Usually some additional tendon or ligament had to be removed after the joint was partially separated, and before the joint could be separated completely. There was variation in the direction and number of knife cuts made during hoof disarticulation, but the variation was due mostly to the degree of thoroughness of the preceding tendon-removal process and not due to individual or forelimb/hindlimb differences (Figure 6.38).

Sinew was not used among this study group for sewing, and all tendons were consumed either by humans (eaten raw) or by dogs (cooked in soup).

Long bone disarticulation

The two long bones were disarticulated from each other after the tendons and hooves were loose and hanging from either the proximal radioulna or tibia.

The cutting of the radioulna-metacarpal joint was relatively quicker than that of the tibia-metatarsal joint. For the former, a cut was made all around the joint on the membrane around the joint, then a knife was inserted into the joint, and then the joint was snapped open. There were no visible individual differences in technique, but Vadim and Yakov separated the joint so the carpal pack was attached to the metacarpal, while Sasha's disarticulation resulted in the carpals remaining attached to the radioulna (Table 6.38: Sasha disarticulated the carpal packs for Spring R04 and R05, after prior processing by Yakov).

The disarticulation of the tibia-metatarsal joint was more complicated, with many gouging movements with the knife into the joint surface. The tarsals ended up with either the tibia or the metatarsal. Both carpal and tarsal packs were subsequently removed from the long bone they remained attached to (see below). The tarsal-attached-to-metatarsal result seemed to have been more preferred, as it was harder to subsequently separate the tarsals from the tibia without the aid of leverage supplied by the attachment of two long bones.

Chachaki *removal*

Chachaki (meat/tendon/hoof-pack) removal was also accompanied by a lot of cutting with the knife, as the meat was taken off as cleanly from the bone as possible. The butchers seemed more concerned with leaving a clean bone than maximizing the amount of meat – if pieces were sliced off, they were casually flung to dogs. The short bits of tendons around the proximal radioulna and tibia, as well as the clump of fat at the tibia, were eaten during this process.

Disarticulation of the carpal/tarsal

The carpal and tarsal packs were removed from the long bones in every case, although there was no obvious reason why this had to be done as they did not really get in the way of marrow-cracking. The only explanation is that they were disarticulated for the sake of complete disarticulation. The study group, especially the men, never did a half-hearted job when it came to hunting or butchery, and most likely there were no reason except it was just the way things were done. In fact, the sudden shift from lazy periods of rest to absolute concentration and speed when they were at work was rather alarming. It could also be that there were ceremonial reasons as to why reindeer remains had to be carefully treated and completely disarticulated, like the cutting of the body of the sable (see Appendix). Both the sable and the reindeer were similar in terms of the degree of culturally significant treatment given them, with remains deposited, nearly complete, on platforms and other bone deposit areas. In any case, the carpals and tarsals were completely removed, although it sometimes took a long time.

Periosteum cleaning and general soft part removal occurred at this time, often interspersed within carpal/tarsal disarticulation. Periosteum was removed from lower limb long bones (radioulna, metacarpal, tibia, and metatarsal) by scraping down all surfaces of the bone along the long axis, with the knife held perpendicular to the bone. The membrane was cut off the ends of the bone using a knife, but with the blade usually facing outwards and away from the bone. The knife point was often inserted and moved along the anterior groove of the metapodials to clean them out (Figure 6.38). Cartilage on the proximal tibial joint and on the ulnar process was also removed at this stage. Periosteum and soft parts removed from the bone were commonly fed to dogs.

Marrow cracking

The radioulna, metacarpal, tibia, and metatarsal were cracked for marrow, which was eaten raw, unflavored, and unprocessed. Vasili did the cracking in all observed cases although he did not otherwise take part in *kamus* butchery much. The bones were cracked by a combination of chopping (with axe) and percussion. For percussion, the hammer and anvil technique was employed using two axe-butts or an axe and a rock, with the bone placed on an axe-butt or rock and hit with the other axe-butt. The back of the knife and a metal hammer were also used as direct percussion instruments (Figure 6.38). The marrow was removed completely, often using a knife point to pierce one end and drag it out. All marrow was collected in a dish and large pieces were seldom eaten by the marrow-cracker during processing. The knife point was also used to clean small bits of marrow at the proximal and distal ends of the bone, and some of these smaller fragments were eaten off the knife-tip by the butcher.

The cracking of the metapodial began by chopping the distal and proximal ends of the bone with an axe, from the posterior side of the bone. If all went well, a crack would extend all the way along the long axis and the bone would cleanly crack in two. Hammer blows were also delivered to the midshaft, and fragments were pried off with a knife. The radioulna was chopped by axe on the distal end, from the posterior side. Several blows were then applied with a hammer or knife-back to the anterior surface of the radius, extending the distal fracture to the proximal midshaft. The proximal end of the radioulna was never chopped by axe. The tibia was cracked on both distal and proximal ends by axe, and also percussion fractured on the midshaft until all the marrow could be accessed.

Discussion

Table 6.39 and 6.40 gives the range of processing time for each step described above. *Kamus* fur removal took, in all but one case, more than five minutes, and shows the care taken in the skinning of this piece of fur. Yakov generally worked slowly and steadily, Vadim faster. Sasha was also faster than Yakov except when he got into trouble in disarticulation. Overall, *kamus* butchery was hurried or particularly efficient, with lots of eating and talking during the process. It was, in some respects, a pleasurable and (relatively) leisurely communal activity for hunters who usually worked alone.

6.2.6 Head butchery

Head butchery was done when the head was going to be eaten (i.e. cooking butchery), but at the same time it also served as a ceremony that predicted future hunts and conferred luck on the hunter that killed the animal. Due to its significance to the study group, it will be described in detail.

The head was completely thawed for the butchery, which was not true for any other part (although this was probably due to the fact that it had to be skinned first). The thawing reindeer head sat on a low stool or chair, as opposed to other parts which usually were thawed on the floor in a basin or on a cloth. The taboo of women stepping over reindeer parts were particularly reinforced while the head lay in the room, with the head placed in a location where there would be no accidental stepping whatsoever.

All but one butchery of the head was done by Vasili, with Vadim doing the other. The first stage of this butchery was the skinning of head fur. Head fur was another important fur part for the study group, second only to the *kamus*. The study group considered this the strongest part of the fur, and used it particularly for saddle-covers, backpack-covers, and traditional seat mats.

Skinning started at the lower jaw, with the knife used liberally but carefully, working up one side of the head from the posterior-lateral area. The ears were cut off together with the fur (and remained attached to the fur). Antlers were knocked or sawed off prior to skinning, but it was nevertheless still difficult and time-consuming to skin around the base of the antler. Techniques used to remove the antler were repeated sawing with the knife blade and using a hammer to knock out the base of the antler.

When one eye was exposed, it was stabbed from the posterior and the eyeball was removed. A slit was cut into the eye from the side of the eyeball and the water and aqueous humor was removed and deposited into the fire (*pechka* or open fire). The rest of the eyeball was eaten (swallowed – it did not look as if the hunters were enjoying the taste). This was part of head butchery that conferred luck[18] on the hunter, and it could be that Vadim did the butchery of Spring R02, and Vasili the butchery of Spring R04 and R05, to get that luck as they were not the successful hunters (Figure 6.41).

The skinning continued past the eye socket after the eyeball ceremony. After one side (mostly on the posterior half) was skinned to the top of the crania, the process started again from under the mandible on the other side, and everything repeated including the eyeball ceremony. The skin was then

[18] The study group was not very forthcoming about ceremonial issues. On one occasion, it was explained that the eating of the eyeball gives the hunter the ability either *to see like* reindeer, or *to see* reindeer – the conversation was terminated before I could confirm.

progressively detached from the top of the crania towards the tip of the nose, with the nose cartilage being cut off together with the fur in the final stroke by knife that detached the fur. Then the nostrils were slit so that the fur lay flat (Figure 6.41).

The atlas was removed next, if it was attached to the head (it was in all but Spring R03 which was processed by Sasha in the field). The meat was cut from the lateral direction on both sides, and then a knife was inserted into the joint from either the dorsal or the ventral side. After these cuts, the atlas came off quite easily with an application of force. While there was no ceremony during the disarticulation of the atlas, this bone was kept after consumption by the window opposite the door of the house, together with *kabarga* skulls (see Section 6.1.3, head unit). The bone was said to resemble the head in general shape and positioning of foramina.

Next, the mouth was slit wider, i.e. the meat on the sides of the mouth was cut open, with a knife pushed towards the occipital along the teeth with the point of a knife facing towards the cheek. After the mouth was cut wider on both sides of the head, the jaw was wrenched open by an application of force, using a pushing motion with a hand on the cranium and a hand on the mandible. The mandibular joint popped open without any disarticulation cuts with the knife.

The roof of the mouth was then tapped or poked with the point of a knife, accompanied by chanting in Evenki under the breath. The chant, while never clearly heard, was similar to that chanted to the sable that asked the animal to come back to be hunted again (see Appendix). The mouth roof ceremony (poking and chanting) was apparently an important step that should not be skipped: when Vasili took over the processing of the cranium of Spring R02 from Vadim, he repeated the tapping and the chant, although Vadim had done it once already. When the jaw was opened, the roof of the mouth was also examined for dark spotting. The presence of spots and/or the tongue hanging out from the side of the mouth were omens for a successful hunt in the future (Figure 6.41)

After the mouth roof ceremony, the mandible and tongue was together removed from the crania. Then, the tongue was removed from the mandible, and cleaned off of extra tissue. While there was no particular ceremony concerning the tongue during the butchery, the tip of the tongue was cut off and offered to the *pechka* by the person eating the tongue.

The incisors were then removed from the mandible by knocking them out as a group (using a knife-butt or a hammer) from the anterior midpoint of the mandible (Figure 6.41). The incisors were still attached to a thin layer of gum membrane, which kept the teeth together. A hole was pierced in the membrane, and the little dangling bundle of teeth was hung up and dried. These incisor bundles were used as a rattle-ornament that decorated the side of salt bags for domesticated reindeer (*riukariuk*) which was used to attract domesticated reindeer with its movement and sound. After the removal of incisors, the mandible was split into left and right elements by pushing down from the posterior side and using the butcher's body weight to snap the joint open.

The last step of head butchery was the chopping of the cranium into four parts by axe (Figure 6.14, see also Figure 6.31). The cranium was scored, using a knife, down the midline of the long axis on the superior and inferior surface, and also down along the front of the eye sockets (see fracture pattern in Figure 7.31). Then the occipital half of the cranium was chopped off from the nose half, with axe blows delivered from the superior and inferior sides, with two separate cuts on each side (left and right). More than one axe blow could be applied to the same cut line, depending on how well the bone split. Simple force was used to separate the halves after the bones were mostly split; the butcher pulled or twisted while holding the two halves with two hands.

The brain was next removed by chopping the occipital half into left and right. The nose half was also chopped into left and right pieces. These four pieces became the cooking units. These cranium quarters and the two sides of mandible were cooked by boiling, but the soup-water was never consumed by humans (it was later fed to dogs). This was a custom of this particular group, and not shared by some of the Evenki they knew. The study group believed that head-soup induced diarrhea. The nose quarters were not eaten late in the Spring field season as they were full of nose bot fly larvae (*Oestridae*). The brain was not boiled with the cranium (unlike *kabarga*). It was eaten fried and as a separate snack/meal. The mandible was cracked for marrow by the person eating it (unlike *kabarga*).

It should be noted that the study group considered the head as a part that *had* to be butchered and preferably also consumed, due to the ceremonies associated.[19] In contrast, Misha (their relative) commonly left the heads of the reindeer he killed with the study group while taking the other parts home. This, and his habit of removing the tongue without disarticulation (by chopping the posterior half of the mandible off with the tongue with an axe) were pointed out, in a gossipy way, as signs that Misha had somewhat lost touch with tradition.

Study group members themselves broke tradition on one occasion and fed cranial parts to the dogs in late Spring field season. These cranial parts consisted of nose parts full of parasites from recent kills, plus old and inedible (unpalatable) crania from Misha's kills that were left on platforms for over two months. When I (and Yulia) expressed surprise during the butchery, Vasili (who made the decision to feed the crania to dogs) explained that he did not care if he ruined Misha's hunting luck. The feeding of parasite-filled nose parts to dogs seemed to be more accepted and routine (i.e. no-one expressed surprise), but perhaps Vasili would have kept these parts away from dogs as well, had they been from Vasili's kills instead from Vadim's.

Table 6.42 compares the head butchery sequences of the six reindeer killed in the field season. The sequences are almost identical. While processing time varies (Table 6.43), the variation was mostly due to the length of ceremonial parts. Late in the Spring field season, Vasili taught Yulia how to do head butchery. Yulia butchered the old reindeer heads that were left by Misha, and fed to the dogs. While data from old carcasses (i.e. those not killed during the

[19] However, some heads were chopped into cooking units and left unused until the end of the field season.

field season) are not otherwise included in this study, the processing time of Yulia's butchery is shown as a reference in Table 6.43.

Discussion

In brief summary, reindeer were butchered in four major butchery events, and each of these butchery events was generally uniform in procedure and time spent among the small sample observed (Table 6.44). Minor individualistic differences in butchery were seen – as was the case in *kabarga* butchery – between Sasha and the core family group. Sasha's differing techniques resulted in the disarticulation of the head from the atlas (instead of at the atlas-axis joint) at kill/field butchery, and the association of carpals and tarsals with different long bones.

Most of the major butchery events had two or more butchers working together, and this made the comparison of butchery sequence difficult. For reindeer, only the parts butchery was analyzed for rank order and processing time, albeit with a small sample size (three). Rank order of parts butchery showed a significant correlation regardless of whether sided elements were ranked separately or combined (Table 6.45). This was to be expected, as the parts were removed in the general order of 1) sided elements and sternum; 2) axial elements disarticulated by knife from cranial to caudal; and 3) axe-disarticulated elements, in all three samples. Processing time between individuals did not vary in a discernable pattern (Figure 6.46).

As there was not much individual variation in processing time, the average processing time for each part could be calculated with reasonable accuracy. This averaged processing time was compared against the sequence of parts butchery (Figure 6.47). There was no significant correlation, and while the faster-to-disarticulate parts were generally removed first, processing time is not thought to be a major factor in determining reindeer butchery sequence. The relationship between the sequence of parts butchery and economic utility (GUI) was significant only if limb elements were included (Figure 6.48). Without these outliers, the sequence does not correlate to economic utility. Thus the major factor in parts butchery was again a matter of mechanics (i.e. outer parts had to be removed first to get to the inner parts) rather than cost or utility. It can thus be concluded for reindeer as well as for *kabarga* that the test expectation that anatomy dictates butchery ('uniformitarian assumption') was fulfilled: that the order and processing time of each part in parts butchery was determined purely by anatomical position of each part (in the case of reindeer, removed outside-in) and the mechanics of the joint (as demonstrated by the lack of individual variation).

6.2.7 Additional butchery activities

Bone boiling

Bone boiling was not strictly a butchery activity, as the process was more of a recycling of discarded bones. However, as this activity is of great zooarchaeological interest, it will be discussed here. Bone boiling was observed once, in the Spring field season. When the study group was previously interviewed about bone boiling practices, they mentioned that it was an activity limited to the springtime. I had assumed this had something to do with seasonal change in the fat content of reindeer bones (and when asked this question, the study group readily answered that the bones were indeed fattier in the spring than in the summer). However, after witnessing springtime conditions, namely the extreme fluctuation of temperatures and the overnight spoilage of large amounts of meat due to heat and bugs, I now believe that the motivation to boil bones for grease might have at least as much to do with preparing a supply of pure grease that could keep for a while. It is interesting to note that while the group no longer practices meat storage (e.g. dried meat) over the summer months, they continue to store grease.

Whatever the reason, bone boiling was observed on May 5 (Table 6.49). Only reindeer bones were used. Almost all the bones being smashed were cooked bones, except for some fragments from lower limb marrow-cracked bones, which were discarded in the raw state. The bones were not specially selected by animal (e.g. large animal, female, etc.) or selectively taken out of the larger bone deposit box by skeletal element; it would be wrong to say that these bones were specially stored for bone boiling use. Rather, it was simply a garbage bag (the bag was mine and co-opted as other large containers were all in use) full of the most recently discarded bones accumulated at the Main Camp. The bag full of bones was transported from the Main Camp to Spring Camp with the intention to use them for bone boiling. The bones were a mix from Spring R01 and R02, and might have included some of Spring R03. They included everything from vertebrae, ribs, to long bones raw and cooked, but due to the timing there were no crania or mandibles.

Bones were smashed using a hammer on anvil (axe-butt on rock) technique, until the bones were pulverized into small fragments of about one centimeter in width maximum, or until the internal cancellous bone was exposed in several places (Figure 6.50). Vasili wore old leather mittens and arranged the anvil-rock within an old backpack in order to catch all the fragments. Vasili asserted that bone boiling “must be done by one person, or the grease will not congeal”, and did all the smashing by himself. He also mentioned that the study group used to boil bones all the time (“if you want oil, you must smash”).

Crushed elements included the boiled fragments of cervical, thoracic, and lumbar vertebrae, ribs, proximal and distal femur and humerus (but not midshaft), scapula and innominate, and the raw fragments of distal radioulna and distal tibia (i.e. no midshaft or proximal fragments). Only one fragment each of radioulna and tibia were used. The fragments that were avoided (midshaft, proximal radioulna and proximal tibia) were hard to break, and in some cases Vasili hit them a few times with the axe and threw them back in the bag when they did not crush as desired. I lost count of the number of fragments used during the process, but at the end, most of a garbage bag full of bones was reduced to approximately seven liters of pulverized bone. This process took over 45 minutes of nearly continuous pounding by Vasili. As a note of interest, Sasha had never seen bones thus pulverized and boiled, but he had seen grease rendered by boiling bone fragments continuously for 2-3 days.

The pot full of pulverized bone was filled with water and cooked over a strong open fire. Grease floated to the surface after about an hour and was scooped out with a spoon into a bowl. Scooping continued every three to five minutes while the pot was kept at a simmer (the fire was regulated by pulling out logs). After about half an hour, a full bowl and a half-full bowl of grease was taken indoors and set on the *pechka* to be re-heated, at which time a dash of salt was added to the grease. The layer of pure oil that rose to the surface was scooped by spoon into a different container and allowed to solidify, resulting in about 900cc of grease. The re-boiling process finished over three hours from the start of bone smashing. The remaining bone mush and water was fed to dogs the next day.

While the boiling and fat-scooping process was not much more labor-intensive than soup cooking, the 45 minutes spent crushing bones was a relatively long and physically strenuous activity. It was longer than parts butchery (of either *kabarga* or reindeer) or any other butchery activity, save for *kamus* butchery. Some additional bone was smashed (by Vasili) while the first pot was boiling (see Table 6.49). This was boiled on May 7, and resulted in 200cc of grease.

Grease was continuously collected by this study group. It was scooped from the surface of boiling soup and saved in a bowl, or the abdominal and intestinal fat (called *rubashka*, or ‘shirt’) was chopped up and rendered into grease by frying the fat and straining out the burnt pieces (which were consumed as a crunchy snack). The grease thus collected was re-heated in small batches and used as a dip for bread when a quick snack was desired. Both kinds of grease (soup grease and *rubashka* grease) were cooled to a solid state and chunks were carried on logistical trips and day trips. The taste of rendered grease was preferred over bottled cooking oil, which was bartered in and used to fry meat but not for dipping bread. The bone boiling grease tasted more like *rubashka* grease, which was purer than soup grease.

Grease was clearly a necessary and desirable part of their diet. Other than bottles of cooking oil, the study group consumed many tubs of margarine (available for the first part of the Fall field season due to the trader that arrived with us on helicopter) at a rather alarming rate. Anecdotes of personal Evenki acquaintances that drank cupfuls of oil were also related to us (the researchers) in a clearly admiring manner. Other kinds of grease used by the study group included marmot (*tarbagan*) oil. Liquid in form, this oil was said to have medicinal qualities (it reminded me of cod liver oil), and was used sparingly. Bear grease, which was their preferred product as a topical cream to prevent frost burn, was not available during the field season.

According to the study group, they had boiled bones for grease the previous spring so the observed boiling event was not a 'staged' activity, but it should be mentioned that it might have been at least partially caused by my persistent interest.

Domesticated reindeer skinning

One of the newborn domesticated reindeer calves died during the Spring field season and the carcass was skinned. The calf (a male) was first laid down on its back, and the fur was slit like the *kabarga*, along the central ventral axis and down the posterior side of all limbs. The genitals and the fur around the genitals were cut off from the fur, so that the genitals were left attached to the carcass. The skin was carefully peeled, using the knife liberally, as a whole piece of fur including the head skin (like the *kabarga*), but with ears on the head skin (unlike the *kabarga*). Neither the *kamus* nor the head furs were separated from the body fur. There were no eye-stabbing or other ceremonial activities. The carcass was later slung high on a tree. The fur was immediately stretched on a frame made from thin twigs, which was attached on the fur side. This stretching method was the same as that for *kamus* fur. The skinning took 12 minutes by Vasili, and Yulia subsequently stretched the skin under the supervision of Yakov. Among the study group, reindeer calf fur was used as baby blankets and raw material for hats.

The fur from this domesticated reindeer calf was skinned like *kabarga*, but the carcass was treated with care like wild reindeer. Other domesticated reindeer carcasses deposited around the study group's sites showed signs of similar ceremonial care. For example, two fetuses that died during calving were also deposited high in trees (only Vadim, Yulia and Nils were present at their death, and their inexperience could be the reason that they did not save the fur). Another example of care was seen in the treatment of the head of a domesticated reindeer that was bartered to Misha, after it grew old and infirm, with the understanding that Misha would slaughter it for meat. The head, returned by Misha, was deposited on the meat platform together with wild reindeer heads. It was not eaten by the end of the field season, but it is unknown if there was a special reason.

6.2.8 Cooking butchery and processing time

The parts created in the field/parts butchery sequence were each processed into smaller units prior to cooking. I will call these smaller butchery sequences *cooking butchery*, as with the *kabarga*. As the first items consumed after field/parts butchery were usually the marrow and soft perishable parts (for use order, see section 6.2.9), cooking butchery never happened in close succession to field/parts butchery, unlike *kabarga*.

In cooking butchery, all reindeer parts were disarticulated into individual skeletal elements. Larger elements were additionally chopped into fragments by axe. Disarticulation times (the time from grabbing a unit for removal, to its separation) are listed in Table 6.51 and individual variation is illustrated in Figure 6.52. Processing time for reindeer was, as was the case with *kabarga*, almost synonymous with disarticulation time, especially for axial elements. The time it took to separate/create a fragment (e.g. proximal from distal femur) will also be included in the discussion of processing time.

Vertebrae (Table 6.51a, Figure 6.52)

<u>Atlas</u>

The atlas was usually attached to the head part and disarticulated during the head butchery process. The processing time for this element was around 30 seconds. The atlas was disarticulated by knife, without much cutting on the joint surface (see description in Section 6.2.6). The atlas of Spring R03 that was left with the neck (cervical) unit was chopped by axe along with the other cervical elements.

<u>Axis and cervical</u>

The neck unit was chopped off from other vertebrae by axe at the field/parts butchery. It was also chopped by axe in the cooking butchery, roughly into individual skeletal elements. Prior to chopping, strips of meat were removed by knife all around the part (i.e. filleting), although there was plenty of meat left with the bone, and the knife did not touch bone. I believe this was done to remove the stringy meat prior to axe use. The meat was later chopped up and fried with other meat pieces.

Parts butchery processing time (disarticulation of neck unit from lower vertebrae) varied by butcher, with Vasili being the fastest and Yakov the slowest among Vasili, Vadim and Yakov. This was consistent with the pattern of individual variation seen in *kabarga* butchery. Butchery time ranged from 17 seconds to over 80 seconds.

Cooking butchery was observed for three neck parts, only one of which was actually processed by axe, which was the usual method of butchery for this part (Spring R03). This axe butchery by Vasili took a total of 1 minute 26 seconds to produce six pieces of neck fragments (hence 17 seconds for each), which agreed with Vasili's axing speed in parts butchery. This unit was to be fed to dogs, together with other parts of Spring R03 that had spoiled due to heat and bugs. Two more neck units (Spring R01 and R02) were disarticulated by knife by Vasili and Yulia respectively[20]. Each unit had an axis and four cervical vertebrae, and each individual skeletal element was separated from the others. According to Vasili, all of the processing of reindeer should have been done by knife[21]. However, they usually did not follow the 'proper way' for this particular unit and would have liberally used the axe.

The observed butcheries were the first attempts to disarticulate the cervical vertebrae by knife by both Vasili and Yulia. Vasili progressively got faster – from 4 to 2.5 minutes per joint. Each articular surface was separated by the point of a knife, and then leveraged off by inserting a knife or an axe-tip and applying force. Vasili quickly increased butchery speed when he realized that he really needed to probe each and every joint to successfully disarticulate these elements – the longer processing times resulted from him taking shortcuts. After his realization, he unerringly found the joints and worked methodically. His fastest disarticulation time was still much longer than that for any other vertebrae, reflecting the complicated shape of this vertebra. Yulia's technique involved sheer persistence, some lucky guesses, and a lot of slicing and sawing with the knife. It was clear that she did not have a mental picture of the shape of these bones, unlike Vasili. Her efforts ranged from 1 to over 7 minutes per disarticulation.

<u>Thoracic</u>

The disarticulation of thoracic vertebra occurred in field/parts butchery when disarticulating the *dramah* part or the thoracic part from the part immediately caudal to that one. The process was as follows: 1) the lateral meat was cut by knife so they would separate at disarticulation; 2) the knife was inserted between the vertebral bodies and from the ventral side; and 3) the knife was pushed through the joint (ventral to dorsal) while forcing the parts apart by pushing one or the other part from the ventral side. For cooking butchery, the same procedure was followed for some thoracic vertebrae attached to the lower *dramah* which had more surrounding meat.

---

[20] Vasili and Yulia butchered the neck unit with a knife for my benefit, as they had noticed my interest in butchery techniques and wanted to show me the 'proper' way to butcher this part.
[21] The reason was never clearly stated, but I feel safe in assuming that it ties into the underlying animal ceremonialism of this group and of circumpolar peoples as a whole.

The majority of thoracic vertebrae were in the upper *dramah* or thoracic unit. When the butcher processed one of these parts (with five or six thoracic in a row) some of the meat on both dorsal-lateral sides of the vertebrae (back strap) were often filleted first. Again, plenty of meat remained on the bone and the knife did not touch the bone. In the case of the *dramah*, the ribs were removed next. Then the meat between the dorsal spines was cut between all vertebrae before separating each vertebra (one by one) in the manner described above (Figure 6.53). Palpation with fingers accompanied the cuts between the spinous processes. Sometimes the knife was twisted between the vertebral bodies to leverage-open the joint. The back strip was taken away and stored for later use with other pieces of meat – the purpose of cooking butchery was to prepare the vertebrae for a soup dish, so the bone parts were consumed first.

There was not much individual variation in this element, for processing time or processing method. Yakov clocked anomalously slow in the butchery of the thoracic part unit of Spring R01, which was partly frozen when he attempted to disarticulate it into individual elements. Excluding this data, the average time for disarticulation for one thoracic vertebra was less than 30 seconds.

<u>Lumbar</u>

The lumbar vertebrae were part of the lower *dramah* or lumbar parts unit. Any thoracic vertebrae or ribs attached to these units were taken off first. The disarticulation procedure of individual lumbar vertebrae was the same as that of the *kabarga*, although for reindeer the axe was often used as a leveraging tool instead of knifepoint, and sometimes used to chop through partially disarticulated joints that were still stuck with cartilage. The disarticulation procedure was as follows: 1) the meat was first cut all around the central axis, parallel to the approximate location of the joint; 2) then the joint was palpated with fingers, and 3) the point of a knife was inserted between the bodies of adjoining vertebrae, and one bone was leveraged off (the axe was inserted in later attempts and the first attempt was by knife). The average disarticulation time for lumbar vertebrae was 79 seconds. The separation of the lumbar from the last thoracic or the lumbar from the sacrum did not differ in process or time from the separation of a lumbar-lumbar joint.

<u>Ribs</u>

Ribs were attached to both *dramah* parts units and rib parts units. The procedure of disarticulating the rib part from the body in parts butchery has been described (see Section 6.2.4); the time for this procedure ranged from one to three minutes. It should be noted that, unlike *kabarga* butchery, the butcher took time in the beginning to insert the knife in between each rib-thorasic joint to force each loose. When the rib was almost detached from the vertebral column and hanging off to the side, like an open zipper, he had enough leverage to force the knife through. Thus, most rib heads remained entirely attached to the rib, but some snapped off in the final forceful part of the removal. Overall, 10% of all ribs had no heads, among which the caudal ribs were disproportionately represented (20% of caudal ribs had no heads); the knife was forced through from the cranial to caudal direction.

For cooking butchery, individual ribs were disarticulated from each other by slicing through the meat between the ribs using a knife. In the case of a rib attached to the thoracic (in a *dramah* unit), the rib was wrenched off after slicing through the meat. A knife was often inserted between the thoracic and rib head articulation to assist the wrenching movement, although sometimes the joint could be simply twisted apart. This procedure usually took less than thirty seconds for each rib. Then, the longer ribs were chopped in half by axe.

The cooking butchery of the rib unit often started by chopping the entire unit in half, so that all ribs were cut into two halves (Figure 6.53). Then each rib fragment was separated from each other by knife. An exception was one rib parts unit (Spring R01), where Vasili separated individual ribs before chopping them in half. The time for the separation of the half-fragments were too quick to be measured (it was at most two seconds). It took less than half the time to butcher a rib-only part that only required ribs-from-ribs disarticulation, compared to parts that required rib-from-thoracic disarticulation.

Femur

The femur was usually butchered at two separate cooking butchery events. In the first event, only the larger chunks of meat were cut off (i.e. filleting). In the second event, the meat was shaved further and the bone chopped in half with an axe. Meat cutting (filleting) was done with a knife and an axe, with a small slice with a knife made first to position and assist the subsequent axe blow. Normally, two large fragments of meat were first cut off from the anterior and posterior of the bone, then more meat was removed on the lateral sides until a square pillar of meat and bone remained (Figure 6.53). Occasionally only one or two large pieces of meat were cut off for immediate use and the majority of meat was left still attached to the bone. Due to these variations, as well as from the fact that sometimes the meat was cut into small cubes in between making large cuts (in which case I could not leave this process out from total butchery time) while on other occasions the cutting was left for later (in which case the time included only large-chunk removal), processing time varied for this first cooking butchery event. The small cubes were used in a fried-boiled dish, and this dish, when using reindeer meat, never included a bone.

In the second cooking butchery event, the bone was chopped into distal and proximal halves by axe. Meat was further removed from around the bone prior to chopping. The bone fragments and occasionally a small piece of meat were cooked as a soup dish, the latter only when there were not a sufficient number of pieces with bone. Both knife and axe was used in the removal of meat off the bone. The axe was mostly used when the unit was not completely thawed out. Care was taken to prevent the knife or axe coming into contact with the bone when shaving meat, but in some case the meat was completely shaved off, and the midshaft showed through. To chop the femur in half, a series of small taps around the midsection was applied with the axe while turning the bone around once or twice completely (Fig 6.53c). Occasionally a knife was used to slice the meat at the midline before the axe was used. The variation in processing time in the second event came from the amount of meat remaining to be sliced off, and also from cutting the removed meat into smaller pieces in the middle of the procedure.

Forelimb (scapula and humerus)

In the cooking butchery of the forelimb, larger chunks of meat were first removed from the anterior and posterior of these two bones while they were still articulated. This meat removal gave better access to the joint. This first step was accomplished mostly by knife but sometimes with the aid of an axe. Then the scapula-humerus joint was disarticulated by cutting through the meat while forcing the humerus away from the scapula. This popped the joint open, and the cut was continued through the meat on the other side in a smooth movement. Then more meat was removed from each element, mostly from the flat (lateral) sides of the scapula, and from around the humerus in a process similar to that described for the second cooking butchery of the femur. The actual disarticulation took 24 seconds for Yakov and 71 seconds for Yulia. Meat removal time was again very variable due to chopping meat in the middle.

Both bones were then chopped into fragments using an axe. The humerus was cut into distal and proximal halves in a process identical to the femur. The scapula (including the cartilage) was chopped into five or more fragments. The distal articular end was first chopped off from the blade of the scapula, and then the blade was chopped in half along the long axis, and then halved again (see fragmentation pattern in Figure 7.51). The distal end of the scapula was chopped off with heavy blows of the axe. A knife slice into the cartilage preceded the first chop on the scapular blade and served to guide the axe. The first chop was delivered from the posterior edge and perpendicularly to the blade. Processing time varied by the degree of frozenness of the unit, but the whole process took on average around 4 minutes. As with the femur, the meat was used for fried-boiled dishes and the bone fragments (and occasionally some meat) was cooked in soup.

Innominate

The cooking butchery of the innominate bone was similar to the femur and humerus, in that the meat was removed first and then the bone chopped was in half with an axe. Meat was cut off (filleted) before and after the bone was chopped by axe, using both knife and axe. To fragment the bone, a heavy axe-blow aimed at the acetabulum was delivered from the lateral side, and a second chop was delivered from the opposite (medial) side. Splinters of bone, if any, were removed from the chopped surface after the blow and before continuing with meat removal, causing a variation in processing time. The actual chopping took around 11 seconds, while the unit as a whole was processed in about 1 to 3 minutes. As with the humerus and femur, the bones were used for soup, and meat for fried-boiled dishes.

Sacrum

The sacrum was cut in two or three pieces and cooked in a soup. On one occasion, Vasili decided to demonstrate how the sacrum could be butchered with a knife, as he was about to butcher a partially unfused (or recently fused) sacrum from a young animal (Fall R01). The point of a knife was inserted from the ventral side and the first (cranial) segment of the sacrum was leveraged off. This process took 62 seconds. Then the demonstration was over and Vasili used an axe to butcher the rest, as was the usual procedure for this part. It took 21 seconds to create three fragments by delivering forceful blows by axe, without any prior cutting with a knife. The most caudal fragment from the observed butchery was not eaten, and thrown directly into the bone deposit box.

Sternum

The sternum was chopped into fragments by axe and cooked as soup. The first step in sternum cooking butchery was to cut the abdominal meat off by knife and put it away for use in a fried-boiled dish. Then, the narrowest segment of sternum at its cranial extreme was chopped off. Then the rest of the sternum was split into left and right halves, by chopping along the midline lengthwise. Prior to axe use, lines were scored into the bone with a knife along the intended line of the cut as was the case with the cranium. Blows with an axe were only applied from one side (either anterior or posterior), although this did not completely separate the two sides. To finish the cut, hands were used to snap open the two sides and then the two sides were completely separated with a knife. Each half was chopped further into smaller pieces, roughly of the same size, about 5cm in length and width. The whole process took on average a little over 2 minutes.

Vasili also demonstrated, on one occasion, a knife butchery of the sternum. This was his first attempt to disarticulate this part with a knife, and was done for my interests, as was the cervical[22]. The cranial segment was snapped off after cutting into the meat on the lateral sides with a knife, but subsequent segments only came off after considerable sawing with the knife. This experimental disarticulation sequence took almost seven minutes in total.

Processing time

The overall trends of processing time in reindeer butchery were investigated using two forms of processing time: processing time for field/parts butchery (i.e. the disarticulation of the carcass into parts), and processing time

[22] I did not ask for, or ask about, any butchery decision before it was made. I would have preferred that they butcher everything the way they usually did, but I could not insist on it.

spent on the part as a whole (i.e. the total effort, measured in time, that was spent on getting a part ready for eating) (see Figure 6.54). There was no linear correlation between processing time for field/parts butchery and GUI (Figure 6.59a). The linear correlation between 'total effort' processing time and GUI was also not statistically significant, but showed a positive relationship among axial elements, indicating that parts with more economic utility took longer to process (Figure 6.54b, see trendline in Figure 6.54c). However, as discussed with the *kabarga*, this is thought to be a reflection of the amount of meat surrounding the joint, the anatomical complexity around the joint, and the number of elements the part had to be cut into.

Compared to *kabarga*, the pattern of cooking butchery and processing time of reindeer was complicated by the use of the axe. The cooking butchery of reindeer was an indoor activity that varied in time, from a little over one minute (e.g. when the innominate part was butchered by axe) to close to half an hour (e.g. for the lumbar/lower *dramah* part, by knife). According to study group members, it was not desirable to butcher parts by axe – a prohibition that seemed to be mainly cultural in its origin, but had practical aspects, such as avoiding splinters of bone in their food. Whether liberal axe use was permissible or not depended on the part of the reindeer, and the rules were uniformly adhered to by all study group members. Only once was the axe used on a part that was usually butchered by knife, when Yakov was trying to butcher a still very frozen lumbar part in time for dinner preparation. Vasili was critical of this incident and reprimanded Yulia for her bad timing in bringing out parts to thaw. The axe was mostly reserved for tasks that would require a lot of force (and, of course, time) if done with a knife, such as the disarticulation of fused joints (e.g. hip, sternum) and the chopping of skeletal elements into fragments (sternum, femur, scapula, humerus, innominate, and sacrum).

Only in one case (the neck unit) was the axe was used as a shortcut to disarticulate a morphologically complex joint. The processing of the neck part by axe represented a significant reduction in processing time, compared to processing by knife (Figure 6.54c). The processing time using a knife in Figure 6.54c was calculated as the average of Yulia and Vasili's first attempts. Even using Vasili's fastest time for disarticulating a cervical element by knife (150 seconds, the estimated total processing time for the neck part would still be 900 seconds (circled in Figure 6.54c), making the processing time much slower and thus more costly, far beyond the costliest of other axial elements (see dotted lines indicating range, Figure 6.54c). Axe use in neck processing is thus a clear indication of cost analysis entering the decision-making process in butchery.

It is regrettable that other larger animals such as red deer and moose were not killed nor observed in butchery during this field season. It would have been interesting to see which parts of these other animals were processed by axe or by knife. The study group members reported that these animals were disarticulated into parts and used the same way as reindeer, but there were probably differences in the details of the butchery. For example, the whole hip part (innominate and sacrum) of the moose was left articulated in the cache (Table 6.30), indicating that the hunters were probably not able to disarticulate these heavy joints in this larger animal in the field, with the knives and small axes they carry on a hunt. Other differences due to size as well as cultural importance likely exist among larger mammals. This is an area for future investigation with this study group, and hopefully also with other Evenki groups. It is also interesting to consider if the cultural avoidance of the axe in butchery would have arisen if a very large animal, such as moose, was their main prey species both numerically and in terms of self-identity.

Two zooarchaeologically interesting points can be made relating to processing cost. While disarticulation method itself (as in the separation of joints) was quite similar between *kabarga* and reindeer across skeletal elements, it seemed that in some cases reindeer parts were actually easier to process than *kabarga* parts, as the joints were larger and easier to see and access and the butcher could get a better grip. This observation directly contradicts the straightforward positive relationship often expected between body size and processing time (e.g. 'size 3 animal parts take x times much longer to process than an equivalent size 1 animal part, with x being proportionate to weight or body mass') (Lyman 1987).

A comparison of roughly equivalent parts shows that there was no linear scaled relationship between the processing time of *kabarga* and reindeer (Figure 6.55). While the weight of each part shows a roughly similar pattern of distribution across parts in reindeer and *kabarga* (Figure 6. 55a), the time it took to disarticulate parts did not proportionally increase (or decrease) for reindeer across the board (Figure 6. 55b). The same can be said for the total processing time devoted to each part, i.e. the 'total effort' time – for example, a *kabarga* thoracic part took almost as much time to process as a reindeer thoracic part despite being much smaller (Figure 6. 55c). The average processing time for individual ribs was also the same for these two species (Figure 6. 55d). Therefore, while processing procedure and time were definitely affected by size-related issues (as discussed throughout this chapter), size affects the butchery procedure in many complex ways and a straightforward relationship between body size and processing time cannot be expected at all (Figure 6. 55e).

As there was only one species studied within each body size category, it remains an open question if processing time *within* a size class – such as reindeer and red deer – would be quantitatively proportionate, regardless of cultural variables that might exist between the culturally significant reindeer and a species with no such connotations[23].

A second interesting point is that processing parts for boiling was fundamentally different than processing for defleshing. To illustrate this point, a comparison is presented between published processing times complied by Marean and Cleghorn (2003) and those from the current study (Figure 6.56a). With the exception for Binford's caribou marrow processing data, the comparative values are from experimental studies. This comparison illustrates the difficulty of comparing processing time from different groups, as this variable

[23] Of course, past ethnographic studies suggest it is highly likely that the red deer also held cultural significance.

is so dependent on the procedure itself. For example, Madrigal and Holt (2002) experimental data using white-tailed deer seem perfectly analogous to the study group's *kabarga* butchery, as an experienced hunter removed each meat cut or bone from a carcass which was already eviscerated and skinned while the deer hung upside-down (Madrigal and Holt 2002:747). While the former recorded a defleshing butchery and the study group exclusively butchered for boiling, an easy assumption to make would be that at least the processing time for disarticulation would be similar in actual length or in relative distribution among skeletal elements. However, data indicate that culinary differences affect the disarticulation process as well (Figure 6.56b).

Another illustration of this point is shown in Figure 6.56c. Marean and Cleghorn proposed a generally applicable model for complete butchery, sorting each skeletal element into "low cost" or "high cost" using perceived difficulty levels of butchery (Marean and Cleghorn 2003:26, Table 8). Their classification of each skeletal element into these cost categories were based on defleshing butchery strategies. To compare, six elements from reindeer and *kabarga* with 'total butchery time' data available were sorted (three each) into low and high cost categories by total butchery time[24]. However, among the six compared, only three elements were categorized alike between defleshing and boiling groups despite using such generalized categories. It is also interesting to note that low- vs. high-cost in terms of processing time does not necessarily correspond to long bones vs. non-long bones in boiling-based butcheries unlike the pattern pointed out for defleshing butcheries[25].

Discussion

In summary, there were common characteristics to this study group's butchery across both small (*kabarga*) and large (reindeer) animals. The butchery procedure was basically redundant and consistent in butchery technique, sequence and parts produced, between species, situations, and individual butchers. The study group ultimately butchers its meat animals into units that incorporate a skeletal element and its surrounding meat, without separating bone from meat or fragmenting the bone before use[26]. Filleting of meat was more of an incidental process during cooking butchery rather than an objective in itself. There was great care shown in the butchery process, and the butcher took pride in the efficiency and skill of his dismemberment procedure.

These characteristics of the study group are in sharp contrast to those reported in previous ethnoarchaeological studies. The hunting and butchery patterns of four groups (Nunamiut, !Kung, Hadza, and Okiek) are summarized in

[24] Total butchery time was selected because Marean and Cleghorn aimed to model complete butcheries.

[25] The variation between reindeer and kabarga in Figure 6.56c again illustrates the point that some elements were easier to process in larger sized animals.

[26] Exceptions are the humerus and femur of reindeer, which were chopped in half. The two halves were always cooked and consumed together. This was loosely a pot-sizing activity and mainly a meal-proportion-equalizing activity

Table 6.57. Surprisingly, the Nunamiut example (the only comparable cold environment case study) differs the most. The difference is mainly in the Nunamiut's high variability in all aspects of their hunting- and butchery-related behavior. The difference between the Nunamiut and the study group is most evident when considering the fact that Binford finds the Nunamiut butchery practices most comparable to bison-hunting Plains Indians (1978:89), specifically in the practice of large migratory herd hunting and mass kills, and.

The presence of more than one carcass per hunter per hunt (and the synchronicity of abundant periods between hunters), plus the habit of caching carcass parts at or near the kill site results in the Nunamiut culling and/or abandoning specific parts of the carcasses at the kill site. The practices of mass processing, abandonment, plus (as this is the Arctic) butchery of frozen carcasses result in a rather more callous (or practical) treatment of the carcass than expected from their circumpolar cultural affiliation. The Nunamiut show great and flexible variation in their dismemberment processes. Some examples of 'callous' treatments by the Nunamiut that would never be seen among this study group were chopping (by axe) long bones mid-shaft for transport, butchering without skinning the animal first, and using the long bones as bludgeons.

African groups differ from the study group as well, but they were in fact more similar to the study group in their redundancy of their initial dismembering butchery pattern in contrast with the Nunamiut. The African groups listed in Table 6.57 usually hunted a single animal at a time, and their intent was to transport and/or consume on site as much of the carcass as possible. This single-prey factor seems to be the major determinant for redundancy in butchery pattern, as suggested by Binford (1978:89). Variability in butchery among the Hadza, !Kung, and Kua come from the variation in carcass body size, carcass condition (i.e. hunted vs. scavenged) and the logistics of transport. Some of their butchery methods indicate a purely utilitarian attitude towards the carcass, for example pulverizing the vertebrae while still encased in meat for easing transportation and pulverizing bones for marrow access (Southern African groups)[27], bashing the head of zebra against trees (Hadza), and lack of periosteum cleaning before marrow cracking (Hadza).

The study group did not practice differential transport unlike African groups. On one level, this was undoubtedly due to the availability of domesticated reindeer for transport, as opposed to groups that had to carry even larger prey on foot[28]. However, the Okiek case study draws attention in its similarity to the study group in its consistent whole carcass transport, regardless of not having transportation aids. There are two possible explanations: the "non-

[27] !Kung and Kua (Bartram 1993a, b)

[28] Another effect of the availability of sled transport is the study group's practice of non-differential *disarticulation* of different sized prey (see Bunn et al. 1988), at least not to the degree seen in African groups. One could, however, consider the reindeer kill butchery as a size- and logistic-dependent disarticulation that was only practiced among larger species. Another size-mediated difference was for example the more liberal use of the axe seen in the butchery of reindeer in contrast to *kabarga*.

marginal highly predictable environment" (Marshall 1994:66) of the rain forest and their use of food from other sources than hunting[29]. The latter *might* make sense as a reason to completely transport carcasses if hunted game is considered a rare, prized and prestigious item (as compared to their daily staple) that must be carried back at all times any cost. However, for the Okiek, hunting was the more regular activity and honey held the high-prestige position. I thus believe that the former explanation, i.e. that the predictability of a forest environment, as well as their non-marginal environment, produced the redundant transportation pattern in both groups. It is interesting to note that the Okiek (like the study group) also do not snack during kill site butchery.

Boiling was a not exclusive to the study group; it was a common cooking method among the Nunamiut as well as African groups. However, other groups always filleted as well, and boiling was reserved for hard-to-fillet parts such as the vertebrae which were carried back to the residential camp for consumption. O'Connell and colleagues suggested that the decision to carry these parts back was to reduce processing costs at the kill site (O'Connell et al. 1988:138). The patterns from this study suggest that some of the hard-to-process parts were also the most favored parts for boiling, and that preference might play a larger role in the transportation equation. Incidentally, boiled food among the Nunamiut and African groups were limited to dishes with smaller meat chunks and fragmented bone instead of dishes with large pieces of bone-within-meat. The scarcity of fuel in the other groups' environments might have meant that they were limited to shorter cooking (boiling) time compared the study group, who boiled their food for more than an hour. It is possible that as a culinary practice, large-piece boiling was limited to fuel-rich environments such as the forested Subarctic.

The study group's redundant butchery pattern thus stems from the redundant hunting and transport practices pursued in a rather rich, uniform and predictable environment. Their cultural inclination to treat the carcass with care amplified the redundancy as study group members rarely cut corners or sloppily deviated from their mental template of how butchery should be. Idiosyncrasy in butchery practices has not been *quantitatively* demonstrated in this study, and it has not been in any other. However, small differences that were not statistically demonstrable were observed between novices and experts, family members and non-family members, and between those with different levels of physical strength.

6.2.9 Use pattern

[29] It must be pointed out that the Nunamiut consumed commercial food items in quantity as well.

A point to be remembered about use patterns of reindeer is that, in contrast to *kabarga*, each parts unit created by the end of the reindeer field/parts butchery sequence was a meal or a few meals in itself. A part was usually retrieved from cold storage, thawed, butchered completely and whatever left over saved, as opposed to being partially butchered.

Most parts were cooked as soup (i.e. boiled), flavored with salt and grains or macaroni added to the broth, and the meat and soup served and eaten separately, as was seen in *kabarga* (see Section 6.1.4). Meat cut off from various parts (femur, humerus, scapula, innominate, back strip from *dramah* and thoracic, and abdominal meat from the sternum) were used in fried-boiled dishes, prepared the same way as described in the abovementioned section. Femur meat was enough for more than three meals of fried-boiled dishes (Table 6.58). Russian dishes such as *pirojok* (large fried buns with minced meat, lungs, and boiled rice filling, with the filling being cooked first) and *pil'meni* (boiled dumplings with minced meat filling, with the meat raw when shaping the dumpling) were also made out of femur meat. These dishes took longer to make, as the meat had to be cut and then ground by a hand-powered Russian meat grinder, and were thus dishes reserved for special occasions, such as birthdays, holidays, and other drinking occasions. As an aside about customs, a piece of the *pirojok* was always fed to dogs at the first meal.

The liver and kidneys were eaten raw, as was with the *kabarga*, although occasionally a piece of the liver was roasted on the *pechka*. The use of windpipe, lungs and heart differed from the *kabarga*, as these organs were not attached to and boiled together with the head. For reindeer, the lungs could only be used in *pirojok* (and the presence of soon-to-be-spoiled lungs sometimes occasioned the cooking of this dish), boiled whole with the windpipe. Windpipe bits were eaten as a snack but remainders were often discarded (presumably they were given to dogs). The heart was cut up and cooked as a fried dish, often with rice or buckwheat, and the brain was cooked in the same manner.

Antler still in growth and covered in velvet were roasted on a stick over an open fire and eaten. In May, when the antler was very newly erupted, the whole antler including the still spongy core could be eaten after roasting[30]. The core was chewed up and spit out. In one of the summer Norwegian-Russian expeditions, one prongs-worth of moose antler velvet was consumed in a similar manner, although only the thin layer of soft tissue was eaten as the core had already hardened.

One large difference between reindeer and *kabarga* use was the eating of reindeer intestines and blood[31]. The intestines were first completely pulled off the fat and membrane holding them together. The sheet of fat (*rubashka*) was hung up and left to dry. Some parts of the stomach (probably reticulum) was boiled and eaten by itself, simply cleaned in water and then boiled. The small intestines were cleaned, then dipped briefly in boiling water, and then in cold

---

[30] It was considered to be an aphrodisiac for women and good for virility of men.

[31] The internal organs of reindeer consumed in the field season were identified after the field season, using figures from Getty (1975) and Engebretsen (1975).

water, and eaten. On one occasion, the omasum from the stomach was eaten raw after intensive washing[32]. Blood sausages were cooked; the casing was made from the abomasum and duodendum (?), and possibly the large intestine. These parts were first washed and checked for holes, and then tied on one end with string. Blood, flavored with salt, pepper and (if available) garlic was poured approximately half full into the intestine-bags, the other end was tied off, and the sausages boiled until the blood was solid. These stomach and intestine dishes made up the first meal at the residential camp after a reindeer was brought back, undoubtedly because they were the most perishable parts.

Another part used in the reindeer but not *kabarga* were the phalanges. On one occasion, Yulia made *holozhets* – a dish of cold gelatin – out of this part. The cooking of this dish was not completely observed. Hoof covers were taken off four reindeer hooves by knocking at the covers with a hammer. The phalanges were cut off, flavored, boiled, and then cooled. This dish was a side dish and did not constitute a meal, and was made for special occasions. The phalanges were discarded whole after eating this dish. There was no marrow-cracking of the phalanges.

There were three reindeer that were observed from butchery to complete or nearly complete consumption (Fall R01, Spring R01 and R02). The use pattern was analyzed using only these three datasets. Spring R03 was killed well before the end of the Spring field season, but the onset of very warm weather coincided with a long drinking binge that started on the day of return with R03, resulting in the spoilage (fly eggs, maggots, and heat damage) of most of the meat. Despite some attempts to rescue some of the meat, the spoiled parts (meat and bone) were eventually used to feed the dogs. Spring R04 and R05 was brought back to camp a day before my departure and thus the consumption sequences were not completely observed.

The three reindeer were each consumed over a course of a month, split into 25-29 meals. However, as these reindeer meals were interspersed with other meals of *kabarga,* fish, squirrel, and birds, and it would be incorrect to state that the study group subsisted on one reindeer a month. The amount of food eaten per day varied greatly on the activity of the day. On some days the study group ate only two square meals and one light meal – for example, at a logistical camp on a day of full hunting, the meals were typically a quick breakfast, a full breakfast, and a dinner. On some days, four full meals plus one or two snacks (e.g. two soup meals, two fried-boiled meals, and some tea with bread and grease-dip) were consumed. As the number of people at each meal fluctuated as well and complicated the picture, a detailed analysis of food and energy consumption will not be included in this dissertation study. Using the carcass weight and estimated muscle weight of Spring R01 and Spring R02 (Table 6.35) and dividing that number simply by the number of meals, 1.8-2.1kg of meat including bone, or 0.8-1.0kg of pure meat mass was consumed per meal.

[32] It still tasted faintly of the stomach contents. The eating of stomach contents, although documented in other cultures, was not observed in the study group.

Using data from the three completely consumed reindeer, the first-use pattern was analyzed as a proxy ranking of preference (Table 6.59). The rank order of use for all three reindeer were significantly correlated, with Spring R01 and R02 being highly significantly correlated ($p < .01$) and Fall R01 being less correlated to the other two. The cause of this difference in Fall R01 was the early first-use of the femur and innominate meat (as compared to Spring R01 and R02), which was occasioned by festive *pirojok* making. This difference is more pronounced when sided elements are combined in Table 6.59c.

As the data set is small, it would be presumptuous to call either of these as the 'normal' use order of reindeer parts. Common aspects of the use order were that soft parts (especially the stomach and intestines) were eaten early; ribs, sternum, and head followed; then the vertebrae were used from lower vertebrae to upper. The neck and the forelimbs (scapula, humerus) were consistently used late[33]. The innominate and sacrum of reindeer were already separated at field/parts butchery and not articulated to the lumbar vertebrae (unlike the *kabarga*). They tended to associate with the femur, for example a chopped innominate plus chopped femur created enough portions for soup meals.

There was no statistically significant linear correlation between use order and economic utility (GUI: Table 6.60), but there was a slight correlation between use order and utility among non-long bones, or the rib/sternum and axial elements (Table 6.60b, Figure 6.61), with higher utility elements being used first. Again, the key factor was probably quality of the meat, not quantity.

Reindeer and *kabarga* use were similar in that they were both preferably boiled and eaten. Most importantly, parts were selected and consumed in a more or less consistent (or redundant) order for both animals. The order of the normal 'soup' pattern of *kabarga* and the order of reindeer use were significantly correlated (Table 6.62).

A zooarchaeologically important pattern that emerges from both *kabarga* and reindeer use patterns is the priority consumption of marrow in lower limb bones, which was a pattern noted in past ethnoarchaeological studies as well (e.g. Binford 1978). The temporal proximity of consumption of these meat-lean and marrow-bearing skeletal elements to the hunt as well as prioritized consumption by hunters/butchers (in the case of *kabarga*) would be useful in reconstructing past behavior.

[33] It is interesting to note that the Okiek consistently gave away forelimbs (Marshall 1994:69)

6.3 Summary

The butchery of *kabarga* occurred in three discrete butchery events (kill, parts, and cooking butchery), although the first was at times skipped and the latter two were merged together. The butchery of reindeer occurred in five discrete phases, four to disarticulate into parts (kill, field, parts, and *kamus* butchery), and a cooking butchery event. The study group's butchery procedures could be characterized as thorough and efficient, their treatment of the carcass neither sloppy nor callous, reflecting their circumpolar religious beliefs. Stasistically invisible individual variations in technique and processing time were observed between novices and experts, family members and non-family members, and between those with different levels of physical strength.

The disarticulation process of both *kabarga* and reindeer were determined by anatomical and mechanical constraints. It was, in other words, dependent on how the carcass was positioned at the start of butchery and was a result of a progressive removal of parts from that start position. Processing time related to joint complexity when compared across various elements, instead of economic utility or order of butchery. These results support the 'uniformitarian assumption' test expectation, that anatomy dictates butchery. There were no quantifiable idiosyncratic differences (also supporting this expectation), although this is an area that requires further study.

Both animals were butchered into consistent parts, used in a consistent order, and consumed in a consistent way according to part (i.e. raw, boiled, roasted, or fried-and-boiled). There were some differences in soft part use (i.e. blood, stomach and intestine consumption of reindeer) between species. The main method of cooking meaty parts was by boiling, using large meat-on-bone chunks (as opposed to chopped filleted meat and separated bone). In reindeer, axial elements were preferred over limb elements, and most of the parts were cooked by boiling. Among the use patterns of *kabarga*, the 'soup' pattern was practically identical to the way reindeer were consumed, and indicated that there was a rigid preference ranking of skeletal elements that was common among ungulates of different sizes.

Many aspects of the study group's butchery pattern were unexpected and unusual as compared to past studies, and contradict the 'typical hunter-gatherer' test expectation. However, comparison between groups also shed light on the reasons behind the patterning (see discussion in Section 6.2.8). Although the effort invested in *kabarga* and reindeer hunting differed (mainly due to the use of dogs in *kabarga* hunting), differential butchery and transport did not occur. Comparison with the Okiek case study (Marshall 1991, 1994) indicated that this was due to their non-marginal and predictable environment. It might be said that while reindeer hunts were less successful and more labor-intensive compared to *kabarga* hunts, they were still easy hunts as compared to the Nunamiut, Hadza, or Southern African hunts and did not put the study group in such circumstances that differential transport decisions must be made. Being able to practice whole carcass transportation and being able to hunt predictably at regular time intervals, the study group was able to butcher and use their prey wholly and in a highly redundant manner. In this respect, the group might be even described as practicing 'storage on the hoof', without having to turn to pastoralism[34]. Living in an environment suitable for boiling-cooking, and not needing to put up long-term storage, they butchered almost exclusively for the purpose of boiling consumption.

In summary, the study group's butchery pattern presents exciting possibilities for zooarchaeological studies, and fills in many gaps in the ethnoarchaeological record. As an analogy for small groups, non-marginal groups, and/or groups with boiling technology, this study illustrates the pattern that might be expected in these situations. As an example of a group that had cultural practices (i.e. animal ceremonialism) with direct zooarchaeological implications (their careful butchery practices and complete disarticulation of carcasses), this study is a case study in cultural influence on archaeology and the post-processual debate on the reflection of intent as well as function in the archaeological record.

[34] By this term I mean the practice of keeping domesticated animals as a food resource, and exclude their form of reindeer domestication.

Chapter 7: Bone modification

The previous chapters described the study group's patterns of hunting, transport, butchery, and use of their two main prey species – *kabarga* and reindeer. The patterns observed were complete transport of carcasses, consistent processing of meaty bone into disarticulated whole bone, and redundant parts use. This chapter discusses how these patterns might (or might not) leave traces in the zooarchaeological record through surface modification.

In this chapter, I first describe each species' surface modification patterns with references to their hunting, butchery, and use patterns. As there were also individual (idiosyncratic) variations noted in butchery methods in Chapter 6 that might have been visible in surface modification, attention would be paid to variation between individual butchers. However, as part of the 'uniformitarian assumption' test expectation – that anatomy dictates butchery – I predict that these idiosyncratic variations do not show up as *quantifiable* differences in terms of surface modification.

Secondly, the 'uniformitarian assumption' is further tested by the comparison of surface modification intensity (i.e. the frequency of modification) and patterning (i.e. their spatial distribution) between datasets. Comparisons are made between large and small mammals (i.e. reindeer and *kabarga*), and between these two species and two comparable size classes from Nilssen's experimental study using African ungulates (2000). As part of the test expectation, I expect the surface modification on reindeer and *kabarga* to be similar across size classes, and I also expect South African butchery to be fundamentally similar to the study group as both groups are processing anatomically similar carcasses.

As described in Chapter 2, the bones of both animals were recorded and analyzed using the GIS image-analysis/bone GIS method (Abe, et al. 2002; Marean, et al. 2001). During the field season, all bones that were destined for the bone platform/bone box for disposal were intercepted and drawn. The missing parts therefore represent those that were given to dogs by the person who ate the bone, or swept away with debris.[1]

From initial kill to (intercepted) discard, the processes that affect surface modification were nearly completely recorded in this study. This study is, as it stands, the most complete of such ethnoarchaeological records to date. However, it should be noted that one step in the process was fully observed but not fully recorded; that step was eating. Accordingly, each bone could not be

[1] This was technically not supposed to happen as the study group strove for complete collection and disposal of their animal remains. However, smaller fragments, such as rib heads that were attached to vertebrae, were often lost in this manner

linked to eater and detailed eating method in the way they were linked to butcher and hunter.

The process was not recorded in full as the study group showed discomfort at the idea of my filming or taking notes during their meals. While general observations were jotted down immediately after meals, in retrospect, these observations were not as structured or organized as they were intended to be, probably reflecting the fact that I was too busy eating to notice much. Nevertheless the soup-meal consumption can be generally described as follows.

Before eating, the parts made in parts butchery were disarticulated further and/or chopped into fragments in cooking butchery (individual disarticulated whole bones or occasionally a bundle of 1-3 bones for *kabarga,* and an individual disarticulated bone or large fragments of a bone for reindeer). Bones always ended up in soup, even if some meat was filleted off earlier. Boiled meat-on-bones and broth were served separately. The meat, drained of broth, was served in a large container at the center of the table from which each person would select what they wanted to eat, and the broth was served in individual bowls. Each cooking-unit part (e.g. several cervical vertebrae of *kabarga*, or half a femur of reindeer) was eaten by one person and never shared between people. The eater almost always used a knife as a tool, as well as fingers. Forks were not used as individual utensils (although they were used as cooking utensils) and individual spoons were used for the broth.

Boiled meat was eaten by each person using his/her hands and a knife. The whole piece was picked up, and a piece of meat held between the teeth. Then a knife was used to cut the meat off from the bone, with the knife pointed away from the bone and meat and towards their mouth and nose. Hardly any marks would have been left on the bone from this procedure, especially as the meat was always thoroughly cooked, usually to the point of falling off the bone. There was no sawing of meat on the bone, eating fork-and-knife style, or any use of knife beyond what was necessary. Knife use on the bone was most frequently observed around cartilage in joint areas (as bits of meat stuck to the cartilage) and along the sides of the rib bones. Each bone was very cleanly eaten using teeth, fingers, and knife. Multiple elements (i.e. *kabarga* axial parts) were disarticulated at the table by the eater.

While the group was egalitarian in most respects, there was a definite 'pecking order' observed during their meals. Yakov (the patriarch) and Vasili (his son, *de facto* leader, and main hunter) picked their pieces of meat from the big container first, often selecting the largest vertebrae parts. On the occasion that there was a soup with pure meat chunks (e.g. a reindeer innominate and femur soup would only have four pieces of meat-with-bone, and some pieces of meat were added to round out the numbers) these were picked last. Vadim (the youngest male) and Sasha (the non-family member) clearly waited for these two men to first take their pick. Yulia (the woman) was last by default – she was often still busy serving the broth in bowls as the men started to eat – or by design. It should be noted that the seating order at the table reflected this 'pecking order'. Vasili usually ate much more than the others (maybe twice that of Yulia in some meals in terms of the amount of meat), picking out his second chunk (usually another good piece of meat with bone) early into the meal. Vadim also ate a lot but only surreptitiously, by cleaning out the leftovers.

The person who ate the femur and humerus cracked the bone for marrow after the meat was cleanly eaten off the bone, and ate the cooked marrow. For *kabarga*, this marrow-cracking occurred at the table using the back of a knife. The bone was sucked or probed with a splinter of wood if the cracking was insufficient. For reindeer, the eater usually ate most of the marrow from the midshaft side (bones were chopped in half at cooking butchery) by sucking on the end of the bone, or by hooking the marrow out using the point of a knife. The eater then made a trip to the chopping block (outdoors) and used an axe to chop open the proximal or distal end to gain access to the rest.

Large fragments of spongy bone at the articular ends of reindeer femora and humeri were often given to the dogs while at the chopping block. Yakov in particular chopped off distal condyles of the femur and the head of the humerus at an angle, specifically to give to his dogs. During the field season, I was able to intercept the bone in most cases before dog-feeding. The reindeer femoral head and the atlas were specifically *not* to be given to the dogs, the latter because it resembled a head in shape and the former because it was significant for a non-specified reason – but probably also for its distinct shape. Small mid-shaft (cortical bone) fragments were also kept away from dogs, but for a functional reason. These fragments were sharp and could injure the dogs' digestive tracts. *Kabarga* ribs and vertebrae were the two elements that were most commonly fed to dogs at the table, aside from the abovementioned spongy bone fragments of reindeer. Tableside feeding was rather irregular except in the case of the dog Ulka, who was spoiled by her owner Vadim. The dogs receiving these parts were always the same select few that the hunters allowed into the house, and were quiet and well trained. In most cases, the study group members only fed small bits of gristle to (quietly) begging dogs and rarely gave a bone.

The bones were drawn after each meal and as soon as time allowed. The bones were not washed prior to drawing. Each bone had some soft tissue still adhering to the bone, most of which were peeled off before using the microscope. The surfaces seemed clean and visible at the time in the field, but from a later lab perspective they were not. The not-quite-clean condition of the bones most likely affected this study in that they lowered the number of marks seen on the surface (Figure 7.1). Hard to remove tissue were concentrated near joint surfaces (i.e. cartilage), and would reduce the number of cutmarks on articular ends as opposed to midshaft areas.

Surface modification and fragmentation patterns are presented in this chapter using the bone GIS recording system. In the figures, for each skeletal element, the template (a photo of the bone in several views) is shown first. Each view (cranial, caudal, etc.) is labeled in the template. If a bone was fragmented, the fragmentation was recorded as drawn outline after refitting of all fragments from that bone. The cut marks were drawn and coded with a modified version of Nilssen's coding system (see Chapter 2). Both the fragmentation and surface modification was recorded on photo templates for each bone, but in the figures they are shown in solid white and gray so the surface modification marks can be seen more clearly in print. It should be noted that each mark is only drawn once per template (as opposed to Nilssen's method), although the surface of the bone that the mark occupies might be repeatedly depicted on several views in the photo templates. The photo templates show anatomical landmarks and are labeled to view, and should be referred to for the relationship between fragment outlines, cut marks, and anatomical landmarks. Gray areas are where the bone was present at the time of recording (i.e. after a meal and before disposal), and white the area where it was absent.

Surface modification marks drawn on each bone are accurate to its relative size (extent) to the bone, shape, orientation, and position, and are shown in black lines in the figures. Fragmentation outlines are also accurate and can be seen as darker lines of gray around solid gray areas (i.e. the refits can be seen in the figures). It should be noted that *kabarga* fragments were drawn on a reindeer template to allow for direct comparison between the species; obvious errors (such as the presence/absence of antler bases) should be disregarded. Additional information such as MNE maps (see Marean et al. 2001), surface modification type[2], and accumulative fragmentation diagrams are presented in the figures for only some elements but were studied for all. The bone GIS method was used as an analytical tool as well as for recording; the specific applications of this method are further described in the section on *kabarga* crania (Section 7.1.1) and reindeer ribs (Section 7.2.8).

Compared to figures in other detailed surface modification studies (e.g. Binford 1981; Nilssen 2000), the figures presented in this text are more zoomed out in scale and repetitive, with each recorded bone shown in its entirety, identified by animal number and, when known, the butcher. This is by intent; I wish to allow the visual comparison of the fragmentation and surface modification that resulted from different butcheries by different individuals and resulted from an accumulation of different hunting and butchery events (as described in Chapter 5 and 6). Each bone can be tied to hunting and butchery method through its animal identification number (e.g. Spring K01, Fall R02…), and butcher information is included in the captions if known. My intent is to generally describe the overall pattern of surface modification that could identify certain behavior, as opposed to trying to identify individual marks that would do the same (e.g. Binford 1981; Nilssen 2000).

7.1 *Kabarga* surface modification

---

[2] It should be noted that when surface modification is symbolized by type, the symbols' orientation and size do not reflect the orientation and size of the actual marks

Cranium (Figure 7.2)

The fragmentation pattern of *kabarga* crania comes from eating – specifically, the cracking of the skull around the occipital area to gain access to the brain. Yakov ate most (if not all) of these *kabarga* crania. He cracked them by tapping the crania with the back of his knife, but the cracking was never completely observed (i.e. I noticed after I heard the bone crack) and the precise location of tapping is not known. There were no percussion marks to mark the spot. The fragmentation is remarkably consistent.

Most of the marks observed on the surface can be attributed to skinning or disarticulation by their spatial location and/or orientation of the cuts. Skinning marks are seen on the top of the skull, with marks parallel to the direction of skin peeling, which proceeded from the occipital area towards the nose (see Figure 7.2a). While knife use around the eye was observed during the skinning process, these usually did not leave a mark. Disarticulation marks are identifiable by their position on the occipital condyles and are slightly more likely to be a shaved cut than any other type, indicating an oblique movement of the knife (see Figure 7.2c-d). One mark was left by the action of eating, by gnawing around the eye sockets.

As most of the occipital fragments were missing from the sample, a straight comparison of skinning marks vs. disarticulation marks would most likely give a skewed picture. The bone GIS method was used to correct for the discrepancy between these two areas (Figure 7.2f, Table 7.3). While the method is fully described in Marean et al. 2001 and Abe et al. 2002, the process can be briefly described as follows: fragments are added together as an overlay to calculate % surface area preservation, which gives an MNE value (Figure 7.2f, darkest area shows MNE=14). Marks falling within the well-preserved and poorly preserved areas are counted separately using a spatial query (Figure 7.2g). The fragment overlay, or MNE map, is a raster image that holds the number of overlays in each pixel. By using the number of pixels that fall within the photo of the bone in the template, the % surface area preservation for this particular bone as depicted on this particular template can be calculated (Table 7.3a, 1-3).

In the case of the *kabarga* crania, this calculation indicates that out of the 14 crania drawn and recorded, the non-occipital part was represented almost completely by recorded fragments (1262% out of possible 1400%), i.e. I had observed almost all the samples. On the other hand, only half of the occipital part was actually recorded (700% out of possible 1400%), indicating that half was lost before I intercepted it for recording. As a side note, the loss of *kabarga* occipital fragments occurred only early in the field season, and was due to their being deposited on outside roofs and other bone deposit areas before an intercept could be made.

To continue the description of the bone GIS method as applied to the *kabarga* crania: the marks, counted in the spatial query, yielded 23 marks for the non-occipital zone and 6 marks for the occipital zone (Table 7.3a, 4). Instead of simply dividing both these numbers by 14 (the number of bones drawn), these numbers are divided by the % preserved surface area (Table 7.3a, 5). This yields a more accurate (as compared to dividing both numbers by 14) estimate of how many marks can be expected to be seen on the occipital and non-occipital areas on *one* kabarga *cranium*, based on the bones recorded. These estimated numbers for one bone will be referred to in this study as the *corrected number of cutmarks (CNC)*, and as they are corrected to an estimated value *per bone or zone*, they can be compared to other elements and other animals regardless of differences in sample size. The corrected number of cutmarks was calculated for all elements for reindeer and *kabarga*, although the calculation process will not be described for each bone.

In any case, the *kabarga* crania was on average very lightly marked, with 0-1 marks on average expected from disarticulation of the crania from the atlas during parts butchery, 1-2 marks expected from the skinning process and/or the eating process on other areas of the crania (Table 7.3b).
Disarticulation marks ranged from 0 to 8, but it was not the case that one butcher left more marks, or vice versa (Table 7.4). The differences in disarticulation marks (if any) from different butchery methods (floor butchery vs. hanging butchery) could not be determined due to the loss of the occipital fragment of the floor-butchered animal.

Mandible (Figure 7.5)

The *kabarga* mandible was cooked together with the cranium, but was sometimes taken off prior to eating and eaten by a different person. The meat was tender by that time and the mandible could be pulled off by hand. Left and right sides of the mandible almost always remained attached until discard. The breakage pattern of the mandible shows some asymmetry (Figure 7.5). Forcing the jaw open by hand at cooking butchery caused this asymmetrical cracking of the coronoid processes.

The act of jaw disarticulation and/or eating left marks on the sides of the mandible. Most marks are probably from disarticulation, as they are mostly concentrated on the buccal side. There might also be a slight bias by butcher in the intensity of marking (mandibles butchered by Yakov show more cuts per mandible than the others; Table 7.6) which also supports the view that these marks were made at disarticulation. However, the number of cutmarks is too small to make a definite statement, and the spread of marks to the ascending ramus suggest that eating marks are mixed in as well. The *kabarga* mandible was never cracked for marrow. .

Atlas (Figure 7.7)

Unlike the reindeer atlas, the *kabarga* atlas remained attached to the cervical vertebrae in parts butchery. The cranial surface of this bone thus reflects the disarticulation from parts butchery. Yulia’s first-attempt at parts butchery (Spring K02) left its mark on the atlas, as an exceptionally high number of cuts seen on the cranial surface (Figure 7.7). However, all other examples show little to no markings, and thus for experienced butchers, there would be no individual variation.

Axis (Figure 7.8)

For elements with flat fusing epiphyseal ends whose presence/absence would not be easily depicted in side views (such as the axis, other vertebrae, and scapulae), the templates depict two sets of cranial/caudal images to record the presence/absence of the epiphyses.

The *kabarga* axis was included as part of the neck unit and shows marks from eating (e.g. shave marks on dorsal process) and from disarticulation during the eating process (e.g. nick marks on cranial surface). There was no fragmentation or damage to this bone.

Cervical vertebrae (Figure 7.9)

The templates for vertebrae and ribs depict three versions of each element, as they change in shape and proportion from cranial to caudal. Each bone was drawn on one of the three versions. There was no attempt made to collect all the vertebrae/ribs from each animal prior to drawing and order them anatomically; in other words the choice of template was made subjectively at the time of recording.

Only eight cervical vertebrae were recorded, of which only one had marks. The marks on this vertebra were on the caudal articular process and were clearly from disarticulation. Disarticulation damage was also evident on a different cervical vertebra, in the form of broken cranial articular processes. Otherwise, the cervical vertebrae of the *kabarga* were largely left unmarked.

Thoracic vertebrae (Figure 7.10)

The thoracic vertebrae had a low intensity of marks. There were two on the ventral body of one vertebra, roughly parallel to the joint, which were most likely cuts that were made during disarticulation (by attempting to cut through the joint at the wrong location). One gnawing mark on the dorsal process was made at the time of eating. Like the *kabarga* cervical, atlas, and the axis, most *kabarga* thoracic vertebrae were not fractured. On two thoracic vertebrae, the dorsal process was cut off parallel to and level to the joint. This suggests that the disarticulation cut, applied from the ventral side of the vertebrae and followed through in a single movement, sometimes cut through these processes instead of following the meaty gaps between bones.

The calculation procedures for values *% preserved surface area* and the *corrected number of cutmarks (CNC)* are shown in Table 7.11, as an example of the modified method of calculation for three-tiered templates. The same method is also applied to the calculation of different zones within a bone (see scapula, below).

Lumbar vertebra (Figure 7.12)

The lumbar vertebrae were more fragmented than other vertebrae, but the damage was confined to the upper and lower lumbar elements. This suggests that the damage occurred during disarticulation at parts butchery, rather than in the cooking butchery (which was more leisurely, conducted with palpation, and done without using much force to separate the joint). Like other vertebrae, this skeletal element was otherwise hardly marked from disarticulation. There were some marks on the transverse processes, most likely from eating.

Ribs (Figure 7.13) and sternum

The *kabarga* ribs mostly survived whole until discard, except for some damage at the rib head that resulted during disarticulation from vertebrae. 'Cut' type marks perpendicular to the long axis of the bone near the distal end of the ribs (especially those on the middle to lower ribs) were more common on the dorsal side of the ribs and suggest that these marks were left during the removal of the sternum in parts butchery. Some of them, however, could possibly have been from eating. The expected number of marks (CNC) per bone was still low (around 1 per bone) even when the presence of rib head fragmentation was counted as a disarticulation mark (Table 7.14).

The *kabarga* sternum was cooked and eaten without further disarticulation, and rib cartilages remained attached until time of discard. There were no surface modification marks on *kabarga* sternum.

Innominate (Figure 7.15)

The disarticulation of the innominate and femur in *kabarga* parts butchery was done with the lightest touch, and left almost no marks on the acetabulum. The separation of the innominate from the sacrum using an axe, which was another parts butchery procedure, left marks more often. In terms of fragmentation pattern, portions of the ilium were commonly missing due to axe use during parts butchery. The missing fragments were probably thrown away with the water when parts were washed prior to boiling. Slop-water from washing meat was usually recycled as cooking water for dog food. It is unlikely that any of the recorded fragmentation or surface modification resulted from eating activities.

Sacrum (Figure 7.16)

The *kabarga* sacrum was commonly missing portions of the sacro-iliac joint, due to the use of axes in parts butchery. The missing fragments were (like those of the innominate) probably lost with the washing-water. One surface modification mark was from an unsuccessful chop of an axe on the cranial surface of the sacrum. There were modification marks within the neural canal that were made during eating. The neural cord was pulled out (in many cases by the point of a knife) and eaten in all vertebrae, but only this one mark was left among all *kabarga* vertebrae, supporting the idea that care was taken at time of eating to avoid marking the bone when possible.

Scapula (Figure 7.17)

The *kabarga* scapulae were usually cooked as an unfragmented whole bone unlike reindeer scapulae. The scapulae of Fall K04 were an exception; both scapulae were chopped in half. Surface modification marks on the scapulae showed a pattern in their spatial distribution, and were analyzed using bone GIS. *Zones* are anatomical portions of a skeletal element, and zones in this study were made to match those of Nilssen's (2000) for comparative purposes. The zones for scapulae are the distal epiphyses (zone 1), distal shaft (thick part: zone 2), and the rest of the scapula including the spine (zone 3) (see Figure 7.17: zones).

Surface modification marks were separately tallied by zone using bone GIS. Marks on the distal epiphyses and distal shaft (zone 1-2) were mostly disarticulation-related and included nicks as well as cuts and shaves. However, there was also a gnawing mark from eating in this area, suggesting that some of the nicks, cuts, and shaves could be eating-related as well. Marks on blade of the scapula (zone 3) follow the edges of the blade and were made during eating when the meat was shaved off. The position and type of the marks support this view.

In reindeer, scapulae were one of the larger-sized elements that were broken into small parts during cooking butchery. These fragmented reindeer elements often had more surface modification as a result of the fragmentation process (e.g. from knife-scoring prior to axe chopping) and were difficult to directly compare with non-fractured *kabarga* elements. To circumvent this problem, an additional set of corrected number of cutmarks was calculated specifically for disarticulation marks in these larger-sized elements (Table 7.18). This *corrected number of cutmarks (CNC) for disarticulation* would be used to compare *kabarga* to reindeer later in this chapter. In the case of scapula, marks from zone 1 were defined as disarticulation marks.

Humerus (Table 7.19)

The *kabarga* humerus was more heavily marked in comparison to other skeletal elements, mostly during the removal of the radioulna from distal humerus. These disarticulation marks were distinct in their parallel placement in relationship to the joint, and were located mostly on the medial condyle. Most of these disarticulation marks were of the 'cut' type. There were also disarticulation marks on the humerus head, but they were more of type 'shave', reflecting the different butchery techniques for these two ends of the humerus described in Chapter 6. The cooking and consumption method (soup boiling) is reflected in the relative lack of marks in the midshaft of long bones including humeri; this pattern will be discussed in a later section.

The *kabarga* humeri could have been cracked for marrow after the meat was consumed, but in many cases the marrow was not eaten and the bone discarded whole. Some additional marks were made along the shaft from eating and in one case from marrow cracking. Marks determined as being eating marks in Table 7.20 include percussion marks (i.e. from eating marrow), tooth marks, and those noted specifically in the drawings as such, according to observations made during eating.

There was no pattern attributable to different butchers for *kabarga* humeri. The corrected numbers of cut marks (CNC) were calculated for the five zones (proximal (zone 1) to distal (zone 5)) for comparison to reindeer.

<u>Radioulna (Figure 7.21)</u>

The radioulna was never cooked in soup, and was either cracked for marrow or discarded whole without use. None of the marrow-cracked fragments of *kabarga* radioulna were successfully collected and drawn. All surface modifications marks shown in Figure 7.21 are thus disarticulation marks.

Compared with the number of marks on distal humerus from the same parts butchery event, the *kabarga* radioulna was rather unmarked. All marks were limited to the semilunar notch area of the olecranon, and the number of marks on observed bone ranged between 1-5 marks per bone (Table 7.22). For the lower limb elements (radioulna, metacarpal, tibia, and metatarsal), carpals and tarsals were drawn together with the element if they were still attached at the time of recording. This is not directly zooarchaeologically relevant as they will not be preserved in an articulated state, but their presence explains the lack of disarticulation marks on some samples. For *kabarga* radioulna, there were no disarticulation marks on the distal end, regardless of the presence/absence of carpals. Most likely the metacarpals were snapped off using leverage instead of tools during parts butchery[3].

The corrected numbers of cut marks (CNC) were calculated for the five zones (proximal (zone 1) to distal (zone 5)) for comparison to reindeer; when averaged this way, the number or cuts range between 1 and 3 marks per bone.

<u>Metacarpal (Figure 7.23)</u>

The butchery process of metacarpals differed between the two species. For *kabarga,* the removal of carpals and/or hooves prior to marrow cracking was *not* mandatory, but it was in reindeer *kamus* butchery. In many cases, *kabarga* metacarpals were separated from the radioulna at parts butchery and given to dogs. If they were removed at cooking butchery as part of marrow-cracking preparation, it was mostly to free the radioulna and not to process the marrow in the metacarpal. The men of the study group were deliberate and meticulous to the extreme in their daily activities – if they decided to do something, they did it right. In the case of butchery, this included complete disarticulation, even if the

---

[3] This action was observed for FK05.

element was not going to be used. Although there were relatively many shortcuts taken in the butchery of *kabarga* compared to reindeer (e.g. dog butchery, leaving the hooves on the metacarpals), this rather unnecessary disarticulation of the metacarpal was consistently observed whenever the radioulna was to be cracked for marrow.

Five out of eight metacarpals recorded had at least the distal carpals (unciform and magnum) attached to the proximal articular surface, if not the whole carpal pack. I neglected to record the presence/absence of phalanges and hooves attached to the metacarpal, but most likely they were attached to the metacarpal in four specimens (two animals) – Fall K05and Fall K09 – as evidenced by the lack of distal disarticulation marks.

Of the metacarpals recorded, six out of eight were *not* processed for marrow. Periosteum cleaning marks were not observed on the remaining two samples, although cleaning was standard procedure and definitely did occur for these samples. Usually, the long bones were rubbed down their length with a knife blade or knife back, with the knife held perpendicular to the bone. The corrected numbers of cut marks (CNC) were calculated for the three zones defined by Nilssen (2000: proximal (zone 1) to distal (zone 3)) for comparison to reindeer (Table 7.24).

<u>Femur (Figure 7.25)</u>

The *kabarga* femur was cooked whole and later cracked for marrow by the person eating it. Midshaft fragments were thrown into the *pechka* (stove) and distal fragments were often given to dogs (some fragments that were intercepted for drawing were given to dogs afterwards). Most marks on the femur were from disarticulation. They were concentrated on the femoral head and the posterior distal condyles. The high number of disarticulation marks on the proximal femur contrasts sharply with the relatively unmarked acetabulum. The assignment of surface modification marks on distal femur to the action of disarticulation was less concrete, as the knife was used in this area to cut off meat while eating. However, most marks (see Figure 7.25d-e) were oriented medial-laterally, and this characteristic agrees with disarticulation marks documented for the femur by Binford (1981) and Nilssen (2000). The patella was often left attached to the femur at parts butchery, cooked together with the femur, and disarticulated by the eater.

The corrected numbers of cut marks (CNC) were calculated for the five zones (proximal (zone 1) to distal (zone 5)) primarily for comparison to reindeer. These long-bone zones were useful to investigate the effect of filleting (or not filleting) on surface modification. As described in previous chapters, the study group members did fillet meat in a way, but the meat was never completely filleted off the bone until the eating process. If the element was to be used in a fried-boiled dish, it was filleted a bit closer to the bone during cooking butchery, but usually meat was left covering the bone all around. Some of the marks on the midshaft (zones 2-4) could have possibly resulted from closer filleting in preparation for fried-boiled cooking, but the sorting of *kabarga* femur surface modification by type of dish proved inconclusive.

In terms of surface modification mark type, a variety of marks were seen on the femur, but the most common were of type 'cut' (Table 7.26). No patterns were discernable by individual butcher.

Tibia (Figure 7.27)

Like the radioulna, the *kabarga* tibia was cracked for marrow and eaten raw, or discarded whole. The tibia was never cooked. The tarsals were often left attached to either the tibia or metatarsal, in contrast to reindeer (where tarsals were removed from long bones). Periosteum was always removed using the knife-blade or knife-back. Marrow cracking resulted in extensive fragmentation. There was no formal tool for marrow removal, but small slivers of firewood were used in addition to the knife.

The corrected numbers of cut marks (CNC) were calculated for the five zones (proximal (zone 1) to distal (zone 5)). Most marks along the midshaft (zones 2-4) were percussion marks. Some periosteum removal marks were seen on the anterior midshaft surface. Disarticulation marks were found on articular surfaces, both proximal and distal. No patterns were discernable by individual butcher.

Like the scapula, a second set of corrected number of cutmarks (CNC) was calculated for disarticulation marks only, for comparison with reindeer (Table 7.28).

Metatarsals (Figure 7.29)

The *kabarga* metatarsals were processed for marrow like the radioulna and tibia, and never cooked. The separation of the metatarsals, tarsals, and tibia seem to be *ad hoc* and entirely dependent on where the knife happened to cut through. Records are uncertain as to which specimens were separated from the phalanges and the hooves; judging from the lack of surface modification on the distal condyles, Fall K05, Fall K06, and Fall K09 were most probably left with hooves on. For metatarsals that had hooves removed, most marks on the bone were on the distal condyles, made when disarticulating the hoof. The astragali were also relatively heavily marked, more so than the proximal articular surface of the metatarsal.

There was extensive fragmentation of the metatarsal for marrow extraction. The corrected numbers of cut marks (CNC) were calculated for the three zones (proximal (zone 1) to distal (zone 3)), as with the metacarpal (Table 7.30).

7.2 Reindeer surface modification

Cranium (Figure 7.31)

As described in the previous chapter, the head part of reindeer was butchered with special care and in a very uniform manner. The recorded bones agree with this observation and show a uniform pattern of fracture. The crania were first chopped into four pieces by axe, separating the nasal/maxillary areas from the rest of the head, and then the two pieces were chopped into left and right halves. The nose quarters from late in the Spring field season were not chopped in half at the time of drawing (being full of fly larvae) but were later thus chopped and fed to dogs.

Many surface modification marks were left during axe-chopping, from unsuccessful chops from the axe and preliminary knife-scoring prior to chopping. Vadim showed some exceptionally zealous knife-scoring in Spring R02, leaving deep scores in the nose part. Axing marks were almost always left in the fracture area, parallel to the fracture line, as the crania was a tough bone to crack open and a single blow rarely sufficed.

There were also marks from skinning (especially from the removal of fur around the antler-base) and from disarticulation. The marking of the occipital condyles during disarticulation seemed to be case-by-case and not dependent on the butcher.

To count marks associated with skinning, buffer zones were drawn generously around fracture lines (to positively eliminate axe-chopping related marks) and in the occipital area (to eliminate disarticulation marks). Figure 7.31e-f show these zones as gray and dark gray, respectively. Marks that were not associated with axe-chopping fragmentation or disarticulation were spatially selected (Figure 7.31f, white marks). The direction (orientation) of marks selected thus was in agreement with the observed procedures of skinning and antler removal.

While there were more marks overall on reindeer than on *kabarga*, there was not a proportionate increase of skinning and disarticulation marks – in *kabarga*, there was one disarticulation mark to two skinning marks, while there was proportionally a greater number of disarticulation marks than skinning in reindeer (Table 7.32). Perhaps more marks were left from carelessness in the quick-and-dirty skinning of the *kabarga*, compared the careful and time-consuming skinning process observed in reindeer. This supports the general observation that knife contact with bone was avoided when possible by the study group, both to conserve their tools[4], and as part of their gesture of respect and care towards the dead animal.

Mandible (Figure 7.33)

The reindeer mandibles were disarticulated from the cranium during head butchery. The mandibular condyles were less damaged than those of the *kabarga* from the jaw-opening process, but very small fragments were occasionally missing at the tip. Left and right mandibles were split from each other at head butchery after knocking out the incisors. I have neglected to carefully record alveolar damage from this process, other than that it was present.

The mandible was boiled together in the head, and served without broth. Whoever ate the mandible cracked it for marrow after s/he finished the meat. Marrow cracking of the mandible took place at the table, using the back of a knife as a hammer. The marrow was not thoroughly eaten, unlike the case with other marrow bones. Usually the person ate what s/he could extract from whatever size hole made on the first attempt; there were no heavy fracturing of this part.

Most marks on the mandible were from disarticulation, and they are concentrated on the ascending ramii. Most were nicks and cuts scored with the point of the knife, most likely left when slitting the mouth open to facilitate opening the jaw (Figure 7.33, Table 7.34). Like the *kabarga* mandible, the reindeer mandible was disarticulated primarily by using the hands and it was not a heavily meaty part. This is the likely reason that there were almost as few marks on the reindeer mandible than the *kabarga* mandible.

Atlas (Figure 7.35)

The reindeer atlas was heavily marked by the act of disarticulation from two separate butchery processes, and also heavily marked at the time of eating. The caudal articular surface was marked at field butchery when the head unit was taken off the body unit. The cranial articular surface was marked at head butchery when the atlas was disarticulated from the cranium. Three atlases disarticulated by Vasili had a shave mark at the cranial-dorsal corner, showing that he habitually cut off the atlas from the right side. Disarticulation marks were generally similar in position and cut type between the reindeer and *kabarga.*

The reindeer atlas was hard to eat cleanly. This is evidenced by the many shaves, cuts, and occasional gnaw marks found across the body of the element. There were more 'shave' type marks than 'cut' type marks on the body left from the eating process (Table 7.36). Eating all the meat off a bone was considered basic good manners among the study group, as mentioned before. It was by the accurate use (and not excessive use) of the knife that they accomplished this. My own efforts at eating cleanly were often not clean enough (although I imagine

---

[4] The desire to conserve their tools (especially knives) was not verbally expressed by the study group, but evident in their constant vigilance and maintenance of knife-blades. Conservation of tools would be an even more important consideration in cultures with stone tools.

I would have been better at it had I not refrained from using a knife) and I was occasionally derided for “eating like a raven”.

The *kabarga* atlas was not as marked up as the reindeer atlas. There are two possible explanations: First, the *kabarga* atlas was one within a series of articulated vertebrae that could be stripped of meat as a whole (while eating), then disarticulated, and then cleanly eaten. Perhaps this method of eating left fewer marks. Second, the reindeer atlas was often kept under the window as the part resembled the head. Perhaps for this reason, the reindeer atlas was more zealously cleaned. As the axis and cervical vertebrae are also marked up more heavily for the reindeer, I favor the former explanation.

<u>Axis (Figure 7.37, Table 7.38)</u>

The axis of the reindeer was marked more heavily than that of the *kabarga*. The cranial articular surface was marked at field butchery during the disarticulation of the head from the body. There were more marks produced by Vadim for this activity than Vasili, although this observation is made from a sample size of one for Vadim. The transverse processes and the caudal articular surface were marked from cooking disarticulation in Spring R01 and Spring R02, which were attempted by knife by Vasili and Yulia respectively. The dorsal surface of the axis shows extensive marking made at the time of eating.

<u>Cervical vertebrae (Figure 7.39, Table 7.40)</u>

The cervical vertebrae of the reindeer were also extensively marked, compared to those from the *kabarga*. There were more marks from disarticulation, particularly when a knife butchery was attempted, and more marks from eating. The location of marking by these two activities tended to coincide (see Spring R03, with gnaw marks on the cranial articular process as well as the caudal epiphyses).

<u>Thoracic vertebrae (Figure 7.41)</u>

The thoracic vertebrae of the reindeer were uniform in their marking pattern. Almost all vertebra were marked in some way. Disarticulation marks were consistent with the butchery activity observed, with disarticulation initiated from the ventral side and leaving marks on the ventral body and ventral caudal articular processes). Marks were left on the caudal and cranial articular surfaces of the body as well.

Some of the lower thoracic vertebrae had fractured dorsal processes. These fractures occurred because these lower vertebrae were originally attached to the lumbar parts unit, and the disarticulation method of this part at cooking butchery involved the application of force. First the meat was cut through at the approximate joint location (cutting through the joint from the ventral), and each segment was snapped back towards the dorsal direction to complete the separation, and this last action occasionally fractured the dorsal process.

Most ribs were individually disarticulated from the thoracic with a knife, and marks left from this activity were present in the appropriate location on the ventral transverse processes.

Eating marks of this vertebrae coincided with the location of disarticulation marks, as evidenced by the occurrence of gnaw marks (see Figure 7.41b-c). The number of eating marks was estimated by a combination of their mark type (i.e. tooth mark), observations at eating, and a spatial determination of marks not explainable by disarticulation (see Table 7.42b). Together these estimated eating marks make up about 13% of the total number of surface modification marks on the thoracic vertebrae.

Lumbar vertebrae (Figure 7.43, Table 7.44)

The reindeer lumbar vertebrae were almost exclusively disarticulated by knife for both parts and cooking butchery. The axe was occasionally used, and in one case resulted in lumbar vertebra being chopped in half (Fall R01). Tips of transverse processes were also fractured, most likely in the cooking butchery process when force was applied to assist the disarticulation. Disarticulation marks were seen on the ventral side of the body and on the cranial and caudal articular surfaces. Nicks and shaves on the dorsal process can only be explained as eating marks.

Ribs (Figure 7.45[5]) and sternum

Reindeer ribs were marked more frequently than that of *kabarga*, but the contrast of mark intensity between the two species were not as great as in vertebral elements. The fracture pattern differed between the two species in that the ribs were chopped into half by axe during the cooking butchery. Additionally, most of the rib heads were disarticulated carefully from at the thoracic, and only some heads of the more caudal ribs were fractured in a similar manner to *kabarga*. There were many disarticulation marks on the rib head, although the presence of eating marks (i.e. gnawing marks) suggests that there was a mixture of mark-leaving activities in this area.

Most marks away from the rib heads were made at eating, as there were no other observed actions that would produce these marks. Most such marks were cuts oriented perpendicularly to the long axis of the ribs, and shaves along the edge of ribs. While similar ‘cut’ type marks were observed on *kabarga* ribs, the marks on reindeer were distributed more liberally across the surface of the rib, and not concentrated on the dorsal side or the distal ends (as were the marks on the *kabarga*). Such marks on *kabarga* were explained as sternum disarticulation marks, but from the spatial distribution and from characteristics of reindeer

[5] In this figure, left and right ribs of one animal are presented as a group to clarify the association of each sample to animal. Blank spaces indicate that the rib(s) from that side were not recorded.

sternum removal[6], the marks away from rib heads in reindeer are most likely all eating marks. This notion is further supported by the relative concentration of marks found along the inner curvature of the rib, where the meat was harder to access with teeth alone. While evisceration could leave marks on the ventral surface (Nilssen 2000), observation of reindeer evisceration suggests that they would be minimal. Eating marks in Table 7.46 were determined by spatial location (as described above), and also using mark type (tooth mark) and eating notes.

The refitting of two rib halves were in many cases difficult, as the ribs were chopped in half by an axe, crushing the refitting ends, and fragments subsequently washed away. The proximal and distal fragments of the ribs were drawn on separate templates if the refit was not certain. This process creates artificial overlaps, and they were corrected using bone GIS. First, a MNE map was created for each reindeer, determining the excess overlap per animal (from the maximum number of ribs possible per animal, and from the number of ribs recorded as being in each parts unit), and removing the overlap. The MNE maps for each animal were then added together to get the total MNE distribution map (see Figure 7.45d). This process does not correct for the *under*estimates (i.e. the parts where the rib fragments do not connect, when they should), but as I tried in most cases to overestimate the coverage of fragments that did not refit (with bone GIS correction in mind) the bulk of the problem was fixed.

There was a clear spatial pattern of rib cutmarks, separating disarticulation and non-disarticulation marks. Unlike the pattern seen in the cranium, where axe-chopping was accompanied by a high number of associated marks (from preliminary scoring and axe slippage), there were few if any marks associated with the act of chopping the ribs in half, as a single blow usually sufficed (see Figure 7.45f).

The reindeer sternum was chopped by axe into small pieces (see Chapter 6). The most cranial (first) segment of the sternum was kept away from dogs, and occasionally (but not always) deposited with the *kabarga* cranium and reindeer atlas on the windowsill after being cleanly eaten. The other segments were frequently fed to dogs after a meal. Rib cartilages were left attached to the sternum unit until discard, as was the case with the *kabarga*.

It was impossible to refit sternum fragments, as the spongy bones were extensively smashed by axe along the cut. The sternum of Fall R01, Spring R01, and Spring R03 were all partially recorded, but it was difficult to quantify the % preservation due to the difficulty of reconstruction and will not be presented in this text. There was a difference in marking frequency and pattern between the first segment and the other segments. In the more caudal segments there were some ‘cut’ type marks near the axe-fracture lines, parallel to the fracture and most likely from unsuccessful chops with the axe. There were no eating marks recorded. On the cranial segment, there were two ‘cut’ marks and a ‘cut-shave-cut’ mark on the cranial extremity on the dorsal side. These were most likely

[6] Sternum disarticulation and knife-scoring prior to disarticulation (during the evisceration process) both occurred on the rib cartilage, close to the sternum.

eating marks, as the area is cartilaginous. However, these three marks all occurred on one sample (among three cranial segments observed), making the overall marking frequency rather low.

Innominate (Figure 7.47)

The reindeer innominates were processed mostly by axe. In parts butchery, the femur was first disarticulated from the innominate with a knife, then the sacrum was disarticulated by axe, and then the two sides of the innominate were separated by axe. In cooking butchery, each innominate was axed into two halves across the acetabulum after the larger pieces of meat were removed from the bone. The fracture patterns show that further unintended fragmentation occurred during axe-chopping events, mostly on the ilium. Surface modification marks were distributed all across the surface; including ‘shave’ and ‘cut’ type marks associated with axe fracture lines.

For three elements (innominate, humerus, and femur), marks on the visible bone surfaces of Spring R04 and R05 were recorded immediately after parts butchery. These marks are thus definitely and exclusively from disarticulation. The comparison of these marks to surface modification on other reindeer is shown in Table 7.48a. In the case of the innominate, this comparison merely indicates the obvious; that disarticulation marks would be concentrated on the acetabulum. The frequency of marking of the innominate at eating varied considerably by sample, with one right innominate (Fall R01) more extensively marked than most.

Sacrum (Figure 7.49, Table 7.50)

Only two reindeer sacra were recorded. The sacrum was disarticulated from the lumbar unit in parts butchery using a knife, and from the innominate using an axe. Axe-disarticulation resulted in the fragmentation and loss of the sacral wings in a fracture pattern similar to sacra of *kabarga*, which were processed using an axe as well. Cranial disarticulation occurred in one case at the epiphyseal joint instead of the articular surface (Spring R01).

Scapula (Figure 7.51)

The scapula was disarticulated from the body of the carcass with no contact of the knife to bone. The disarticulation of the humerus from the scapula was done with a knife at cooking butchery after excess meat was removed. The reindeer scapula was then chopped by axe into small pieces, much like the sternum. Smaller fragments of the scapular blade produced by chopping were removed immediately and thrown into the fire, as they were sharp and not desirable in soup dishes.

Disarticulation of the humerus from the scapula left marks in the glenoid cavity. There were also marks on the distal shaft of undetermined cause (probably from eating), and marks on the blade definitely from eating. Corrected numbers of cut marks (CNC) were calculated for three zones, as described for *kabarga* (Table 7.52).

<u>Humerus (Figure 7.53)</u>

The reindeer humerus was heavily marked at disarticulation on both articular ends. The disarticulation of the radioulna occurred first, in field butchery, when the lower *kamus* parts were removed. The humerus remained attached to the scapula in parts butchery, and disarticulated from the scapula in cooking butchery after most of the meat was taken off from both scapula and humerus. Both disarticulation processes were by knife. The humerus was subsequently chopped in half by axe. The axe-chopping was done by a series of small controlled blows applied all around the midshaft, through a layer of meat, which in most cases resulted in the clean break of two humerus halves (i.e. with little to no extra fragments).

Removal of the radioulna produced marks on the distal condyles, perpendicular to the long axis of the bone and consistent with disarticulation marks seen in *kabarga* and documented by Binford (1981) and Nilssen (2000). There were no discernable differences between individual butchers.

The disarticulation of the humerus and scapula produced a surprising number of cuts on the proximal head of the humerus, considering that the disarticulations observed used mostly smooth and economical movements, with minimal forceful cutting or sawing with the knife blade. Presumably the knife skidded against the articular surface, causing a series of cuts parallel to each other across the articular surface.

The chopping of the humerus into two halves – in a series of small chops – left marks consistent with the observed method (small parallel cuts along the midshaft fragmentation line). The proximal humeri from one animal (Fall R01) were chopped further by axe after eating both the meat and marrow, for the purpose of giving a spongy bone fragment to a dog. For this specimen, there were more chop marks along the fragmentation line in the proximal area. For other specimens, marrow was eaten only from the opening in the midshaft and the two halves were not fragmented further. Aside from axing marks, reindeer humerus modification patterns were generally similar to that of the *kabarga* (see section 7.3.1).

There were four additional old reindeer humeri recorded, belonging to animals hunted before or in between field seasons but consumed during the field season (Figure 7.53f). These bones showed a similar fragmentation and mark pattern. One sample was also fractured further in the distal end for marrow access, and one half of the distal end was given to dogs.

As with the innominate, disarticulation marks of Spring R04 and Spring R05 were documented after parts butchery (i.e. the removal of radioulna). These disarticulation marks were tabulated by surface modification mark type (Table 7.54a).

Eating marks were mostly found around the proximal head (Table 7.54b: double dots), and agree with the position of filleting marks described by Nilssen

(2000), suggesting that they were made at meat removal. Marks associated with chopping were found around the fragmentation line (Table 7.54b: gray dots). Both sets of marks were removed before calculating the corrected number of cutmarks (CNC) for disarticulation, which were calculated for five zones, as described for *kabarga.*

Radioulna (Figure 7.55, Table 7.56)

The radioulna was disarticulated from the humerus during field butchery, and then from the carpals and metacarpals in *kamus* butchery. The radioulna were then cleaned of periosteum and cracked for marrow. The radioulna was never cooked.

The disarticulation from the humerus left more marks on the humerus than on the proximal ulna, as was the case with *kabarga*. The marking pattern was more or less the same, and there were no marks that could be attributed specifically to *kamus* butchery, which was a process specific to reindeer and characterized by careful skinning. On the radioulna, however, the *kamus* skin did not come into contact with bone and thus the results do not contradict observations.

While less intensively marked than distal humeri, the proximal end was the most intensively marked area within the radioulna. Distal disarticulation resulted in the next highest frequency of marks. The carpals were removed in all but one observed sample.

The anterior of the radius was extensively fractured. There were 'nick' type marks where the point of a knife was inserted to remove a fragment to gain access to the marrow. Periosteum cleaning marks were observed on both the anterior and posterior sides of the bone. The ulna was infrequently marked, except for marks on the posterior ulnar shaft where the point of the knife seems to have dragged during periosteum cleaning. There was no discernable differences of marking or fracture by butcher. The corrected number of cutmarks (CNC) for disarticulation was calculated for five zones, as described for *kabarga.*

Metacarpal (Figure 7.57)

The metacarpals were disarticulated from the radioulna, carpals, and hooves during *kamus* butchery. All reindeer metacarpals were cracked for marrow, unlike *kabarga*. Marrow-cracking involved chopping both distal and proximal ends with an axe, and applying further hammer strokes where necessary (see Chapter 5). In the best-case scenario, the two strokes of axe at both ends would result in a cleanly halved metacarpal. The axe chops were initially delivered from the posterior side of the bone, although in some cases additional chops were delivered from the anterior.

The bulk of the marks on the metacarpal were from disarticulation of phalanges and hooves, which left a series of small parallel 'cut 'or 'shave' type marks, perpendicular to the long axis of the bone on the posterior distal surface. While skinning marks from *kamus* butchery would fall in the same location, the posterior concentration suggests that most if not all were in fact disarticulation marks rather than skinning. Carpals were extensively marked compared to the articular surfaces of the distal radioulna or proximal metacarpal, suggesting that the knife was used with point and blade facing towards the carpals while holding the long bone with the aim of popping the carpals off. The overall marking frequency was much higher in reindeer than *kabarga* (Table 7.58). The corrected number of cutmarks (CNC) for disarticulation was calculated for three zones, as described for *kabarga.*

Femur (Figure 7.59)

The femur was disarticulated at parts butchery from the innominate and the tibia. The patella remained attached to the femur. The cooking butchery of the femur followed a pattern similar to the humerus, with meat being filleted off in several episodes (in most cases without any bone being exposed) and then the bone being chopped in half by axe.

The disarticulation of the femur from the innominate and tibia left marks similar in distribution and type to those of the *kabarga*, with a roughly proportionate increase in mark frequency across five zones. While filleting usually left no marks, there was a series of parallel marks on Fall R01 (on the anterior midshaft) which most likely resulted from a closer-than-usual meat removal job before chopping the femur in half. The femur was chopped into two halves using a series of small axe chops around the midshaft, as was the case with humerus. There were a high number of marks associated with this action, as was the case with the humerus.

The marrow was usually eaten from the opening at midshaft, but in some cases both proximal and distal ends were chopped by axe on the chopping-block to get at the remaining marrow. If the eater made the trip to the chopping block, s/he commonly aimed to take the distal condyles off to give to dogs, resulting in the fragmentation of the distal end into smaller pieces as compared to the proximal. Old reindeer femora also showed a similar pattern of fracture and marking.

Surface modification marks of Spring R04 and R05 after their disarticulation at parts butchery were tabulated in Table 7.60a. Eating, axing, and disarticulation marks were separated out using spatial, mark type, and note-based classification (Table 7.60b). Three sets of corrected number of cutmarks (CNC) were calculated for five zones (as described for *kabarga*); one using all surface modification marks, one excluding axe marks, and one excluding both eating and axing marks.

Tibia (Figure 7.61, Table 7.62)

The tibia was disarticulated from the femur at field butchery, and disarticulated from the tarsals and metatarsal at *kamus* butchery. The tibia was then cleaned of periosteum and cracked for marrow in its raw form. The tibia was never cooked.

Overall the frequency distribution of the marks across zones is similar to that of the *kabarga*, but there were more marks on reindeer per zone. The proximal articular surface often had ‘shave’ type marks near the posterior edge, agreeing with the observed method of disarticulation. It should be noted that marks were similarly positioned in *kabarga*, but as marks on reindeer were more frequent, they are presented in cranial view in the figures for legibility. *Kamus* butchery might have left a mark on the reindeer tibiae (on the proximal posterior shaft of right Fall R01 tibia) – this mark is judged to be possibly from skinning from the position of the cut relative to the length of the tibia and its orientation.

The distal disarticulation marks were more likely to be ‘nick’ type marks, probably left because more force was required to dislodge the astragalus in this larger animal.

The tibia was cracked for marrow using the axe, with blows delivered on both distal and proximal ends. The shaft portion was hammered further if they did not break cleanly after the two axe chops. The tibia was cleaned of periosteum, but marks associated with this activity were not identified. The corrected number of cut marks (CNC) was calculated for five zones, as described for *kabarga*.

<u>Metatarsals (Figure 7.63, Table 7.64)</u>

The metatarsal was disarticulated from the tibia, tarsals, and hooves during *kamus* butchery. In most cases the distal tarsal pack remained attached to the metatarsal even after the sequence of ‘tarsal removal’ (i.e. only the calcaneus and astragalus were taken off). As a side note, the calcaneus and astragalus in some cases came off together, and in other cases one by one, but they were definitely taken off before marrow cracking.

As was the case with the metacarpals, most marks on the metatarsal were from hoof removal, with marks mainly left on the posterior distal end. Definite skinning marks from *kamus* butchery were also not identified.

The bulk of the marks on the metatarsal were from disarticulation of phalanges and hooves, with marks generally identical in type, orientation, and position as described for the metacarpal. The corrected number of cutmarks (CNC) for disarticulation was calculated for three zones, as described for *kabarga.*

7.3 Discussion

The comparison of reindeer and *kabarga* surface modification will be discussed together with the comparison of these two animals to Nilssen's dataset of small (size class I and II) and large (size class III and IV) African bovids (2000). The comparison between butchery marks left on different animals *within* the study group sample and to animals butchered in a completely different cultural context aims to answer the question "is the main determinant of butchery mark frequency and placement the anatomy of the animal?" If anatomy is the main determinant, as is expected in the 'uniformitarian assumption' test expectation, the surface modification of ungulates should resemble each other most closely within size classes; small African bovids should be similar to *kabarga*, and large bovids to reindeer. This size-based similarity should be greater than that within the two Siberian samples and two African samples.

In case that size is not one of the main factors that determine butchery – in other words, in case that variation in surface modification cannot be pinpointed to this single cause, another question would be asked: would the variation *within* a size/species dataset – between different butchers or different butchery events – be as great as the differences *between* size/species? As had been noted in the previous sections, with the possible exception of *kabarga* mandible disarticulation (with Yakov leaving a higher frequency of marks), there were no differences observed in surface modification marks left by individual butchers[7]. However, there were differences between each butchered specimen within each skeletal element, as is evident from the figures in this chapter. These variations had occurred despite the intent and execution of the butchery being redundant to the extreme. This question in effect asks how useful averaged values (such as CNC) would be in representing the butchery pattern.

Nilssen's actualistic study was conducted among seasoned butchers who regularly butchered wild game using metal tools to produce dried meat and sausage. His dataset was recorded using the same bone GIS method and this study matched his in coding and methodology wherever possible. An important difference between Nilssen's study and this one is the primary use of the carcass – dried meat vs. soup – which caused meaty bones in Nilssen's sample to be fully filleted, sometimes while skeletal elements were still articulated. This study's animals were processed in a quite opposite manner.

The possibility of "differences in culinary processes" affecting the butchery pattern has been noted by Nilssen (2000:358) as well as in many other previous ethnographic studies (Bunn, et al. 1988; Gifford-Gonzalez 1989a; Yellen 1977), particularly in the context of boiled vs. filleted use. In this section, an attempt to directly compare these disparate datasets is made by using a) activity categories and b) the corrected number of cutmarks (CNC) generated by the bone GIS method.

[7] Yulia's inexperienced butchery also affected frequency and placement, but these novice's attempts fell within the range of variation produced by more experienced butchers on a 'bad day'. In contrast, Yakov's difference in butchery style is (presumably) permanent and is a concrete example of idiosyncratic difference in butchery.

The frequency of marks on reindeer and *kabarga* bones were converted to a value called the *corrected number of cutmarks (CNC)* which extrapolates the number of expected cuts on a single bone (or zone) from multiple fragmentary samples using the MNE density map provided by the bone GIS system. For most elements, two sets of this value were calculated: one that represented the total CNC (called *total CNC*) from all the processes that affected the bone (including various forms of butchery and eating); and another set which excludes marks from the more obviously animal-specific or culture-specific activities (e.g. the chopping of the femur and humerus in half in reindeer, marrow-cracking percussion marks on the lower limb bones on reindeer) as well as known eating marks before calculating the CNC. This latter will be called *disarticulation CNC*, as the majority of marks counted in this set should be from the action of disarticulating one skeletal element from another. While disarticulation CNC most likely still included marks that were not specifically identified to cause (such as unidentified marks from eating), this set eliminated the more obvious causes of difference and should correlate between different animals if anatomy was the main driving cause of butchery and by extension, butchery marks.

A similar process was used to make 'total' and 'disarticulation' datasets for Nilssen's data using his activity categories and his MNE counts. By observing the butchery procedure closely, Nilssen's was able to assign activity categories to each surface modification mark, such as "filleting", "disarticulation", "filleting and disarticulation", "skinning, disarticulation, and filleting" etc. (2000:380). For Nilssen's total CNC, all activity categories were included in CNC calculation, while the disarticulation CNC excludes purely non-disarticulation activity categories such as "filleting" and "skinning". It should be noted that all mixed categories (e.g. "filleting and disarticulation") were included in the calculation for disarticulation CNC (see Table 7.66b for details). As all of Nilssen's samples were complete bones, the correction by surface area that would usually involve a MNE density map was equivalent to dividing the number of cutmarks by the number of elements (i.e. sample size, or MNE count). Thus, total CNC was calculated for Nilssen's data by summing all cutmark counts from all activity categories and dividing by sample size, and disarticulation CNC was calculated by summing cutmarks from only disarticulation-related activity categories and dividing by sample size.

Larger patterning among the four datasets (*kabarga*, small African bovids, reindeer, and large African bovids) should be discussed first. Nilssen noted in his comparison of large and small bovids that, if butchered under similar conditions, "large bovid bones should retain significantly more cut marks than the bones of small bovids" (2000:353). This relationship held true between reindeer and *kabarga* for all long bone elements and most of the axial elements. The percentage of bones that had more than one mark (Table 7.65) illustrates this point most clearly, but the comparison of CNC by element (Tables 7.66, 7.67, 7.71, 7.75, and 7.79) tells the same story as well.

One element that did not follow the 'larger animals would be marked more' pattern in the within-Siberian comparison was the scapula, which was a relatively unmarked element in both *kabarga* and reindeer. In the comparison of the percentage of bones marked, *kabarga* scapulae were more frequently marked, although in the comparison of total and disarticulated CNC, the relationship reversed[8]. This is an example of the palimpsest drowning out individual variation. Aside from this one element, most skeletal elements (both axial and non-axial) from the Siberian dataset thus support the expectation that anatomy dictates butchery, in that size and mark frequency was positively correlated. While the size difference resulted in a) non-axial elements of reindeer being chopped smaller, and b) smaller elements of *kabarga* not being disarticulated until the eating process, each element was otherwise processed in a similar manner for these two species.

This 'larger animal would be marked more' pattern was also observed in the relationship between small and large African bovids by Nilssen (2000: 353). However, when the animals were compared across Siberian and African datasets, the CNC for reindeer were not always (i.e. for every skeletal element) larger than the CNC of small African bovids, even when using disarticulated CNC (Table 7.65). Thus, in this cursory examination, the hypothesis that anatomy is the determinant of butchery mark intensity (with intensity varying proportionally by size alone, all other conditions being equalized by the similarity in anatomy among ungulates) did not hold true for each and every skeletal element when examined across cultural and geographical boundaries.

So far, however, the comparisons were between (in most cases) single numbers representing the total number of cuts per element. Non-axial (long) bones could be examined in a more detailed manner by comparing the spatial distribution and intensity of marking by zone. The humerus, radioulna, femur, and tibia were chosen for further examination of mark frequency and placement.

Nilssen's data for these elements were presented across five anatomical zones, so the same system was used for this study. The comparison between four animals was made using linear correlation analysis. In addition, for each element, complete or nearly complete specimens with surface modification marks were added to the analysis as samples of individual variation. Bones missing large fragments were omitted, as they would not have the same distribution of marks as whole bones. The linear correlation analyses thus examine the relationship between averaged (palimpsested) *kabarga*, small bovid, reindeer, and large bovid, as well as individual specimens of *kabarga* and reindeer.

<u>Humerus (Table 7.67)</u>

The CNC across five anatomical zones of the humerus for the four animals (*kabarga*, small bovid, reindeer, and large bovid) are shown in Figure

[8] An element that did not follow the pattern in Nilssen's dataset was the lumbar vertebra, which showed a higher frequency of marks among small bovids. This is in effect a sampling error: the large bovids were butchered using different strategies (including disarticulation-only samples) and were larger in sample size, while the sample size of small bovids was smaller and were mostly filleted (Nilssen 2000). Thus the direct comparison of *total* CNC between these two groups is probably not valid. When using disarticulation CNC (Table 7.66), the expected relationship holds true for lumbar as well.

7.68. The total CNC varies greatly by animal, with no significant linear correlation between any pair (Figure 7.68c), indicating that the palimpsest of various factors going into butchery and use leaves marks that are quantitatively different in distribution among these four datasets.

The disarticulation CNC showed a significant correlation in its mark distribution pattern between *kabarga*, small bovids, and large bovids, while the relationship was almost significant between reindeer and *kabarga* (0.851, critical value 0.878 for p< .05). In other words, the humerus was disarticulated in the same manner across body size and across the Siberia-Africa dichotomy – suggesting that in this case, anatomy was the prime determinant for surface modification mark placement. Interestingly, while the ratio of marks across zones was similar (i.e. the spatial distribution of marks; thus the significant relationship), the absolute number of expected marks on both proximal and distal epiphysis zones (i.e. the intensity of marks) was much higher in the Siberian dataset than the African dataset.

Figure 7.69 shows the mark frequencies of individual specimens against the CNC of the four animals. While the frequency of surface modification marks of each bone are discrete values and a bar graph is more appropriate, the number of samples necessitated the presentation in line graph format. Figure 7.69a shows individual specimens of reindeer (gray lines) compared to the total CNC for four animals. As the total CNC for the latter four were not significantly correlated, it was expected that individual reindeer specimens would all correlate most closely to the reindeer total CNC than that of any other animal. However, one sample (left Spring R02) was correlated more closely to *kabarga* total CNC instead (Table 7.70a). This result indicates that the variation could be as great within the animal as between animals.

Among the individual *kabarga* specimens were also some that correlated with CNC of other animals more closely (Figure 7.69b, Table 7.70b; left Spring K15 and right Fall K02), although in this case they resembled the disarticulated CNC of small and large bovids, which were statistically correlated to *kabarga*. The individual *kabarga* samples also included a very anomalous sample (right Fall K11). What is interesting is that this sample was effectively ‘drowned out’ in the CNC for *kabarga*, mimicking what would probably happen in archaeological and ethnographical datasets.

<u>Radioulna (Table 7.71)</u>

The total CNC for the four animals show extreme variation, especially between Siberian and African animals, in the intensity of marks on the shafts (cortical bone). While this was true for the humerus as well, it is more obvious in the radioulna due to the extremely lightly marked nature of the Siberian radioulnae (Figure 7.72a). The surface modification marks on the shaft in African sample were mostly due to filleting for the humerus and mostly due to skinning for the radius (Nilssen 2000: 107,111,114,117).

Surface modification marks on the distal radioulna also reflect differing butchery styles. Most reindeer bones were disarticulated between the carpal and the distal radioulna, resulting in a high number of cuts on the distal epiphysis zone. Comparable intensity of marking was not seen among the African sample, as the African butchers usually disarticulated *between* proximal and distal carpals (Nilssen 2000:123). Correlation was thus disrupted by stylistic factors, and was not significant between Siberian and African animals. There was, however, a highly significant correlation between total CNC of reindeer and *kabarga*, as they were generally similar in butchery procedure other than the difference in distal disarticulation.

The relationship between disarticulation CNC was highly significant between *kabarga* and small bovids, and also significant between *kabarga* and large bovids, due to the lack of distal disarticulation marks, as *kabarga* radioulna-metacarpal disarticulation used force to snap the joint (Figure 7.72b, c). Again due to the difference in the intensity of distal disarticulation marks, the reindeer disarticulation CNC did not correlate to any other animal. Thus, for this element, the expectation that disarticulation marks would be universally the same (if anatomy dictates butchery) was not met. It should be noted that the expectation was not met due to a concern for *completeness* of disarticulation in reindeer by the study group.

The individual reindeer specimens were highly varied in surface modification mark frequency across zones, and nine out of ten specimens did not significantly correlate to disarticulation CNC for reindeer (Figure 7.73a, Table 7.74a). A few individual reindeer specimens correlated with *kabarga* disarticulation CNC (left and right Fall R01), but these were 'false positives' coming from the paucity of marks on the distal zone of these individual specimens. Individual specimens of *kabarga* were 100% correlated to *kabarga* disarticulation CNC and were significantly correlated to the disarticulation CNC of small bovids ($p < .01$) and large bovids ($p < .05$) (Figure 7.73b, Table 7.74b). Overall, the frequent occurrence of null-value zones (3-4 out of five zones) in disarticulation CNC makes the results of correlation analysis dubious at best.

<u>Femur (Table 7.75)</u>

The total CNC of reindeer and *kabarga* femora were almost, but not quite, significantly related (Figure 7.76a, c). That they were similar at all was a surprising result as the total CNC for reindeer included cuts in the midshaft from axe chopping, while the total CNC for *kabarga* did not. The relationship between these two animals was also significant for disarticulation CNC (Figure 7.76b, c). There were no significant linear correlations between other pairs, in both total and disarticulation CNC. Thus, the expectation that anatomy dictates butchery was upheld within the cultural group only.

The large number of marks on the shaft seen in African animals' total CNC, due to the process of filleting, was the major difference between African and Siberian samples. There was also another major difference in femur surface modification mark distribution between the two cultural/geographical groups: Siberian animals had a higher number of surface modification marks on both proximal and distal end zones – in both total and disarticulation CNC, indicating that most of these cuts were from disarticulation – when compared to its African size-class counterparts. This pattern was observed in the humerus as well. This difference most likely came from the study group disarticulating while there was still meat on the bone, while African butchers disarticulated after filleting. This is a clear example of anatomy *not* dictating butchery, as disarticulation marks that are commonly assumed to be universal were, in fact, not. Rather, it was the intended use of the animal (i.e. the study group was butchering *in anticipation* of boiling-soup culinary use) that determined the pattern.

There was not much individual variance in reindeer femur, and all individual specimens showed a negative correlation with African animals' CNC, supporting the conclusion above (Figure 7.77a, Table 7.78a). For *kabarga,* the individual specimens were slightly less uniform, with one (right Spring K02) showing a significant linear correlation to disarticulation CNC of large bovids (Figure 7.77b, Table 7.78b).

<u>Tibia (Table 7.79)</u>

The total CNC of the tibia was dissimilar between Siberian and African animals, as the African animals were marked extensively in shaft zones from filleting while at the same time their distal ends had infrequent marks (Nilssen 2000:140-3, see also Figure 7.80a, c). Disarticulation CNC of African bovids was also dissimilar to either reindeer or *kabarga*. Small bovids virtually had no disarticulation marks. The pattern of large bovids could be a recording bias; many marks on the distal shaft (zone 4) were marked "skinning, filleting, and disarticulation" and were included in the calculation of disarticulation CNC, but were most likely just from skinning. Like the femur, the surface modification pattern of tibiae was not dictated by anatomy, but rather by culinary use (i.e. filleting for African bovids). Reindeer and *kabarga* were significantly correlated to each other in both total and disarticulation CNC (Figure 7.80b, c).

The individual samples of reindeer showed great variation, as was the case with the radioulna (Figure 7.81a, Table 7.82a). In one case (left Spring R02) the specimen was significantly correlated to small bovid total CNC, but this was because this specimen was only marked on the midshaft. Some reindeer specimens resembled *kabarga* total CNC. Individual specimens of *kabarga* also varied from *kabarga* disarticulated CNC (Figure 7.81b, Table 7.82b), but verall, individual variation did not jump the Siberian/African divide.

7.4 Summary

To apply the findings of actualistic studies to zooarchaeological collections, reasoning by analogy must be employed (see discussion in Section 1.3.2). Cross-cultural applications of ethnoarchaeoloigcal and experimental data rely heavily on the central assumption of methodological uniformitarianism in butchery; an assumption that surface modification marks are practically and efficiently placed (Lyman 1987) and that anatomical constraints would encourage redundancy in butchery marks (Guilday et al. 1962). The 'uniformitarian assumption' leads one to expect that butchery marks would be fundamentally similar across all ungulates. This chapter tested this assumption by looking for idiosyncratic variations in butchery marks, and by comparing butchery marks across a wide cultural/geographical boundary while holding methodology constant.

In general, the 'uniformitarian assumption' held up in this study of surface modification as individual butchery styles were not evident in modification, with the exception of *kabarga* mandibles. Differences in butchery patterns among butchers were more obvious in the processing of soft parts (e.g. Sasha's style of *kabarga* fur removal) and in the *order* of processing (e.g. Sasha's typically leaving the reindeer carpals attached to the radioulna instead of the metacarpals). Despite these differences, each skeletal element was separated out into element by the time of discard[9] and had gone through the same number of opportunities to get marked, often through the hands of multiple butchers. If the observed differences in order caused any differences in mark placement and frequency (e.g. the disarticulation of the carpals from the radioulna by Sasha could have involved different techniques without the leverage afforded by an attached metacarpal), they were not recognizable as such among the plethora of marks.

While some butchers produced significantly more marks than others (a notable example is Yulia's butchery of the reindeer atlas), the variation *between* butchers in total mark frequency usually was not any greater than the variation by *one* butcher in different butchery situations. Also, while intensity varied by specimen, the spatial distribution (i.e. the anatomical placement) of the marks did not vary. To rephrase, there were variations in butchery mark frequency and placement that were identified to various causes observed during the butchery process, but these variations were strictly case-by-case and no identifiable quantitative patterns emerged overall.

While the 'uniformitarian assumption' test expectation – that anatomy is the prime determinant of butchery pattern – also held for butchery *sequence* determination (as seen in Chapter 6) and held (as summarized above, and in the sense that larger animals were more intensively marked) when compared *within* the study group's data, there were disagreements with this expectation when the comparison was expanded to Nilssen's African dataset. Using experienced

[9] An exception is the *kabarga* cervical vertebrae, where 2-3 pieces were occasionally still connected at discard, but if and what vertebrae were left connected did not vary by individual butcher. The *kabarga* mandible (with left and right sides attached) and the patella/femur is another example of incomplete disarticulation, but these elements were consistently butchered in this way by all individuals.

butchers, ungulate species, and metal tools, the South African study's conditions were comparable to the study group's. The methodology was also held constant through the use of bone GIS in both studies. At least the disarticulation marks on long bones of African bovids and Siberian deer were expected to be similar in terms of intensity and spatial distribution across zones. In both intensity and spatial distribution, there were counterexamples that indictated another factor other than anatomy influenced the frequency and placement of surface modification marks.

That factor was culinary preference (filleting vs. boiling). The differences from culinary practices were clear and statistically testable for long bone elements such as the femur. This study quantitatively confirmed the assessment made by many other researchers that the culinary process is a major factor in butchery mark frequency and placement (Binford 1981; Bunn, et al. 1988; Gifford-Gonzalez 1989a; Nilssen 2000; Yellen 1977). In light of this confirmation, it is impossible to understate the importance in selecting the appropriate comparative sample for zooarchaeological analysis. Past detailed surface modification studies (Binford 1981; Nilssen 2000) and butchery studies in general were focused on filleting-based butchery strategies. The study group's near-exclusive preference for boiled food makes this study an excellent ethnoarchaeological analog from the other end of the boiling-filleting spectrum. It is hoped that the CNC and spatial distribution presented in this chapter for reindeer and *kabarga* would be used as the boiling-pattern reference for future archaeological studies.

Chapter 8: Conclusions

This study was an ethnoarchaeological study of hunting and butchery among a small group of forest-dwelling Evenki hunters in Siberia. The objective of this study was zooarchaeological, and three specific aspects of subsistence behavior – hunting, butchery, and surface modification – were the focus of my study.

This study was loosely structured around two test expectations, one ethnoarchaeological, and one zooarchaeological. The first test expectation was that the subsistence pattern of this study group would fit into frameworks set up by previous studies of hunter-gatherers. This test expectation served as a check for where this study group deviated from the 'typical hunter-gatherer' norm and stimulated the exploration of reasons behind deviations. It also served to ultimately judge this study's applicability to the archaeological record. The second test expectation was that the anatomy of the prey species (ungulates) would be the primary determinant of the butchery process. Testing this basic assumption in zooarchaeology, commonly called the 'uniformitarian assumption', was the main analytical goal of this study.

8.1 On the ethnoarchaeological aspects of this study

The mobility patterns, general subsistence activity patterns, overall patterns and specific cases of hunting, transport, and carcass use by the study group was compared against ethnographical and ethnoarchaeological studies in each section. The Evenki were one of the circumpolar peoples distributed across the circumpolar region which includes both the tundra and *taiga* (boreal forest) zones, or the Arctic and the Subarctic. Peoples in this region shared not only a cold and harsh environment, but a religious belief that included animal ceremonialism which manifested in "the maintenance of a respectful attitude to the animal, and the proper treatment of its remains after it ha[d] been killed and eaten" (Hultkranz 1994:357). This cultural trait unsurprisingly had a large effect on the hunting and butchery behavior of circumpolar groups including the study group.

The Evenki were distributed across a wide swath of Siberia, both tundra and *taiga*, and were engaged in various forms of subsistence. However, the prototype forest-dwelling Evenki had traditionally been hunters of large forest game such as woodland reindeer, red deer, and moose, and also skilled trappers of fur animals such as sable, ermine, and squirrel. These hunters dispersed in small family units for most of the year and hunted within clan territories, and kept a herd of domesticated reindeer exclusively as transportation aid (i.e. not as a food source). Among circumpolar groups, only those on the Eurasian continent had traditionally exploited domesticated reindeer. Of the many forms of reindeer domestication documented among groups with domesticated reindeer (Ingold 1980; Krupnik 1993), the forest Evenki's way of using small numbers of very tame forest reindeer for riding, pack-carrying, and sled-pulling has a long tradition, possibly being the original form of reindeer domestication. The study group kept a herd of domesticated reindeer in this forest Evenki fashion. The presence of domesticated reindeer aided the study group greatly in terms of their mobility and undoubtedly affected their hunting and transport strategies.

The Northern Transbaikalia area where the study group resides had been historically renowned for its abundant fur animal population, especially of sable, an animal whose fur was known as 'soft gold' and was important as a currency in outside trade and tribute. Their particular region was also known for its reindeer-friendly environment and the high population of domesticated reindeer it once supported. Within this favorable environment, the study group has positioned itself in a location with access to lakes, rivers and their aquatic resources, with relatively mild climatic conditions and a healthy population of major ungulate prey. At the time of the field study, recent political and economical conditions had prompted an exodus of Russian and native families from the area, and the study group was left with nearly exclusive access to this very good hunting ground as well as a lot of equipment that was left behind by those who left. Due to these multiple factors, the study group had become relatively sedentary in recent years, supporting themselves comfortably by hunting during the colder months and by fishing in the summer.

While maintaining a subsistence lifestyle, the study group was also nevertheless connected to the outside world and its market economy. Barter for bullets and commercial foodstuffs were supported by fur animal hunting in particular. The study group was basically a single family, and their group composition at the time of the field study was four adult males and one adult female; an abnormally high ratio of adults and hunters per family. The small group size, high worker/hunter ratio, and inclusion into the marketing economy were characteristics found in North American Subarctic groups involved in the fur trade at the turn of the century and such societal conditions have been termed "atomistic societies" by anthropologists (Honigmann 1968). While not uncommon among circumpolar groups, atomistic societies are routinely excluded from global surveys of hunter-gatherers, as they result from modern conditions (Binford

2001). However, as a case study of an Evenki group, the study group was probably as 'traditional' as could be at this time.

Such were the general conditions of the study group. Fieldwork covering their cold-weather hunting season showed that their mobility pattern was at the extreme logistical end of the spectrum, as expected for high latitude groups in global surveys (Binford 2001; Kelly 1995). Hunts were well planned in advance; each logistical campsite seemed to be chosen near a 'fallback plan' resource. Weather, location, distance from residential camp, or type of base camp (residential or logistical) did not seem to significantly affect the way each day trip, or potential hunting event, was conducted. On a logistic move, hunters moved outside the usual activity diameter and simply re-created the daily activity pattern in a new location (i.e. new river valley).

The study group's main hunting method was to search and track each animal on foot. The study group hunted two kinds of large mammal prey during the field season – *kabarga* (musk deer) and reindeer – as well as a variety of fur mammals, birds, and fish. *Kabarga* and other small game were hunted opportunistically, while reindeer and sable (two prey species that were culturally and economically important to the study group) were strategically hunted. While on hunts, each hunter hunted alone and took care to canvass a different area on their hunting trips. Their knowledge of the area and their understanding of prey behavior, combined with a careful visual search, usually resulted in the discovery and successful pursuit of fresh tracks on each hunt.

A major break from expected behavior was the study group's lack of emphasis in storage, as was expected for high latitude groups in global surveys (Binford 2001; Kelly 1995). Their usual strategy was relatively immediate and complete consumption of their hunt results without thought for long-term storage to get through the leaner months. In other words, a carcass was usually consumed completely before going out to hunt another, and meat storage was by freezing large chunks and not drying (the former would not last during the warmer months). This de-emphasis on storage was made possible by the study group's increased access to aquatic resources and the trapper-trader aspect of their economy that brought in commercial foodstuffs into their diet (which was in fact a traditional economical mode for the Evenki since the 1600's (Anderson 1999a)). Combined, fish from lakes/rivers and commercial salt to preserve them provided the study group with enough food during the lean summer months to a point that they stopped making dried meat for storage. During the hunting season, the rich hunting environment in which the study group currently found themselves in negated the need for storage. Their forest environment was stocked year-round with non-gregarious meat animals, which were in effect evenly spread around their territory without much hit-or-miss. In this environment, using their domesticated reindeer, hunting dogs, and guns, the study group was able to predictably procure large game through encounter hunting in the colder months. In effect, the forest environment and high mobility provided by domesticated reindeer resulted in an exploitation strategy that could be termed ‘storage on the hoof’[1]. It is interesting to consider that under these conditions, there would have been no incentive to intensify or change their domestication strategy to that of more intensive forms of pastoralism.

Another break from ‘typical’ hunter-gatherer expectations was their transport pattern. Unlike what was predicted by Binford’s utility model or the Hadza transport model (Binford 1978; O'Connell et al. 1988, 1990), the study group did not discard low-utility parts or non-edible parts to reduce transportation costs. Instead, they invariably transported both their small (*kabarga*) and large (reindeer) prey whole. This pattern of complete transportation was not simply the product of the advantage given by the reindeer as pack animal; the combination of ecological conditions and hunting patterns also nearly guaranteed that the catch per hunt would be small enough to transport back completely without difficulty. At the same time, the study group’s beliefs in animal ceremonialism dictated the respectful treatment of carcasses, and Evenki ceremonialism was geared towards complete transport.

Lastly, this study group was noteworthy in its small size and its isolation; in this case study, the need to share parts of the carcass did not arise as the study group lived, cooked, and ate as a single group and lacked relatives and neighbors in the area to share with. As documented throughout this text, the study group exhibited activity patterns that were highly redundant in terms of hunting method, did not differentially transport their prey, and butchered with little variation. This redundancy resulted from the combination of factors and circumstances above.

The redundancy in hunting, transport, and butchery across seasons and prey size was anomalous among hunter-gatherer studies and was at least partially caused by modern conditions. Still, the characteristics of butchery and use patterns that resulted from such conditions provided a unique look into the situation in a small ‘single-hearth’ group. One fruitful inquiry was into their sequence and method of carcass part use. Their ‘use order’ of carcass parts, which was studied completely due to the lack of sharing or differential transport, proved highly uniform in this study. It suggested that the study group followed a set order of preference for using parts, rather than following *ad hoc* decisions made by the cook. This order did not correlate with economic utility; it characteristically favored axial elements over limb parts, and it was most likely based on quality of meat instead of quantity of meat (i.e. economic utility). This order of preference in fact highly significantly correlated with the preference order given by the Nunamiut (Table 8.1), suggesting that this ranking might be at least as valid in modeling carcass parts choice (e.g. for transportation decisions) as economic utility indices.

How useful, or how applicable, would this study be as an ethnoarchaeological study? I consider this study to be widely applicable, as many aspects of this study group’s behavior provides an example of ‘what would happen to small, independent groups practicing immediate return hunting’. For example, the redundancy and completeness of carcass use resulting from this

[1] Thanks to K. Twiss for this term and her insight.

small group could be a useful analog to analyze early colonization sites from the early Middle Paleolithic in Europe. Redundancy and an absence of any evidence of sharing is a characteristic of Neanderthals (Petitt 1997) that has often been interpreted as primitive. This study suggests that these traits could be simply characteristics of small groups in non-marginal environments.

It must be conceded that the study group's overall hunting and butchery patterns would not be *directly* comparable to most archaeological case studies as they are riddled with modern and culture-specific characteristics. Nevertheless, this study could be useful for the interpretation of archaeological sites in geographically compatible areas across northern Eurasia, Europe, and America, and (in a direct historical approach) to the Upper Paleolithic record in Eurasia. For example, in contexts where animal ceremonialism could be reasonably expected, zooarchaeologically visible patterns that emerged from this case study – such as 'lower limb fragments only' patterns separating out logistical camps from residential camps, and the presence of small-sized limb bones indicating more temporary camps – could be used to test if this is the case.

Lastly, this study provided food for thought to the debate on how much meaning can be interpreted through archaeological evidence. The study group took care to completely disarticulate elements, kept bones intact when possible, and deposited all skeletal elements in a single special area, all with the intent of showing ritual respect for the hunted animal – an example of how the intent of the actor may be interpretable through archaeological evidence.

8.2 On the zooarchaeological aspects of this study

The validity of the 'uniformitarian assumption' in zooarchaeological studies was tested through the study group's butchery patterns and surface modification patterns, as well as by direct comparison of this study group's surface modification patterns to a South African dataset (Nilssen 2000) that was methodologically compatible.

Among the major results, processing time was shown to be chiefly related to joint complexity when compared across various elements. While variation among individuals in both butchery procedure (i.e. personal style) and processing time (i.e. efficiency and/or skill) was observed, these differences were effectively drowned out by the variation produced by a plethora of circumstantial conditions surrounding each butchery event. The only consistent factor affecting processing time was thus an anatomical one.

Disarticulation procedures were determined by how the animal was positioned at the start of butchery and the logical removal of parts from that position. Both main prey species of the study group (*kabarga* and reindeer) had a set starting position for the carcass, which was a hanging posture for the smaller *kabarga*, and an on-its-back position for the larger reindeer. Carcasses were processed into basically identical parts in both species. In fact, there are only so many ways to partition a carcass, and the study group was not particularly different from other groups in their types of parts (Table 8.2). Most parts consisted of a single skeletal element; the exceptions that combined more than one kind of skeletal element (e.g. the *dramah* unit) were still commonly found in many groups (Binford 1981:91). Butchery patterns were studied by following the carcass parts carefully from kill to consumption, resulting in the most complete sequential record to date. It can be concluded that the disarticulation process of both *kabarga* and reindeer were clearly determined by anatomical and mechanical constraints.

To test the 'uniformitarian assumption' through surface modification, individual bones were compared. Generally, individual butchery styles were not evident in surface modification patterns. Differences between butchers were most obvious in the processing of soft parts and in the *order* of processing; these aspects did not leave zooarchaeological traces. The variation *between* butchers in total mark frequency usually was not any greater than the variation by *one* butcher in different butchery situations. There were variations in butchery mark frequency and placement that were identified to various causes observed during the butchery process, but these variations were strictly case-by-case and no identifiable quantitative patterns emerged overall.

In terms of statistical presence/absence of individual variation, the results were mixed. Variation of the same magnitude as found between African and Siberian animals were found within the study group's dataset despite their redundant butchery pattern. However, numerically these variant specimens were in the minority, and were in effect 'drowned out' by the main pattern of surface modification.

While the 'uniformitarian assumption' held for butchery *sequence* determination and held when species and individuals were compared *within* the study group's data, there were disagreements with this expectation when the comparison was expanded to Nilssen's African dataset (2000). As experienced butchers of ungulate species using metal tools, the South African butcher's situation was comparable to the study group's, and by using bone GIS, the methodology was held constant. Disarticulation marks resulting from African bovids and Siberian deer were expected to be similar in terms of *intensity* and in terms of *spatial distribution* across zones. On both counts, there were counterexamples, indicating that factors other than anatomy influenced the frequency and placement of surface modification marks. This finding simply suggests that analogs for zooarchaeological inference must be chosen carefully, and the factors that affect butchery thus strongly should be taken into consideration.

One of these factors that superseded anatomy was culinary preference (filleting vs. boiling). This study is unique in its thorough ethnographical and zooarchaeological documentation of a group focused on boiling as a cooking method. A zooarchaeological implication of not considering the culinary factor could be the misinterpretation of the importance of scavenging at archaeological sites that evince boiling technology. The study of this group's surface modification pattern indicated that when a meaty part is boiled and the meat consumed completely, it might only leave a surface modification pattern that would be interpreted as disarticulation-only. This case study was also an example of boiling happening in the absence of pot-sizing.

Another factor that was visible on occasion was what would be called for a lack of a better term, 'cultural style'. 'Cultural style' was evident in the study group's maintenance of a certain ceremonialism surrounding everything to do with wild animal carcasses, from special treatment of certain parts to careful deposition of the remains. While further study is needed, their ceremonial carefulness might be quantifiable through cutmark frequency and spatial position. 'Cultural style' was not specific to circumpolar groups; for example a characteristic culture-specific butchery activity of Southern African groups (!Kung and Kua) would be the strategy of smashing vertebrae for transport (Table 8.3). It might be possible to map geographical and temporal ranges of such general style characteristics in butchery behavior.

Lastly it should be noted that only one pattern in butchery and use emerged as being universal, so far, among ethnoarchaeological studies. This pattern was the preferential eating of marrow after a successful hunt, often by the hunter. This pattern has already been applied successfully to the interpretation of archaeological sites (Waguespack 2002). It is interesting to note that the marrow bones (and to some extent the crania) were treated differently from other skeletal elements in most cultures. However, the definition of 'special treatment' could be quite different – e.g. they could be quickly consumed at the kill site by those present on the hunt (Hadza), or preferentially transported back to be eaten by the hunter and his family (study group). Again this finding suggests that analogs for zooarchaeological inference must be chosen carefully.

8.3 Last notes and future directions

This small group of Evenki hunters provided me with a unique opportunity to closely study a situation without hunting-, butchery-, transport- or sharing-related variations, which would hopefully be useful to future zooarchaeological studies. The ethnographic data gathering methods worked well in this study, and resulted in detailed data with many analytical possibilities. Possible improvements for future studies include keeping a more systematic time record (so that the activities of all individuals are recorded without bias), recording eating activities, and recording multiple hunting episodes in one day. However, I am not sure if I would have changed my methods for this particular study, had I the chance to do everything all over again. All of these improvements necessitate additional personnel or an adherence to stricter observer status, and I feel that both these changes might not have been desirable in studying a group this small.

In terms of zooarchaeological data gathering, there was room for improvement. Mistakes that should not be repeated include not cleaning the fragments before surface modification recording, not recording more zooarchaeological variables (fracture outline, fragment length, etc.), and not paying more attention to compact bones and phalanges. A post-analysis regret was that it might have been interesting to study the postdepositional collection after all, as while the group claimed that they deposited all the bones in their bone box, the figures in Chapter 7 suggest that quite a few fragments, especially of the smaller and less culturally important species, were fed to dogs. This is an avenue for future study.

Additional avenues for future investigation would be further investigation with the study group, which would increase sample size from this group and in particular clarify whether the reindeer-heavy focus recorded in this study was anomalous. A survey of butchery patterns in widening circles, for example among neighboring Evenki families, neighboring families of different ethnic origin, and more distantly located Evenki would be of interest, as they would clarify if the butchery patterns seen in the study group were family-specific, general to area, or general to Evenki as a whole. Lastly, a surface modification lab study of specimens created by the study group would clarify if the surface modification marks reported in this study was compromised in any way by the condition of the bones at recording.

Bibliography

Abe, Y., C. W. Marean, P. J. Nilssen, Z. Assefa and E. Stone

2002 The analysis of cutmarks from archaeological sites: a review and a new GIS image-analysis approach. *American Antiquity* 67(4):643-664.

Anderson, D. G.

1991 Turning hunters into herders: A critical examination of Soviet development policy among the Evenki of southeastern Siberia. *Arctic* 44(1):12-22.

1992 Property rights and civil society in Siberia: An analysis of the social movements of the Zabaikal'skie Evenki. *Praxis International* 12(1):83-105.

1995 *National identity and belonging in arctic Siberia: An ethnography of Evenkis and Dolgans at Khantaiskoe Ozero in the Taimyr Autonomous District*, University of Cambridge.

1999a The Evenki of the lower Enisei Valley. In *The Cambridge Encyclopedia of Hunters and Gatherers*, edited by R. B. Lee and R. Daly, pp. 143-146. Cambridge University Press, Cambridge.

1999b Fieldwork and the 'Doctoring' of Identities in Arctic Siberia. In *Human Dilemmas of Fieldwork*, edited by H. G. DeSoto and D. N. University of Wisconsin Press, Madison.

2000a *Identity and ecology in Arctic Siberia: the Number One Reindeer Brigade*. Oxford University Press, Oxford.

2000b Tracking the "Wild Tungus" in Taimyr: Identity, ecology, adn mobile economies in Arctic Siberia. In *Hunter and gatherers in the modern world: Conflict, resistance, and self-determination*, edited by P. P. Schweitzer, M. Biesele and R. K. Hitchcock. Berghahn Books, New York.

Andrews, P.

1990 *Owls, caves, and fossils*. University of Chicago Press, Chicago.

Ansimov, A. F.

1963a Cosmological concepts of the peoples of the north. In *Studies in Siberian Shamanism*, edited by H. N. Michael. University of Toronto Press, Toronto.

1963b The shaman's tent of the Evenks and the origin of the shamanistic rite. In *Studies in Siberian Shamanism*, edited by H. N. Michael. University of Toronto Press, Toronto.

Armstrong, T., G. Rogers and G. Rowley
1978 *The Circumpolar North: A political and economic geography of the Arctic and Sub-Arctic*. Methuen & Co. Ltd., London.

Ascher, R.
1961 Analogy in archaeological interpretation. *Southwestern Journal of Anthropology* 17:317-325.

Banfield, A. W. F.
1961 A revision of the reindeer and caribou, genus Rangifer. *National Museum of Canada Bulletin* 177.

Bartram, L. E. J.
1993a *An ethnoarchaeological analysis of Kua San (Botswana) bone food refuse*, University of Wisconsin, Madison.

1993b Perspectives on skeletal part profiles and utility curves from eastern Kalahari ethnoarchaeology. In *From bones to behavior: ethnoarchaeological and experimental contributions to the interpretation of faunal remains*, edited by J. Hudson, pp. 115-137. Southern Illinois University, Carbondale.

1999 Explaining the "Klasies Pattern": Kua ethnoarchaeology, the Die Kelders Middle Stone Age archaeolofauna, long bone fragmentation and carnivore ravaging. *Journal of Archaeological Science* 26:9-29.

Beach, H.
1981 *Reindeer-herd management in transition: The case of Tuorpon Saameby in northern Sweden*, Uppsala University.

Bell, J.
1764 *Travels from St. Petersburg in Russia to diverse parts of Asia.* W. Homer, London.

Bennett, J. L.
1997 Thermal alteration of buried bone. *Journal of Archaeological Science* 26(1-8).

Berhensmeyer, A. K.
1978 Taphonomic and ecologic information from bone weathering. *Paleobiology* 4:150-162.

Bettinger, R.
1991 *Hunter-gatherers: Archaeological and evolutionary theory*. Plenum Press, New York.

Binford, L. R.
1977a *For theory building in archaeology*. Academic Press, New York.

1977b Forty-seven trips: A case study in the character of archaeological formation processes. In *Stone tools as cultural markers: change, evolution and complexity*, edited by R. V. S. Wright, pp. 24-36. Australian Institute of Aboriginal Studies, Camberra.

1978 *Nunamiut ethnoarchaeology*. Academic Press, New York.

1980 Willow smoke and dogs' tails: Hunter-gatherer settlement systems and archaeological site formation. *American Antiquity* 45(1):4-20.

1981 *Bones: ancient men and modern myths*. Academic Press, New York.

1984a Butchering, sharing, and the archaeological record. *Journal of Anthropological Archaeology* 3:235-257.

1984b *Faunal remains from Klasies River Mouth*. Academic Press, Orlando.

1988 Fact and fiction about the Zinjanthropus floor: data, arguments, and interpretations. *Current Anthropology* 29:123-135.

2001 *Constructing Frames of Reference: An analytical method for archaeological theory building using hunter-gatherer and environmental data sets*. University of California Press, Berkeley.

Binford, L. R. and J. B. Bertram
1977 Bone frequencies -- and attritional processes. In *For theory building in archaeology: Essays on faunal remains, aquatic resources, spatial analysis, and systemic modeling*, edited by L. R. Binford, pp. 77-156. Academic Press, New York.

Blumenschine, R. J.
1986 Carcass consumption sequences and the archaeological distinction of scavenging and hunting. *Journal of Human Evolution* 15:639-659.

1988 An experimental model of the timing of hominid and carnivore influence on archaeological bone assemblages. *Journal of Archaeological Science* 15:473-502.

1995 Percussion marks, tooth marks, and experimental determination of the timing of hominid and carnivore access to long bones at FLK Zinjanthropus. *Journal of Human Evolution* 29:21-51.

Bonnichsen, R.
1979 Pleistocene bone technology in the Beringium Refugium. In *Archaeological Survey of Canada Paper No. 89, Mercury Series*. National Museum of Man, Ottawa.

Bradley, J. V.
1968 *Distribution-free statistical tables*. Prentice-Hall, Englewood Cliffs.

Brain, C. K.
1981 *The hunters or the hunted? An introduction to African cave taphonomy*. Universisty of Chicago Press, Chicago.

Bunn, H. T.
1986 Patterns of skeletal representation and hominid subsistence activities at Olduvai Gorge, Tanzania, and Koobi Fora, Kenya. *Journal of Human Evolution* 15:673-690.

Bunn, H. T., L. E. J. Bartram and E. M. Kroll
1988 Variability in bone assemblage formation from Hadza hunting, scavenging, and carcass processing. *Journal of Anthropological Archaeology* 7:412-457.

Bunn, H. T. and E. M. Kroll
1986 Systematic butchery by Plio/Pleistocene hominids at Olduvai Gorge, Tanzania. *Current Anthropology* 27:431-452.

Burch, E. S. J.
1972 The caribou/wild reindeer as a human resource. *American Antiquity* 37(3):339-368.

Burke, A. and A. Pike-Tay
1997 Reconstructing "L'Age du Renne". In *Caribou/Reindeer hunters of the Northern Hemisphere*, edited by L. Jackson and P. Thacker. One World Archaeology, Brookfield.

Bush, R. J.

1871 *Reindeer, dogs, and snow-shoes: a journal of Siberian travel and explorations made in the years 1865, 1866, and 1867*. Harper & Brothers, New York.

Campbell, C. A. R.
2001 *The Evenki system of paths: A study of travel and technology in east-central Siberia*, University of Alberta.

Capaldo, S. D.
1995 *Inferring hominid and carnivore behavior from dual patterned archaeofaunal assemblages.* Ph.D., Rutgers University.

Chase, P. G.
1988 Scavenging and hunting in the Middle Paleolithic. In *Upper Pleistocene prehistory of Western Eurasia*, edited by H. L. Dibble and A. Montet-White, pp. 225-232. University Museum, University of Pennsylvania, Philadelphia.

Church, R. R. and R. L. Lyman
2003 Small fragments make small differences in efficiency when rendering grease from fractured artiodactyl bones by boiling. *Journal of Archaeological Science* 30:1077-1084.

Crader, D. C.
1983 Recent single-carcass bone scatters and the problem of "butchery" sites in the archaeological record. In *Animals and archaeology: 1. hunters and their prey*, edited by J. Clutton-Brock and C. Grigson, pp. 107-141. British Archaeological Reports International Series 163.

Dmitriez, N. G. and L. K. Ernst
1989 *Animal Genetic Resources of the USSR*. Animal Production and Health Paper. FAO, Rome.

Ellenberger, W., H. Dittrich and H. Baum
1956 *An atlas of animal anatomy for artists*. Dover Publications, New York.

Engebretsen, R. H.
1975 Topography of internal organs of reindeer (Rangifer tarandus): Topographic anatomy applied in the hunting of reindeer. *Acta vet. scand.* 16(Suppl. 57):1-17.

Enloe, J. G.
1991 *Subsistence organization in the Upper Paleolithic: Carcass refitting and food sharing at Pincevent*, University of New Mexico.

1993 Ethnoarchaeology of marrow cracking: Implications for the recognition of prehistoric subsistence organization. In *Bones to Behavior: Ethnoarchaeological and experimental contributions to the interpretation of faunal remains*, edited by J. Hudson. Center for Archaeological Investigations, Carbondale.

1994 Patterns of faunal processing at section 27 of Pincevent: The use of spatial analysis and ethnoarchaeological data in the interpretation of site structure. *Journal of Anthropological Archaeology* 13:105-124.

1995 Hunting specialization: single-species focus and human adaptation. In *Le bison: Gibier et moyen de subsistance des hommes du paleolithique aux Paleoindiens des Grandes Plaines*, edited by J. P. Brugal, F. David, J. G. Enloe and J. Jaubert. Actes du colloque international, Toulouse.

1997 Seasonality and age structure in remains of Rangifer tarandus: Magdalenian hunting strategy at Verberie. *Anthropozoologica* 25-26:95-102.

2003a Acquisition and processing of reindeer in the Paris basin. In *Zooarchaeological insights into Magdalenian Lifeways*, edited by S. Costamagno and V. Laroulandie. BAR International Series 1144, Oxford.

2003b Food sharing past and present: archaeological evidence for economic and social interactions. *Before Farming* 1(1):1-23.

Enloe, J. G. and F. David

1992 Food sharing in the Paleolithic: Carcass refitting at Pincevent. In *Piecing together the past: Application of refitting studies in archaeology*, edited by J. L. Hofman and J. G. Enloe. BAR International Series 578, Oxford.

Erman, A.

1848 *Travels in Siberia: including excursions northwards, down the Obi, to the Polar Circle, and southwards, to the Chinese frontier*. Longman, Brown, Green, and Longmans, London.

Feit, H. A.

1994 Dreaming of animals: the Waswanipi Crree shaking tent ceremony in relation to environment, hunting, and missionization. In *Circumpolar religion and ecology: An anthropology of the north*, edited by T. Irimoto and T. Yamada. University of Tokyo Press, Tokyo.

Fisher, J. W. J.

1995 Bone surface modifications in zooarchaeology. *Journal of Archaeological Method and Theory* 2(1):7-68.

Fondahl, G. A.
1998 *Gaining Ground? Evenkis, land, and reform in Southeastern Siberia*. Allyn and Bacon, Boston.

Frison, G. C.
1970 The Glenrock Buffalo Jump, 48CO304: Late Prehistoric buffalo procurement and butchering. *Plains Anthropologist Memoir* 7.

1971 Shoshonean antelope procurement in the Upper Green River Basin, Wyoming. *Plains Anthropologist* 16(54):258-284.

Getty, R.
1975 *Sisson and Grossman's the anatomy of the domestic animals*. Fifth Edition ed 1. W.B. Saunders Company, Philadelphia.

Gifford, D. P.
1981 Taphonomy and paleoecology: a critical review of archaeology's sister disciplines. *Advances in Archaeological Method and Theory* 4:365-438.

Gifford-Gonzalez, D. P.
1989a Ethnographic analogues for interpreting modified bones: some cases from East Africa. In *Bone modification*, edited by R. Bonnichsen and M. H. Sorg. vol. 179-246. Center for the Study of the First Americans, Orono.

1989b Modern analogues: developing an interpretive framework. In *Bone modification*, edited by R. Bonnichsen and M. H. Sorg, pp. 43-52. University of Maine, Maine.

1991a Bones are not enough: analogues, knowledge, and interpretive strategies in zooarchaeology. *Journal of Anthropological Archaeology* 10:215-254.

1991b Gaps in zooarchaeological analyses of butchery: Is gender an issue? In *From Bones to Behavior*, edited by J. Hudson, pp. 181-199. Center for Archaeological Investigations, Carbondale.

Gould, R. A. and P. J. Watson
1982 A dialogue on the meaning and use of analogy in ethnoarchaeological reasoning. *Journal of Anthropological Archaeology* 1:355-381.

Goulet, J. A.

2000 Visions of conflict, conflicts of vision among contemporary Dene Tha. In *Hunters and gatherers in the modern world: Conflict, resistance, and self-determination*, edited by P. P. Schweitzer, M. Biesele and R. K. Hitchcock. Berghahn Books, New York.

Graburn, N. H. H. and B. S. Strong

1973 *Circumpolar peoples: an anthropological perspective*. Goodyear Publishing Company, Pacific Palisadies.

Gron, O.

1999 *Conflicts in cultural traditions and habitat use in an Evenk society in Northern Transbaikal: the development of sustainability strategies for a stressed environment.* Arctic Network for the Support of the Indigenous Peoples of the Russian Arctic (ANSIPRA).

Gron, O., O. Kuznetsov and T. Klokkernes

2002 The tent in the middle of the world. Paper presented at the Ninth International Conference on Hunting and Gathering Societies, Edinburgh.

Guilday, J. E., P. W. Parmalee and D. P. Tanner

1962 Aboriginal butchering techniques at the Eschelman site (36LA12), Lancaster County, Pennsylvania. *Pennsylvania Archaeologist* 32(2):59-83.

Guilday, J. E. and D. P. Tanner

1962 Animal remains from the Quaker State Rockshelter (36 Ve 27), Venango County, Pennsylvania. *Pennsylvania Archaeologist* 32:131-137.

Hodder, I.

1987 The meaning of discard: Ash and domestic space at Baringo. In *Method and Theory for Activity Area Research*, edited by S. Kent, pp. 424-448. Columbia University Press, New York.

Holliday, T. W.

1998 The ecological context of trapping among recent hunter-gatherers: Implications fot subsistence in Terminal Pleistocene Europe. *Current Anthropology* 39(5):711-720.

Honigmann, J. J.

1968 Perspectives on the atomistic-type society: Interpersonal relations in atomistic communities. *Human Organization* 27(3):220-235.

Hultkrantz, A.

1994 Religion and environment among the Ssaami: An ecological study. In *Circumpolar religion and ecology: An anthropology of the North*, edited by T. Irimoto and T. Yamada. University of Tokyo Press, Tokyo.

Humphrey, C.
2000 An anthropological view of barter in Russia. In *The vanishing Rouble: Barter networks and non-monetary transactions in Post-Soviet societies*, edited by P. Seabright, pp. 71-92. Cambridge University Press, Cambridge.

Ingold, T.
1974 On reindeer and men. *Man* 9:523-538.

1980 *Hunters pastoralists and ranchers: Reindeer economies and their transformations*. Cambridge University Press, Cambridge.

1987 *The appropriation of nature: Essays on human ecology and social relations*. University of Iowa Press, Iowa City.

Jones, K. T.
1993 The archaeological structure of a short-term camp. In *From bones to behavior: ethnoarchaeological and experimental contributions to the interpretation of faunal remains*, edited by J. Hudson, pp. 101-114. Southern Illinois University, Carbondale.

Kelly, R. L.
1995 *The foraging spectrum: diverstiy in hunter-gatherer lifeways*. Smithsonian Institution Press, Washington.

Kerttula, A. M.
2000 *Antler on the sea: The Yup'ik and Chukchi on the Russian Far East*. Cornell University Press, Ithaca.

Klein, R. G.
1972 Late Quaternary mammalian fauna of Nelson Bay Cave. *Quaternary Research* 2:135-142.

1978 Stone Age predation on large African bovids. *Journal of Archaeological Science* 5:195-217.

Krupnik, I.
1993 *Arctic adaptations: Native whalers and reindeer herders of Northern Eurasia*. University Press of New England, Hanover.

Kwon, H.
1993 *Maps and actions: Nomadic and sedentary space in a Siberian reindeer farm*, University of Cambridge.

Laufer, B.

1917 The reindeer and its domestication. *Memoirs of the American Anthropological Association* IV(2).

Lee, R. B. and I. DeVore
1968 *Man the Hunter*. Aldine, Chicago.

Levin, M. G. and L. P. Potapov
1964 *The Peoples of Siberia*. University of Chicago Press, Chicago.

Lissner, I.
1961 *Man, god and magic*. G.P. Putnam's Sons, New York.

Lupo, K. D.
1994 Butchering marks and carcass acquisition strategies: distinguishing hunting from scavenging in archaeological contexts. *Journal of Archaeological Science* 21:827-837.

1998 Experimentally derived extraction rates for marrow: implications of body part exploitation strategies of Plio-Pleistocene hominid scavengers. *Journal of Archaeological Science* 25:657-675.

Lupo, K. D. and D. N. Schmitt
1997 Experiments in bone boiling: Nutritional returns and archaeological reflections. *Anthropozoologica* 25-26:137-144.

Lyman, R. L.
1978 Prehistoric butchering techniques in the lower Granite Reservoir, southeastern Washington. *Tebiwa miscellaneous papers* 13:1-25.

1984 Bone density and differential survivorship of fossil classes. *Journal of Anthropological Research* 3:259-299.

1987 Archaeofaunas and butchery studies: a taphonomic perspective. In *Advances in archaeological method and theory, vol. 10*, edited by M. B. Schiffer, pp. 249-337. Academic Press, San Diego.

1994 *Vertebrate taphonomy*. Cambridge University Pres, Cambridge.

Madrigal, T. C. and S. D. Capaldo
1999 White-tailed deer marrow yields and Late Archaic hunter-gatherers. *Journal of Archaeological Science* 26:241-249.

Madrigal, T. C. and J. Z. Holt
2002 White-tailed deer meat and marrow return rates and their application to Eastern Woodlands Archaeology. *American Antiquity* 67(4):745-759.

Marean, C. W., Y. Abe, P. Nilssen and E. Stone
2001 Estimating the minimum number of skeletal elements (MNE) in zooarchaeology: a review and a new image-analysis GIS approach. *American Antiquity* 66(2):333-348.

Marean, C. W. and N. Cleghorn
2003 Large mammal skeletal element transport: Applying foraging theory in a complex taphonomic system. *Journal of Taphonomy* 1(1):15-42.

Marean, C. W. and S. Y. Kim
1998 Mousterian faunal remains from Kobeh Cave (Zagros Mountains, Iran): behavioral implications for Neanderthals and Early Modern Humans. *Current Anthropology* 39:S79-S114.

Marshall, F.
1991 Food sharing and the faunal record. In *From bones to behavior: Ethnoarchaeological and experimental contributions to the interpretation of faunal remains*, edited by J. Hudson, pp. 228-246. Center for Archaeological Investigations, Carbondale.

1994 Food sharing and body part representation in Okiek faunal assemblages. *Journal of Archaeological Science* 21:65-77.

Martin, C.
1978 *Keepers of the game: Indian-animal relationships and the fur trade*. University of California Press, Berkeley.

Metcalfe, D. and K. T. Jones
1988 A reconsideration of animal body-part utility indices. *American Antiquity* 53:486-504.

Monahan, C. M.
1998 The Hadza carcass transport debate revisited and its archaeological implications. *Journal of Archaeological Science* 25:405-424.

Monton Subias, S.
2002 Cooking in zooarchaeology: Is the issue still raw? In *Consuming passions and patterns of food consumption*, edited by N. Milner and P. Miracle, pp. 7-15. Oxbow Books, Oxford.

Munch, P. A. and C. E. Marske
1981 Atomism and social integration. *Journal of Anthropological Research* 37:158-171.

Murphy, R. F. and J. H. Steward

1956 Tappers and trappers: Parallel process in acculturation. *Economic Development and Cultural Change* 4(4):335-355.

Nelson, R. K.
1986 *Hunters of the northern forest: Designs for survival among the Alaskan Kuchin*. University of Chicago Press, Chicago.

Nilssen, P. J.
2000 *An actualistic butchery study in South Africa and its implications for reconstructing hominid strategies of carcass acquisition and butchery in the Upper Pleistocene and Plio-Pleistocene.* Ph.D. dissertation, University of Cape Town.

Nuttall, M.
1998 *Protecting the Arctic: Indigenous peoples and cultural survival*. Studies in Environmental Anthropology, v.3. Overseas Publishers Association N.V., Amsterdam.

Oakes, J. and R. Riewe
1998 *Spirit of Siberia: Traditional native life, clothing, and footwear*. Douglas & McIntyre, Vancouver/Toronto.

O'Connell, J. F.
1993 Discussion: Subsistence and settlement interpretations. In *From bones to behavior: ethnoarchaeological and experimental contributions to the interpretation of faunal remains*, edited by J. Hudson, pp. 169-178. Southern Illinois University, Carbondale.

O'Connell, J. F., K. Hawkes and N. Blurton Jones
1988a Hadza hunting, butchering, and bone transport and their archaeological implications. *Journal of Anthropological Research* 44(2):113-161.

1988b Hadza Scavenging: Implications for Plio/Pleistocene Hominid Subsistence. *Current Anthropology* 29(2):356-363.

1990 Reanalysis of large mammal body part transport among the Hadza. *Journal of Archaeological Science* 17:301-316.

1991 Distribution of refuse-producing activities at Hadza residential base camps: implications for analyses of archaeological site structure. In *The interpretation of archaeological spatial patterning*, edited by E. M. Kroll and T. D. Price. Plenum Press, New York.

Okladnikov, A. P.

1959 *Ancient populations of Siberia and its cultures*. Russian translation series of the Peabody Museum of Archaeology and Ethnology, Harvard University Vol. 1 No. 1. Peabody Museum, Cambridge.

Oliver, J. S.
1993 Carcass processing by the Hadza: bone breakage from butchery and consumption. In *From Bones to Behavior: Ethnoarchaeological and experimental contributions to the interpretation of faunal remains*, edited by J. Hudson. Center for Archaeological Investigations, Carbondale.

Osgood, C.
1936 Contributions to the ethnography of the Kuchin. *Yale University Publications in Anthropology* 14.

Oswalt, W. H.
1976 *An anthropological analysis of food-getting technology*. John Wiley & Sons, New York.

Outram, A. and P. Rowley-Conwy
1998 Meat and marrow utility indices for horse (Equus). *Journal of Archaeological Science* 25:839-849.

Pelto, P. J.
1973 *The snowmobile revolution: Technology and social change in the Arctic*. Cummings Publishing Company, Menlo Park.

Petitt, P. B.
1997 High resolution Neanderthals? Interpreting Middle Paleolithic intrasite spatial data. *World Archaeology* 29(2):208-224.

Pika, A.
1999 *Neotraditionalism in the Russian North: Indigenous peoples and the legacy of Perestroika*. Circumpolar Research Series No. 6. Canadian Circumpolar Institute, Edmonton.

Pike-Tay, A. and H. M. Bricker
1993 Hunting in the Gravettian: An examination of evidence from Southwestern France. In *Hunting and animal exploitation in the Later Paleolithic and Mesolithic of Eurasia*, edited by G. L. Peterkin, H. M. Bricker and P. Mellars. Archaeological Papers of the American Anthropological Asoociation Number 4.

Preucel, R. W.
1991 The philosophy of archaeology. In *Processual and postprocessual archaeologies: Multiple ways of knowing the past*, edited by R. W.

Preucel. Center of Archaeological Investigations Occaisional Paper 10, Carbondale.

1995 The Postprocessual condition. *Journal of Archaeological Research* 3(2):147-175.

Putman, R.
1988 *The natural history of deer*. Comstock Publishing Associates, Ithaca.

Rapson, D. J.
1990 *Pattern and process in intrasite spatial analysis: site structural and faunal research at the Bugas-Holding Site*, University of New Mexico.

Rholf, F. J. and R. R. Sokal
1981 *Statistical tables*. W. H. Freeman and Company, San Francisco.

Riasanovsky, V. A.
1965 *Customary law of the nomadic tribes of Siberia*. Mouton & Co., The Hague.

Ringberg, T., E. Reimers and R. Sorumgaard
1979 Growth and seasonal change in organ weights and carcass composition in Svalbard reindeer (Rangifer tarandus platyrhunchus). In *Proceedings of the second international reindeer/caribou symposium*, edited by E. Reimers, E. Gaare and S. Skjenneberg. Direktoratet For Vilt Og Ferskvannsfisk, Trondheim.

Rogers, E. S.
1972 The Mistassini Cree. In *Hunters and gatherers today: A socioeconomic study of eleven such cultures in the twentieth century*, edited by M. G. Bicchieri. Waveland Press, Prospect Heights.

Rogers, E. S. and M. B. Black
1976 Subsistence strategy in the Fish and Hare Period, Northern Ontario: The Weagamow Ojibwa, 1880-1920. *Journal of Anthropological Research* 32(1):1-43.

Russell, M. P.
1987 Mortuary practices at the Krapina Neandertal site. *American Journal of Physical Anthropology* 72:381-397.

Seabright, P.
2000 *The vanishing Rouble: Barter networks and non-monetary transactions in post-Soviet societies*. Cambridge University Press, Cambridge.

Selvaggio, M. M.
1998 Evidence for a three-stage sequence of hominid and carnivore involvement with long bones at FLK Zinjanthropus, Olduvai Gorge, Tanzania. *Journal of Archaeological Science* 25:191-202.

Service, E. R.
1971 *Profiles in ethnology*. Harper & Row, Publishers, New York.

Shipman, P., W. Bosler and K. L. Davis
1981 Butchering of giant geladas at an Acheulian site. *Current Anthropology* 22:257-268.

Shipman, P. and J. Rose
1983 Early hominid hunting, butchering, and carcass-processing behaviors: approaches to the fossil record. *Journal of Anthropological Archaeology* 2:57-98.

Shirokogoroff, S. M.
1929 *Social organization of the northern Tungus*. Garland Publishing, New York.

1935 *Psychomental complex of the Tungus*. Kegan Paul, Trench, Trubner & Co., London.

Soffer, O.
1994 Ancestral lifeways in Eurasia -- the Middle and Upper Paleolithic records. In *Origins of anatomically modern humans*, edited by M. H. Nitecki and D. V. Nitecki. Plenum Press, New York.

Sokal, R. R. and F. J. Rholf
1981 *Biometry: The principles and practice of statistics in biological research*. 2 ed. W. H. Freeman and Company, San Francisco.

Speavakovsky, A. B.
1994 Animal cults and ecology: Ainu and East Siberian examples. In *Circumpolar religion and ecology: An anthropology of the North*, edited by T. Irimoto and T. Yamada. University of Tokyo Press, Tokyo.

Spiess, A. E.
1979 *Reindeer and caribou hunters: An archaeological study*. Academic Press, New York.

Ssorin-Chaikov, N. V.
1998 *Stateless society, state collectives, and the state of nature in sub-arctic Siberia: Evenki hunters and herders in the twentieth century*, Stanford University.

2000 Bear skins and macaroni: the social life of things at the margins of a Siberian state collective. In *The vanishing Rouble: Barter networks and non-monetary transactions in Post-Soviet societies*, edited by P. Seabright. Cambridge University Press, Cambridge.

2003 *The social life of the state in Subarctic Siberia*. Stanford University Press, Stanford.

Stiner, M. C.
1991 Food procurement and transport by human and non-human predators. *Journal of Archaeological Science* 18:455-482.

1993 Modern human origins: faunal perspective. *Annual Review of Anthropology* 22:55-82.

1994 *Honor among thieves: a zooarchaoelogical study of Neandertal ecology*. Princeton University Press, Princeton.

Straus, L. G.
1996 The archaeology of the Pleistocene-Holocene transition in Southwest Europe. In *Humans at the end of the Ice Age: The archaeology of the Pleistocene-Holocene transition*, edited by L. G. Straus, B. V. Eriksen, J. Erlandson and D. R. Yesner, pp. 83-96. Plenum Press, New York.

Syroechkovskii, E. E.
1995 *Wild reindeer*. Science Publishers, Lebanon, NH.

Tanner, A.
1979 *Bringing home animals: Religious ideology and mode of production of the Mistassini Cree Hunters*. St. Martin's Press, New York.

Utechin, S. V.
1961 *Everyman's concise encyclopaedia of Russia*. J.M. Dent & Sons Ltd., London.

Vasilevich, G. M.
1969 *Evenki: Istoriko-etnograficheskie ocherki (XVIII-nachalo XX v.)*. Nauka, Leningrad.

Vasilevich, G. M. and A. V. Smolyak
1956 The Evenks. In *The peoples of Siberia*, edited by M. G. Levin and L. P. Potapov, pp. 620-654. University of Chicago Press, Chicago.

Vorob'ev, D. V.

2004 Subsistence and adaptive strategies among the Evenki in the late twentieth century. *Anthropology & Archaeology of Eurasia* 43(1):8-45.

Waguespack, N. M.
2002 Caribou sharing and storage: refitting the Palangana site. *Journal of Anthropological Archaeology* 21:396-417.

Waisberg, L. G.
1975 Boreal forest subsistence and the Windingo: Fluctuation of populations. *Anthropologica* XVII:169-186.

Weinstock, J.
2002 Reindeer hunting in the Upper Paleolithic: Sex ratios as a reflection of different procurement strategies. *Journal of Archaeological Science* 29:365-377.

Wemmer, C.
1998 *Deer*. Information Press, Oxford.

Wheat, J. B.
1979 The Jurgens Site. *Plains Anthropologist Memoir 15*.

White, T. E.
1952 Observations on the butchering technique of some aboriginal peoples: no. 1. *American Antiquity* 17:337-338.

1953 Observations on the butchering technique of some aboriginal peoples: no. 2. *American Antiquity* 19:160-164.

1954 Observations on the butchering technique of some aboriginal peoples: no. 3,4,5 and 6. *American Antiquity* 19:254-264.

1955 Observations on the butchering technique of some aboriginal peoples: no. 7, 8, and 9. *American Antiquity* 21:170-178.

1956 The study of osteological materials in the Plains. *American Antiquity* 21:401-404.

Whitehead, G. K.
1993 *The Whitehead Encyclopedia of Deer*. Swan Hill Press, Shrewsbury.

Winterhalder, B.
1983 Boreal foraging strategies. In *Boreal forest adaptations: The northern Algonkians*, edited by A. T. J. Steegman. Plenum Press, New York.

2001 The behavioural ecology of hunter-gatherers. In *Hunter-gatherers: An interdisciplinary perspective*, edited by C. Panter-Brick, R. H. Layton and P. Rowley-Conwy. Cambridge University Press, Cambridge.

Wylie, A.
1982 An analogy by any other name is just as analogical: A commentary on the Gould-Watson dialogue. *Journal of Anthropological Archaeology* 1:382-401.

Yates, A. and N. Zvegintzov
1995 *Siberian BAM guide: Rail, rivers, & road*. Trailblazer Publications, Surrey.

Yellen, J. E.
1977 Cultural patterning in faunal remains: Evidence from teh !Kung Bushmen. In *Experimental Archaeology*, edited by D. Ingersoll, J. E. Yellen and W. Macdonald, pp. 271-331. Columbia University Press, New York.

1991 Small mammals: !Kung San utilization and the production of faunal assemblages. *Journal of Anthropological Archaeology* 10:1-26.

Appendix: Customs and traditions

The following is a list of cultural information (rules/taboos and beliefs) observed during the field season. Not all of the following are assumed to be traditional Evenki cultural beliefs; some could be common superstition among all kinds of people (including Russians) in the area, family quirks, or running jokes on the researchers. This information is presented here as supporting evidence for the overall importance of hunting for this group and the importance of certain prey species for this group.

1. Practices observed during hunting

Many small rules with the purpose of ensuring good luck during hunting and on hunts were followed by the study group. Here they are sorted by two driving purposes that seemed to be behind these rules – the first, to ritually avoid doing any thing special and preparatory that would alert the prey to the intentions of the hunter; and the second, to avoid pollution of hunters and hunting gear from polluting elements (e.g. dogs and females), and to cleanse the same.

It should be kept in mind that the rules concerning the polluting aspect of females might be blown somewhat out of proportion, simply because the hunters had ample occasion to point them out to me – a non-indoctrinated female accompanying them on hunts – in the form of short explanations given with commands such as “don’t step over there!” It should be stressed that this group was pretty much gender-neutral in most hunting and butchery practices, in contrast to what has been documented among Evenki in the past (Shirkogoroff 1929).

When gender restrictions applied, old women were less restricted than young women. I was ambiguous in age status as well, as I was not exactly young, but still unmarried and without children. This gender and age rule also seemed to apply to dogs; e.g. an old female dog was allowed to eat the fetus of the *kabarga*, while this was forbidden for other dogs.

1.1 Avoiding notice of hunting intentions by prey

- No sewing on the day/night before leaving on hunt, as it brings bad luck. Also, no sewing while on the road. This rule was broken only once; some last-minute leather mending occurred on night before hunt, despite some members voicing concern about this rule.
- No sweeping on floor before leaving on hunt.
- Defecating while on a hunt causes loss of prey. Also, one should avoid defecating on the morning of a hunt (or just prior to a hunt).
- Do not cut nails on the morning of a hunt (this rule only applies to young people).
- One must be sitting when hunters leave camp (i.e. no formal greetings or send-offs). This rule was only strictly adhered to when the need for meat was dire, and for the bear trap hunt. Greetings (e.g. waving) cause hunters to return with no game.
- Cutting down a tree to fall across a track or road brings bad [hunting] luck.
- Do not leave the fire-stick (pole that supports kettle over open fire) up when leaving a campsite, as wild reindeer will know that hunters are close by.

1.2 Avoiding pollution; cleansing

- Females should not step over guns and other hunting equipment.
- Hunter's clothing should be separately hung up [to dry], and always above the females' items of clothing – especially garments that cover the females' lower body (boots, pants). [It is also possible that the real taboo was for the females to hang clothes up to dry above the *pechka* (stove)]. According to Vasili, women used to dry their items in the tent while men were out to hunt, and take them down before they returned. As footgear had to be dried every day and was impractical to enforce on hunting trips (where everyone shared one tent), this rule was invoked only on one occasion after a bad hunting day.

Usually, everyone's clothes were hung up to dry on the top horizontal pole of the tent frame (canvas tent).

- One should shoot and/or smoke a gun (i.e. pass gun through smoke above open fire or smudge fire) to purify it. In one observed case, one round was shot across the river (at no particular target) and then smoked. This was to purify the gun after it was used to shoot a dog, and the reason given was "because it would be used to shoot at wild reindeer next".
- Bullet-bags are also purified by smoking. On one occasion, after I stepped over one by mistake, it was waved inside a *pechka* or over the coals for a few times.

2. Practices observed during butchery and use

The rules for butchery and use were driven by a need to be respectful to the prey, and to this end, each prey species observed during the field season were treated carefully in a manner specific for each species. Respect was shown so that the animal would be hunted again. Signs and portents for future hunts were also carefully noted. This concern for hunting luck and the addressing of spirits has been noted in past studies (Shirkogoroff 1935:231). The respectful treatment of carcasses is a common characteristic across the circumpolar zone and underlies many actions taken by the study grouop during the hunting, butchery, and use of the animal (see Chapter 1).

Meat animals (reindeer and *kabarga*) were generally treated in the same way, but there were more special rules for reindeer. The butchery process for red deer and moose has been described by the study group as "the same as with reindeer", but it is unknown if there would have been differences in the details. As noted in Chapter 4, red deer was an animal that was usually treated ceremoniously by the Evenki, but none were hunted or butchered during the period of observation.

Some interesting notes: a saying went "moose is big brother to *kabarga*, and reindeer is big brother to roe deer" (the roe deer are not found in the study area, but are common in areas immediately to the south). It would have been interesting to see if any parallels in special treatment (or lack thereof) exist between these pairs. The two species treated most ceremoniously by the study group, during observation, were wild reindeer and sable. They were also the two species consistently referred to with non-Russian terminology by these primarily Russian-speaking people.

2.1 Treatment common to all meat animals

- If the tongue is lolling out to one side of mouth of the carcass, it is an omen that means "more meat is to come" (i.e. good hunting luck). Thus the tongue position was carefully noted after a kill. On one occasion, this tongue-lolling was explained as "self-shamanizing by the prey" (Vasili), and a sign that "there is no need to shamanize [the meat animals], because they do it themselves".
- The heads of meat animals must be kept off direct contact with ground[1]. In one observed case, Yulia was scolded for throwing a reindeer head on the ground – she was throwing carcass parts off the meat platform to the ground, as they were to be transported to a different storage area. She was scolded only for the head. Vasili said "that is how we go hungry". Possible causes for the reprimand were: the reindeer head was on the ground; the act of throwing; or because the tongue (that lolled out) broke off. *Kabarga* heads were also placed high, such as on platforms, and never given to dogs. In one case, the head of a spoiled frozen *kabarga* from a trap was thrown to a dog when packing up the camp. This act was later reconsidered and the person who threw it picked up and placed the head on the abandoned tent frame, out of the reach of dogs.
- Genitals and fetus (if any) of meat mammals are hung high and away from dogs.
- The back of both eyes of meat animals were stabbed at butchery, so that the animal could not see how it was being butchered.
- Females (and dogs) should not walk over, step over blood or any part of reindeer, in any situation. Especially, females cannot be allowed to walk over the heads of reindeer, because if they do, no more wild reindeer will be caught. The same rule was applied less stringently to *kabarga* heads.

[1] The special treatment of the head and/or skull has also been noted among North American Subarctic groups (e.g. Tanner 1979).

2.2 Treatment specific to reindeer

- Reindeer tongue tip is cut off, never eaten, and thrown into *pechka* (stove).
- If the roof of mouth of reindeer shows black [spots], it means that there is more meat to come [and is thus a good omen] – so the roof of mouth is always checked at butchery.
- If the knife makes a clicking sound when splitting reindeer bones apart at joint, it means more butchering to come [and is thus a good omen].
- Reindeer meat should be cut by knife, and specifically not by axe. [However, Vasili also noted that axe-cut parts were not good to eat as bone splinters get into the soup].
- Hunters eat the eyeball of the reindeer at butchery, "so [the eater] could see wild reindeer better" (Vasili). Water inside the eyeball is thrown into the fire or *pechka*.
- The butcher taps the roof of the mouth with knife-point at time of butchery, with or without chanting. The chant was in Evenki.
- Do not give bones of reindeer to dogs. This rule was generally adhered to, but exceptions were made for smaller fragments, ribs/vertebrae/sternum, and older meat and bone. Bones specially kept away from dogs were the atlas, patella, and the head/mandible.
- The eater taps around the ear of reindeer when eating the crania, so the reindeer will not hear. Sometimes the ear bones were broken off for the same purpose at time of eating.
- Genitals and fetus (if any) were hung high or deposited away from dogs[2]. Esophagus was also hung high and away from dogs.

2.3 Treatment specific to *kabarga*

None, outside what is noted in section 2.1.

[2] In contrast, the fetus was one of the first parts brought back to camp as a token of the hunt among the Misatassini Cree, and was always consumed (Tanner 1979:147).

2.4 Treatment specific to sable

- When the sable is taken into the house or tent, it is put in the location opposite the doorway (which was at window the windowsill in the study group's main cabin), usually wrapped in canvas[3].
- The hunter skinned and butchered the sable himself in all observed cases.
- Before skinning, the sable is fed butter-smoke (smoke from butter dropped onto hot coals). This feeding ceremony is "so there will be more [of sable]". The sable is also waved in front of an open *pechka* door with the head positioned towards the flames. The hunter muttered a chant in Evenki under his breath. The sable chant was translated as: "let us meet again in the creek [in heaven], you come to me and I come to you. [Please do not run away from me]."
- Sable skinning was much more careful and time-consuming than that of the squirrel, and also more time consuming than that of the mink. In particular, the paws of the animal were carefully skinned (unlike squirrel or mink), instead of just cutting it off or pulling the skin off by force. This could also be because the sable was a high-value trade item that merited more care.
- The sable, after skinning, was stabbed behind the eyes (like *kabarga*), cut at all joints along the limbs, and in many locations down the vertebrae and tail parallel to the joints (not at every vertebrae, but in small increments). Then the animal was curled up and deposited somewhere high (e.g. upper part of tent), often wrapped in canvas. Sometimes some food (e.g. bread) was placed in the mouth. Later, the carcass was taken outside. It could be deposited on top of tent frames and roof structures, but they were supposed to be placed in holes (which mimicked their nests). The final deposition of sable was never observed. Study group members also avoided discussing what they did with the sable carcass (beyond what is noted here), avoided being observed depositing the carcass if possible, and deflected casual inquiries.
- Special care is taken in the drying of sable fur (e.g. paper was plastered onto each paw to avoid their curling inwards) and in the subsequent softening (using salt-water and working very carefully), although again, this could just be because sable furs are high-value trade items.
- One should not touch the sable-furs hanging and stretching by the window of the house. [Unknown if it only applied to researchers, or to females, or to everyone except the hunter].

---

[3] The same location of respect (opposite the door) is seen among other circumpolar groups including the Ainu and Misatassini Cree (Speavakovsky 1994; Tanner 1979).

2.5 Treatment specific to mink

No special treatment occurred. The carcass was thrown away casually after skinning.

2.6 Treatment specific to bear

The hunting, butchery, and use of bears were not observed during the field season, but here is the procedure as can be reconstructed from various casual conversations during the field season. Many circumpolar groups gave special ceremonial status to bears (see Chapter 1) and it seems that the study group was no exception.

- According to the study group, bears were not actively hunted. They will kill bears if they see them around or in the camp area. For example, in the fall of 2000, a bear was killed by the outhouse at the Main Camp. Generally in leaner years, there are more bear encounters. Thin bears can attack people and must be tracked intensively, while fat bears will run away from people and so can be left alone. Some bear encounters occur in berry-picking season (summer). Reindeer calving season (spring) is also a time with a high encounter rate, as the bears are hungry. During one calving season, a bear killed a lot of [juvenile or adult?] reindeer with a blow to the back of head with its paw, and study group members wanted to track that bear down but had to give up as there was no snow on the ground. In other seasons, most bear encounters occur while hunting. If the hunter sees the bear first while the bear is far, they will not normally shoot. (This is probably because their usual weapon is too small a caliber to kill a bear, and trying to kill a bear with this gun is considered dangerous). When hunting down problem bears, they will use a shotgun loaded with heavy slug.
- Although they say they do not hunt bears, the group also boasted that Yakov killed a lot of bears in his lifetime. Misha is said to actively hunt bears [he

also owns a better gun]. An (unsuccessful) baiting at a bear trap was observed during the field season.

- The bear trap used in the Spring field season was a deadfall trap where more than eight big logs were triggered to fall when the bear moves the bait, trapping and/or killing the bear. As a female, I was not able to go see the trap. The trap was of major semi-permanent construction, dug partly into a slope and used massive logs. Moving parts were made anew before setting up the trap. There were three moving parts – the bait-stick, the vertical log to be pulled out from under the deadfall when the bait-stick was moved, and a tie in between. The bait was a fake reindeer head, made of old *kabarga* meat parts (femur and tibia) and a capercaille head wrapped in a reindeer head fur. The bait was shaped so it would look like a head, and concealed a carved stick within. The tie was constructed of a twisted willow sapling. These two parts were made under the instruction of Yakov, and set in the trap the day after they were made. In the Spring field season, there were multiple conversations among study group members in which bear eating was mentioned, and bear hunting hinted at, before the bear trapping trip occurred.
- When a bear is killed, the hunter must say '*kok*' at the time of death. The same word must be said at the first bite of bear meat, later. After the kill, the bear would be skinned and field-butchered, and all parts transported home, as with the reindeer or other large game. For the parts butchery of bear, back at the Main Camp, there would be some special precautions taken. Females could not take part in the butchery of bears. Everyone in the house must be very quiet, especially the females. There cannot be any banging around of dishes and cutlery. Only a knife would be used, and no axe would be ever used. Common precautions that applied to meat animals also apply to bear, for example females cannot step over blood and parts.
- The bear is skinned whole, from head to limbs, similar to *kabarga*. The fat layer under the skin is also taken off, like a second layer of fur. Meat is cut into parts in the same way as other large game.
- Some bear parts were processed/cooked but not eaten. The eyeball would be smeared with blood on a tree, at approximately the eye-height of the dead bear. The head (skull and mandible) would be boiled and the jaw propped open, like the *kabarga*, but not eaten. Nor were the brain or tongue eaten. The liver would also be boiled but not eaten, and the kidneys and intestines were not eaten. The boiled head and liver were deposited together with the bones. The marrow and spinal cord were never eaten, and "a person will wither and die" if these parts are eaten. Females cannot eat the meat at the back of the head and neck, with the exception of old women.
- Parts that can be consumed are the heart, lungs, and meat. The hands are the most tasty, as they are fatty. Lungs would be cut up (like ground meat, but using a knife) and thrown into a pot of fat. This dish is said to be very tasty, and would be eaten from a big bowl. Custom dictates that each person must eat three spoonfuls [or eats with three spoons?] and pass the bowl on to the next person. Bears hunted in the fall would be fat and generally taste good. Old or stringy meat (for example, the bear killed in fall 2000) could be

fed to dogs, or bartered away. The gallbladder would be boiled, dried and used as medicine [or sold as medicine]. The fat would be boiled down and used as cream – used on hands and face to prevent frostbite on sled-trips – but this fat could also be eaten. (During the field season, marmot (*tarbagan*) oil was used instead as face-cream, as they were out of bear oil).

- The fur would be sewn in a special way (details unknown), and made into blankets, sleeping bags (four bear furs per bag), and hats.
- Bear remains (bones, head, and liver) would be specially deposited into a raised and closed platform-box [resembling a traditional human coffin]. Bones were also boiled before depositing on the platform [probably the lower limb bones, which were deposited raw after cracking for marrow in other game]. A bone box should be made for each bear, but in practice, bone boxes could be re-used if the old bones were emptied for some reason or other[4].
- Bears were said to be the owner/master (*hajain*) of the forest. They will hear what people are saying[5]. For example, after we had a conversation about bear, Vasili predicted that we would encounter a bear on our next trip. As another example: the bear trap trip was never openly discussed, and the mention of the word 'bear' was actively discouraged during the preparation of the bait and during the days while the trap remained open.

2.7 Other butchery- and use-related practices

- Bone smashing for bone boiling must be done by one person, because if many people take part in it, the oil will not render properly (*maslo ne budet*).
- Small pieces of *pirozhok* (fried meat pies) must be fed to hunting dogs, each time this dish was made. They were not given to puppies, as they were not hunting dogs yet.
- In case of illness, one must avoid the part of animal that corresponds to the area of illness (e.g. when Vadim had a bad liver, he did not eat reindeer or *kabarga* liver).

[4] The study group recounted one case where a live bear tore down an old bear bone-box near the Main Camp [while the camp was unoccupied], scattered the bones, and left. This bone-box was subsequently used to house the remains of a second bear.
[5] A common belief among northern peoples, according to Lissner (1961:157).

- Duck wishbones were broken [by two people holding each end] to seal bets.

3. Practices related to domesticated reindeer

Aside from hunting, the study group spent a considerable amount of time caring for their domesticated reindeer. Domesticated reindeer gear was made out of wild reindeer materials when possible, and this choice of raw material probably had ceremonial meaning. For example, wild reindeer incisors were used to make rattles and to decorate the *riukariuk* (salt bag), and harnesses were made out of wild reindeer leather. However, domesticated reindeer care was mostly practical and less riddled with rules than hunting or butchery activities. Some observed non-practical activities were:

- When one sees a domesticated reindeer sleeping with its neck stretched out on the ground the animal must be woken up, because they are dreaming of being slaughtered by their owners [as their posture mimics posture at slaughter].
- No bead-work was allowed on dog collars, but bead-work often adorned domesticated reindeer collars.
- An old reindeer bell belonging to a female reindeer that was killed by a wolf was left unused, hanging from wall, although the group was short on reindeer bells. The bell was left un-used because “it might attract wolves to another meal”.
- Spoiled reindeer milk should be poured into/under the *pechka*, and should never be given to dogs.

4. Other customs

While the study group professed to not take part in any shamanistic rituals, one behavior, the feeding of the fire/hearth, was clearly ritualistic. Offerings were put into the *pechka* (stove) at every meal by at least one person – most often a piece of buttered bread – but in some cases (e.g. after moving to a new location for a hunt), a small piece of everything on the menu (e.g. bread, sugar, and meat). Food items were thrown into the *pechka*, onto the fire. Offerings were made without exception when arriving at a new location (e.g. moved camp), specifically on the first meal at the new location. Once it was explained that only one person was to make the offering, but in some observed cases, everyone did. The same ritualistic offering was observed among a different group of Evenki (Anderson 2000).

In some cases, the person making the offering muttered the word "*burula[kh]*" (spirits, possibly same as "*burkan*" in Shirkogoroff (1935)?). The offering was not for *pechka*, but for the fire (and *burulakh*). The strips of cloth tied to a tree as an offering to this *burulakh* were also seen in some camp locations (a custom imported from Buriat/Lamaist traditions: Shirkogoroff 1935). A mountain-pass used to cross north into a different river system from River Cen' was commonly referred to as *burulah*, reportedly in reference to a cloth-tree there.

All the customs listed up to this point – from the treatment of carcasses, the use of wild reindeer as material for their domesticated reindeer gear, and *pechka* offerings – could in some ways be linked to the shamanistic belief system underlying their culture. There were, however, some beliefs held by the study group that seemed to fall more into the category of superstition. These are listed below.

Weather

- Playing with snow (snowballs, snowman-building) will call snow.
- Beat [or do something] to the bear fur, and the weather will change [for the worse?].
- Whistling brings wind [so one should not whistle].
- If woodpecker calls, it will rain all summer.
- A ring around the sun means cold weather is coming.
- If the moon stands or slants, the weather is turning [bad].
- If a domesticated reindeer's [or a person's] ears itch, it will be windy.
- If domesticated reindeer clean their antlers, the weather will turn warm.
- Don't wear red during thunder, and don't run [as it is dangerous].
- Shoot a gun downstream to make ice go away faster at spring breakup.
- Cut [with knife] and shoot [with gun] at strong winds, especially whirlwinds, because they are evil[6].

Other omens

- If the right hand itches, it means a visitor is coming.

[6] Wind-cutting is described by Anisimov (1963b:221).

- If one leaves a single piece of firewood unused, that person will be alone for life [so don't do it].
- When the wind blows hard, it means someone died.
- Drop a knife/spoon – a woman will arrive/visit.
- If one grabs two cups/spoons by mistake, that person will have two husbands/wives.
- If one spills tea-leaves, men will soon get drunk.
- If one shakes hands with the left hand, it means one will get money.
- When cracking a reindeer mandible for marrow, if the bone splits clean, that person is good and well liked. If not, that person had enemies.
- Cutting a photograph is the same as cutting love [so one should not cut photographs].

Dream omens

- Fish in dreams signifies illness and bad things.
- Policemen in dreams signify wolves.
- Riding domesticated reindeer in dreams means it would snow.
- Crying in dreams is a good omen, and means there are good things to come. [Study group noted that this was the opposite of what Russians believed.]
- Rhododendron flowers in dream are a bad omen, as these flowers are only placed on graves.
- Old man or woman in dreams signifies "*burulakh* (god or spirit)" [and is a good omen].
- Bear in dreams means that visitors will arrive.
- Dogs in dreams mean that visitors will arrive.
- Baby in dreams means that sable will be caught.
- Defecating in dreams means that meat animals (red deer, reindeer) will be caught. If a hunter announced that he dreamed this kind of dream, much interest was shown.
- Lots of [domesticated] reindeer in dreams mean that a change of weather was coming (snow/rain).
- A young woman in a dream is the devil. If one took the young woman's hand and went away in that dream, that person would die. "Misha's wife's brother died the day he dreamed [of the young woman], by drowning" (Vasili).

Good/bad luck

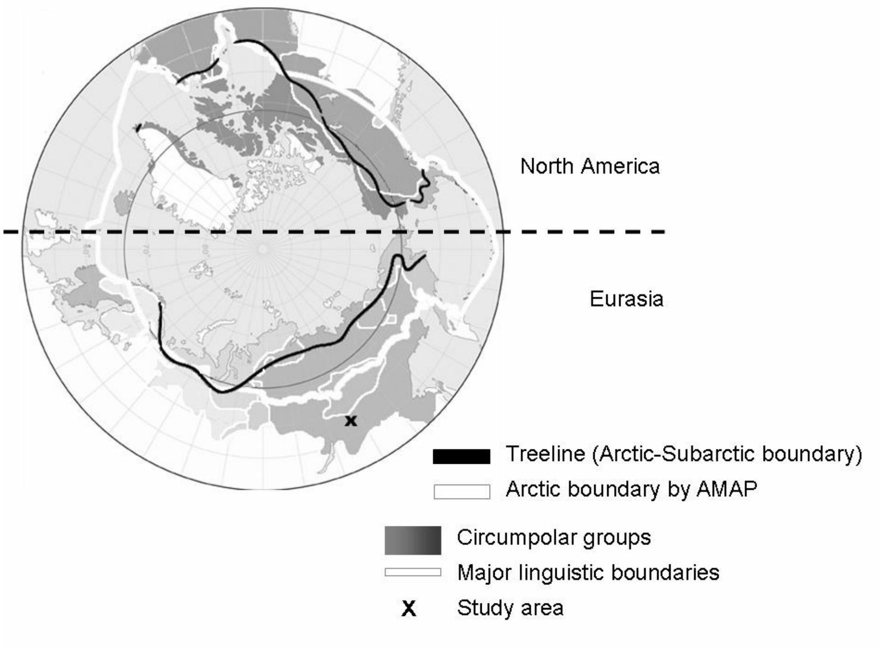
- New items (such as bags) should not be empty. Yulia put little pieces of leather in newly made containers, and an empty toothpaste tube into a new backpack.
- It is bad luck to spill salt.
- It is bad luck to walk on coals – bad things will happen.
- One should not cut hair with a knife (one should only use scissors).
- No salt can be put into the fire.
- Dogs howling were a bad thing, and had to be stopped [by scolding].

- A person should not use his/herself to describe sickness or death (e.g. point to body parts, mention death of own parents while they are alive). If s/he already did so, s/he must spit to the side or over his/her shoulder.
- One should not sew clothing while it is being worn.
- When a hollow tree is cut down, one must put a young cut sapling inside. In one case, Vadim explained this as "preventing the devil from escaping".
- If one steps on a feather, a gun won't fire. Thus, birds were plucked well away from living areas.
- Hazel grouse (*rapchik*) feathers were burnt on the *pechka* surface to create medicinal smoke.
- One should not pass behind the back of a sitting person.
- The wagtail is a bad bird because it can jinx or 'shamanize' a person when it crosses a doorway or walks behind a tent/house.
- Ravens are bad birds because they will eat out the eyes [of domesticated reindeer?]. Dead ravens should not be touched by hand.

Figure 1.1: The circumpolar region.

Modified from maps by Arctic Monitoring and Assessment Programme (AMAP: http://www.amap.no/) and Arctic Network for the Support of the Indigenous Peoples of the Russian Arctic (ANSIPRA: http://www.npolar.no/ansipra/)

a) Circumpolar groups in North America and Eurasia (shown in gray).



b) Boundary between tundra and taiga vegetation zones.

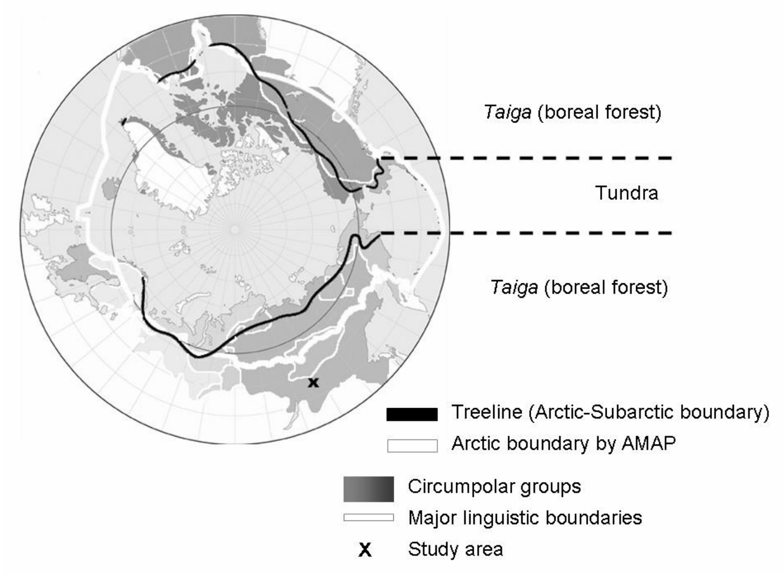


Figure 1.2: Distribution of wild reindeer/caribou and reindeer domestication.

Modified from map by Arctic Monitoring and Assessment Programme (AMAP: http://www.amap.no/).

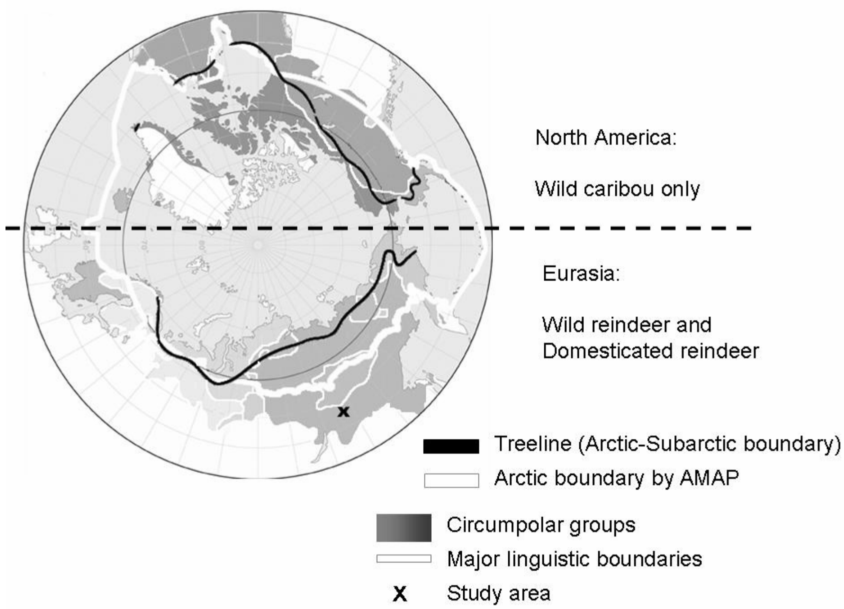
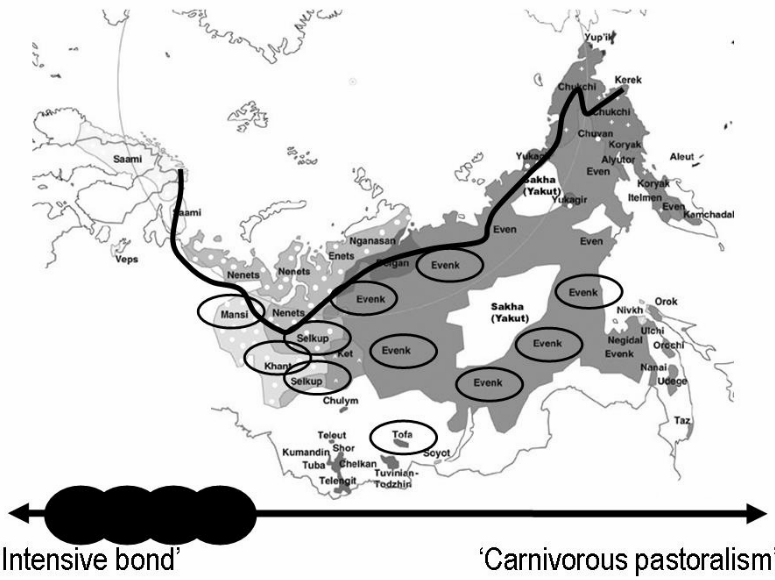


Figure 1.3: Spectrum of reindeer domestication.

Modified from map by Arctic Network for the Support of the Indigenous Peoples of the Russian Arctic (ANSIPRA: http://www.npolar.no/ansipra/)

a) ‘Intensive bond’ approach.



b) ‘Carnivorous pastoralism’ approach.

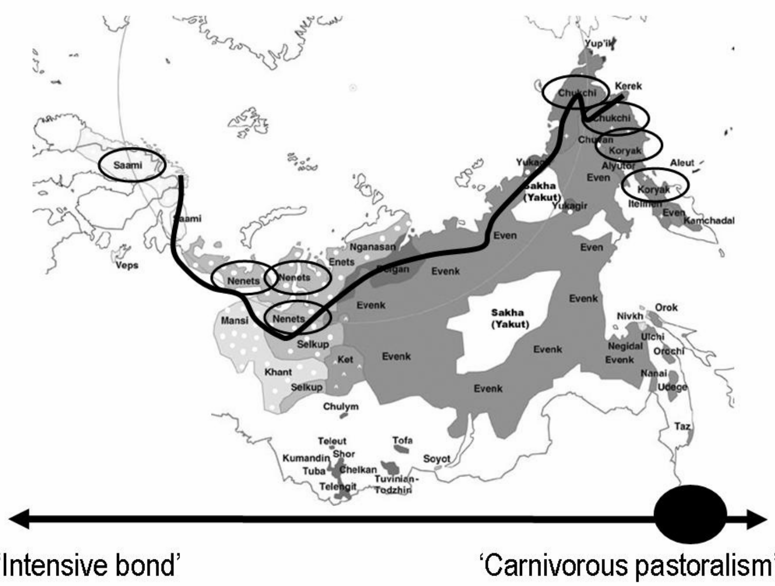
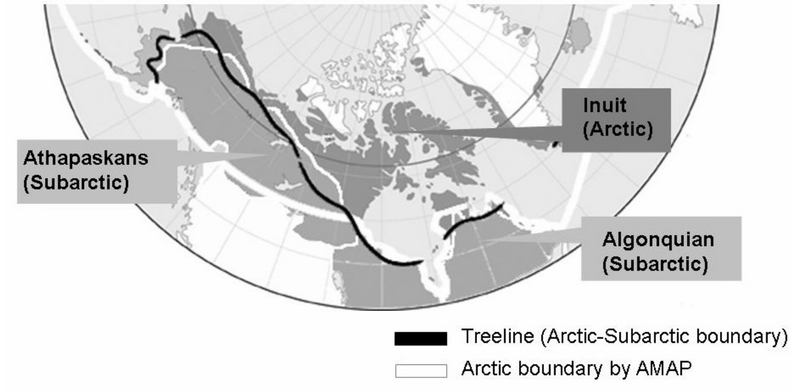


Figure 1.4: Circumpolar groups and their distribution across ecozones.

a) Group distribution following tundra/*taiga* boundary in North America.



b) Group distribution across tundra/*taiga* boundary in Eurasia.
Detailed map shows major language groups.

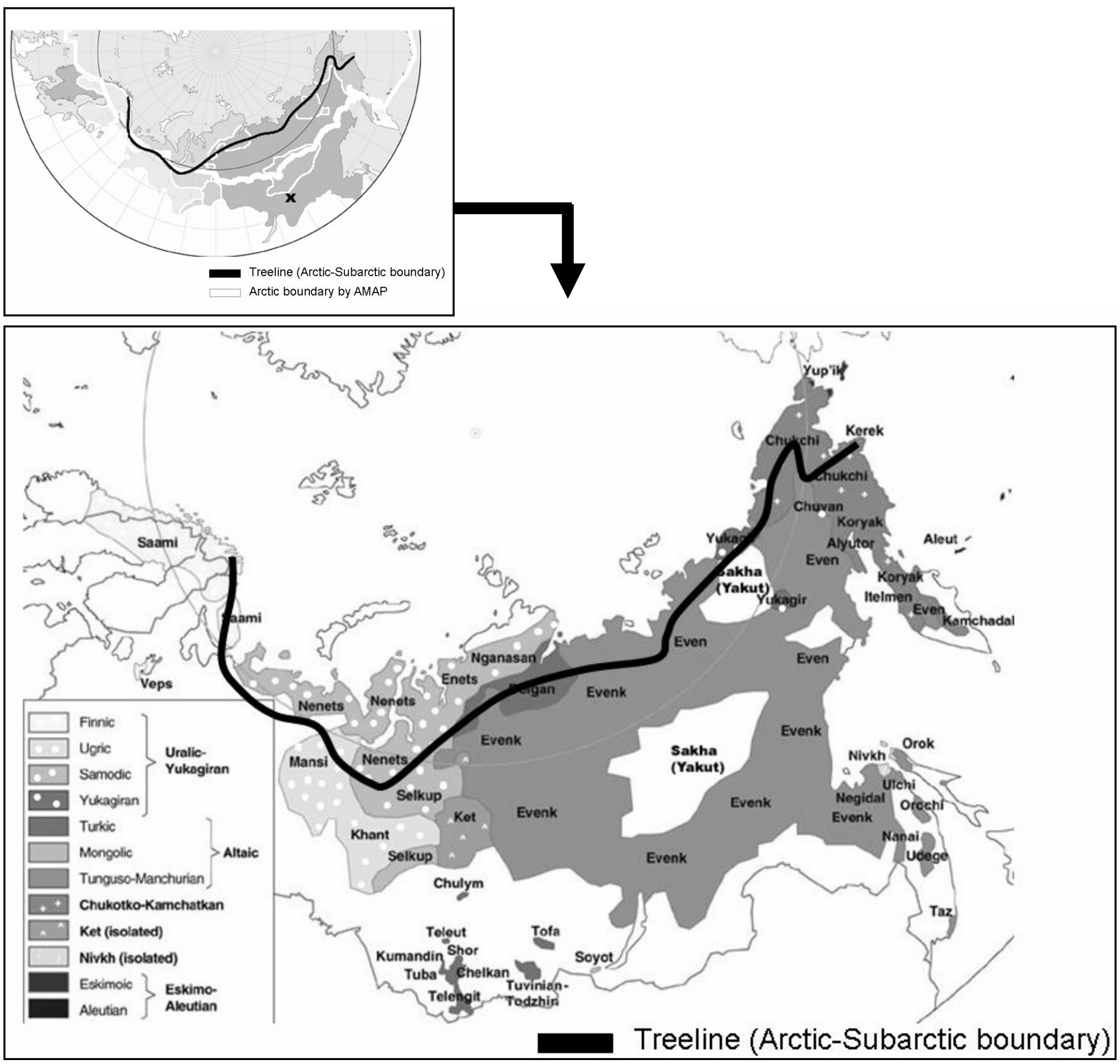


Figure 1.5: Schematic of zooarchaeological inference.
Modified from Gifford-Gonzalez (1991:229, Figure 2).

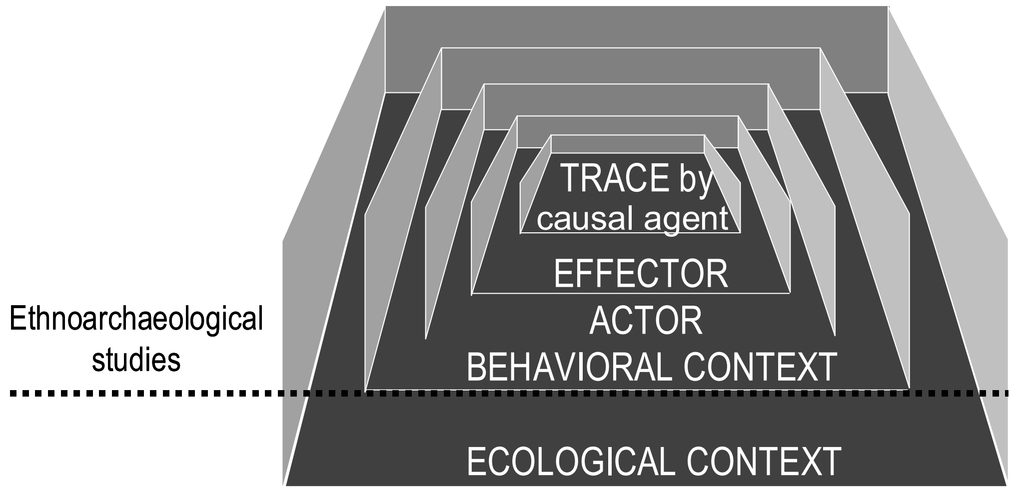
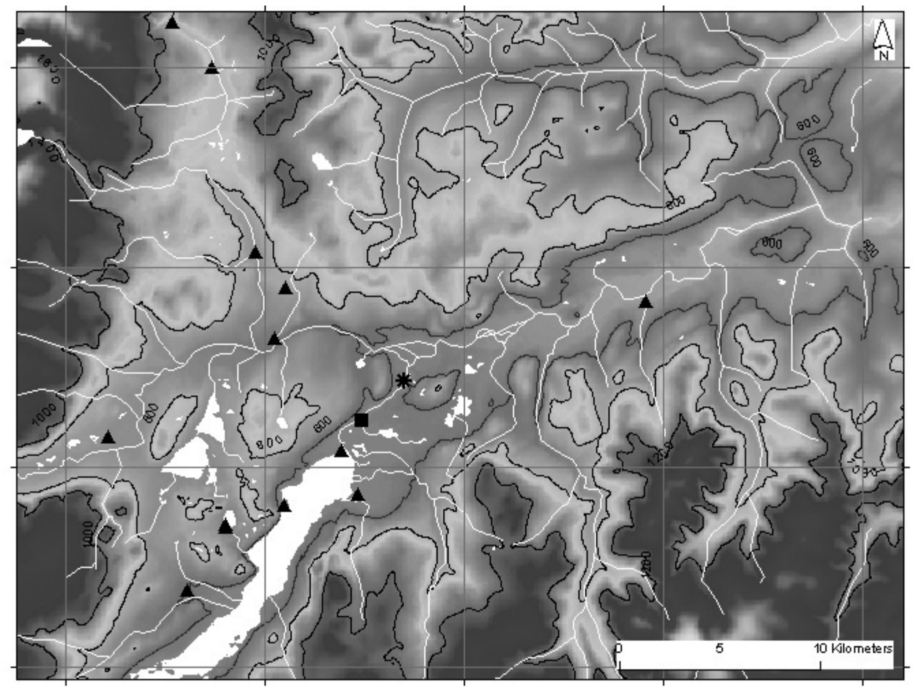
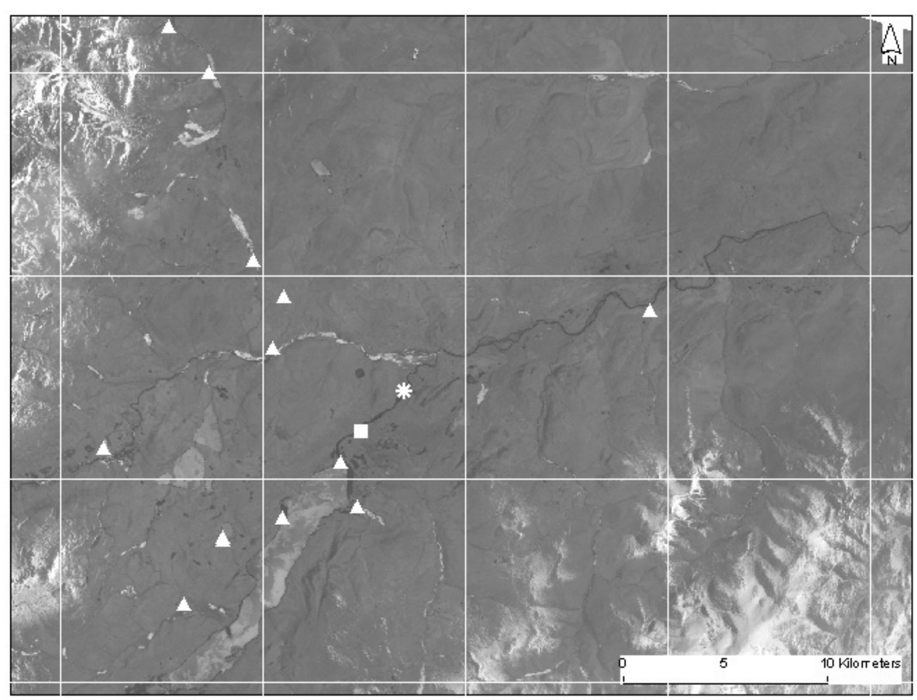


Figure 3.1: Study area.

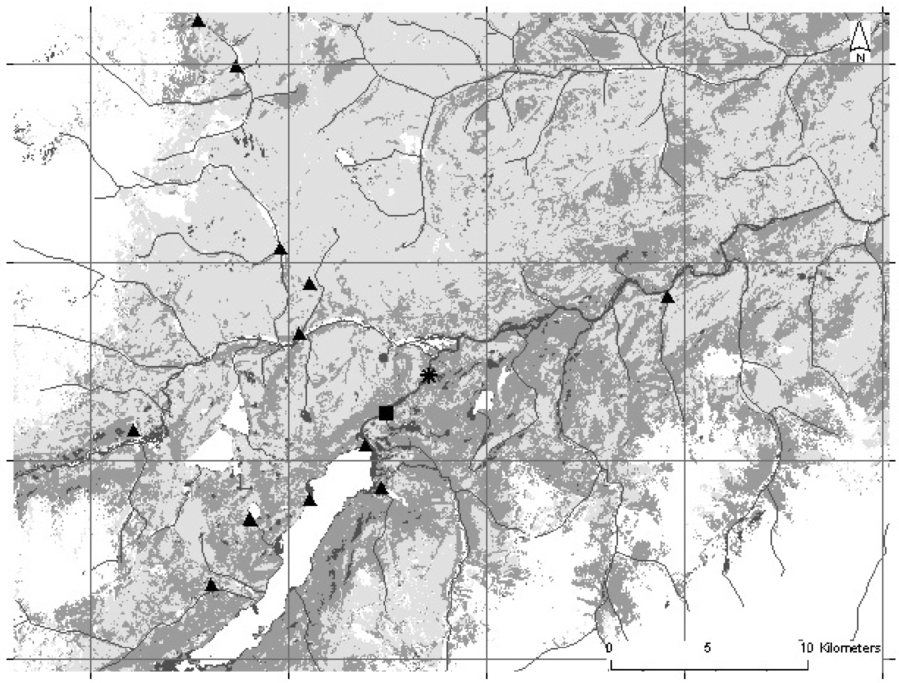
a) SRTM elevation map of area used by study group during field season. Contour lines = 200m intervals, white lines = rivers, white solids = lakes. Star = Main Camp, square = Spring Camp, triangles = short-term camps.



b) LANDSAT satellite image of same area (June 1995).



c) Land cover model from LANDSAT satellite image.
White = snow or ice, black = rivers or open water, darker gray = forest, lighter gray = light forest cover and/or open areas.
Star = Main Camp, square = Spring Camp, triangles = short-term camps.



d) Typical landcover (Vadim in 2001).

Figure 3.2: Climate conditions in study area.

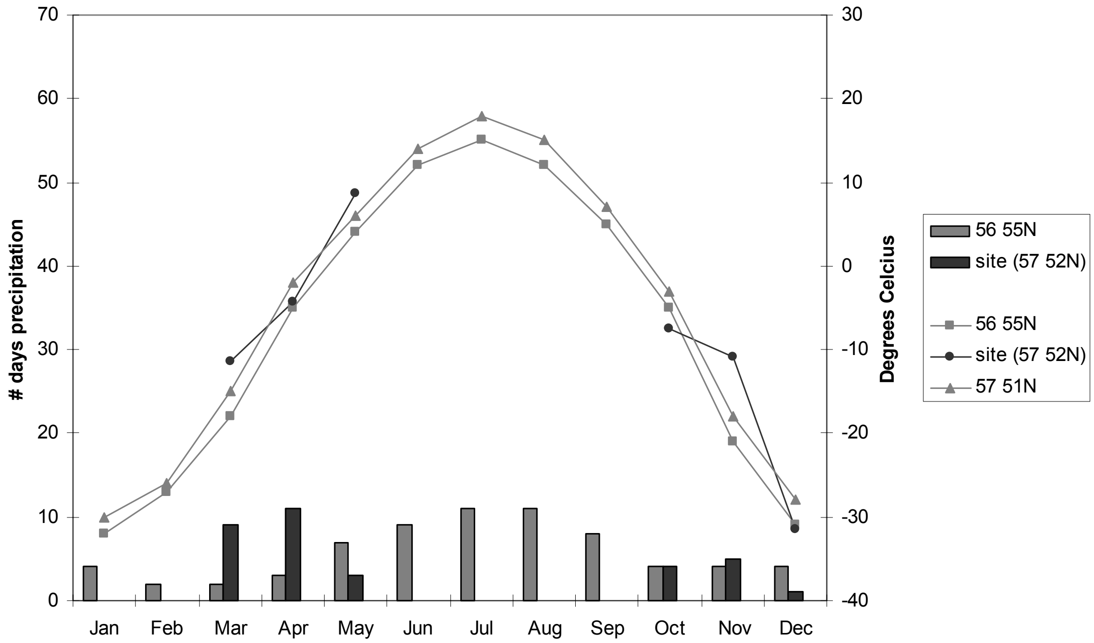
a) Temperature and precipitation of study site and nearby weather stations. Sources: A = Weatherbase (www.weatherbase.com), B = World Weather Information Service (www.worldweather.org)

City A	**56 55N, elevation 703m**					
	Average temperature (Celsius)	**Average high temperature (Celsius)**	**Average low temperature (Celsius)**	**Average # days precipitation**	**Average precipitation, rain (mm)**	**Average preciptation (mm)**
Jan	-32	-26	-39	4		2
Feb	-27	-18	-37	2		3
Mar	-18	-8	-28	2		3
Apr	-5	2	-13	3	10	10
May	4	11	-2	7	30	24
Jun	12	20	4	9	60	59
Jul	15	23	8	11	60	104
Aug	12	20	5	11	60	84
Sep	5	12	-1	8	50	37
Oct	-5	1	-12	4	20	10
Nov	-21	-15	-27	4		5
Dec	-31	-25	-37	4		4
# years on record	23	23	23	10	10	?
source	A	A	A	A	A	B

City B	**57 51N elevation 275m**					
	Average temperature (Celsius)	**Average high temperature (Celsius)**	**Average low temperature (Celsius)**	**Average # days precipitation**	**Average precipitation, rain (mm)**	**Average preciptation (mm)**
Jan	-30	-26	-34			21
Feb	-26	-20	-32			12
Mar	-15	-7	-22			8
Apr	-2	4	-8			14
May	6	13				39
Jun	14	22	7			61
Jul	18	25	11			79
Aug	15	22	9			80
Sep	7	13	2			60
Oct	-3		-6			24
Nov	-18	-14	-22			29
Dec	-28	-12	-32			26
# years on record	53	52	53			
source	A	A	A			A

Study site	**57 52N, elevation 560m**		
	Average temperature (Celsius)	**# days precipitation**	**# days on record**
Jan			
Feb			
Mar	-11	9	25
Apr	-4	11	30
May	9	3	19
Jun			
Jul			
Aug			
Sep			
Oct	-8	4	25
Nov	-11	5	30
Dec	-31	1	12

b) Study site temperature and precipitation in comparison to two weather stations.



c) Environmental variables.

	mean temperature warmest month (MWM)	mean temperature coldest month (MCM)	latitude	effective temperature (ET)	temperateness (TEMP)
City A	15	-32	56 55N	10.7	22.2
Study site		-31	57 52N	11	22-23
City B	18	-30	57 51N	11.1	23.4

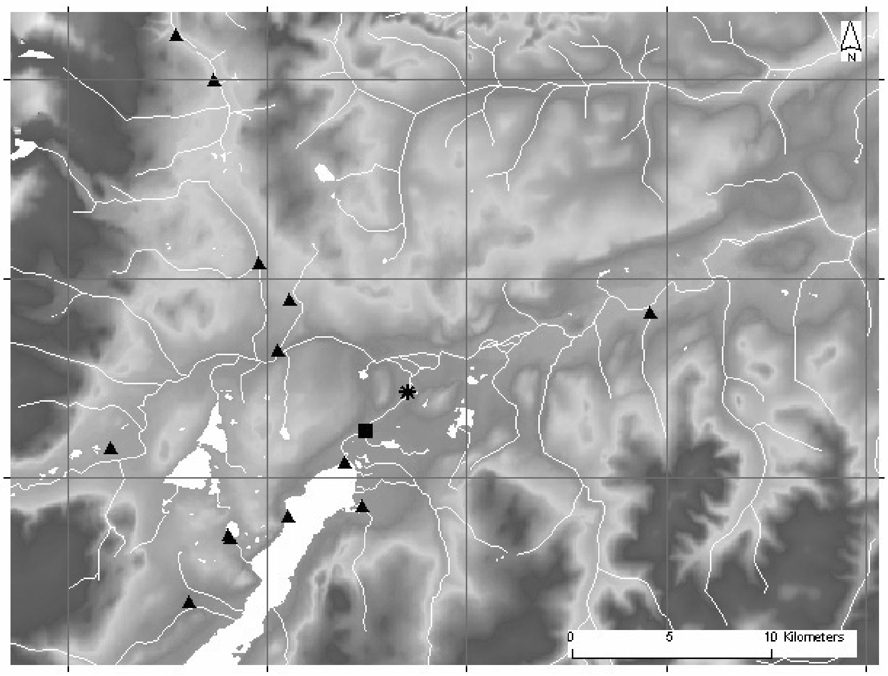
Calculation (from Binford 2001:59):

$$ET = (18 * MWM) – (10 * MCM) / (MWM - MCM + 8)$$

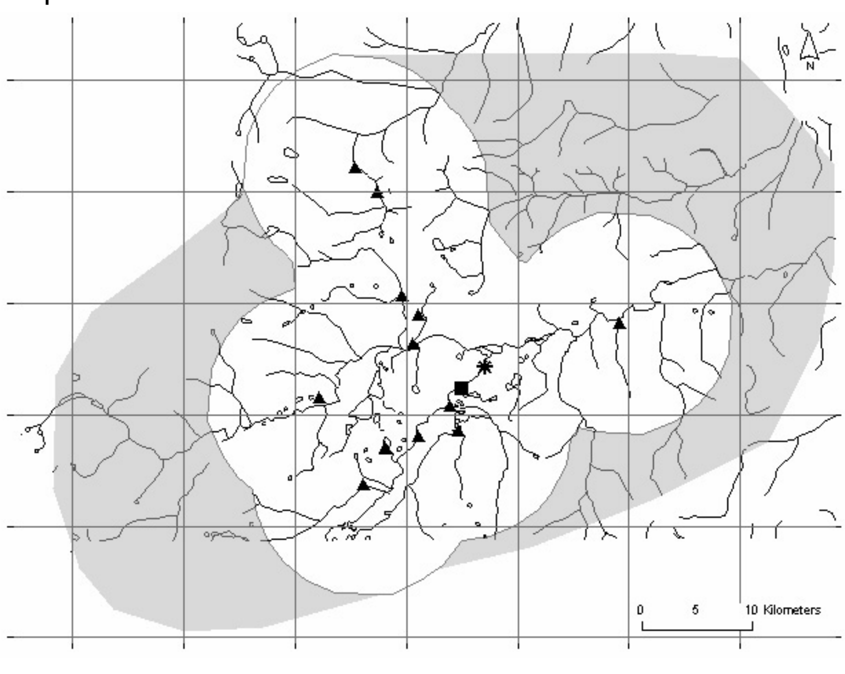
$$TEMP = 161.7 – 41\log_{10}[(MWM – 10)^2 + (MCM – 18)^2]$$

Figure 3.3: Settlements and land use by the study group.

a) Areas visited during field season.
Star = Main Camp, square = Spring Camp, triangles = short-term camps.



b) Estimated territory.
A conservative estimate is given by drawing circles of 10km radius around camp locations observed during field season (white area). A more likely estimate includes additional gray area, which covers all major river systems used by the group.



c) Additional areas of activity.
In addition to territories shown in b), the study group visited two outlying areas regularly. Hatched area to north indicates area around Perevoz, and double-hatched area to the west shows approximate location of a highland creek visited for marmot (*tarbagan)* hunting in August. Black outlines indicate approximate access route and possible hunting zones *en route*. Star = Main Camp, gray lines = rivers, double black line = road.

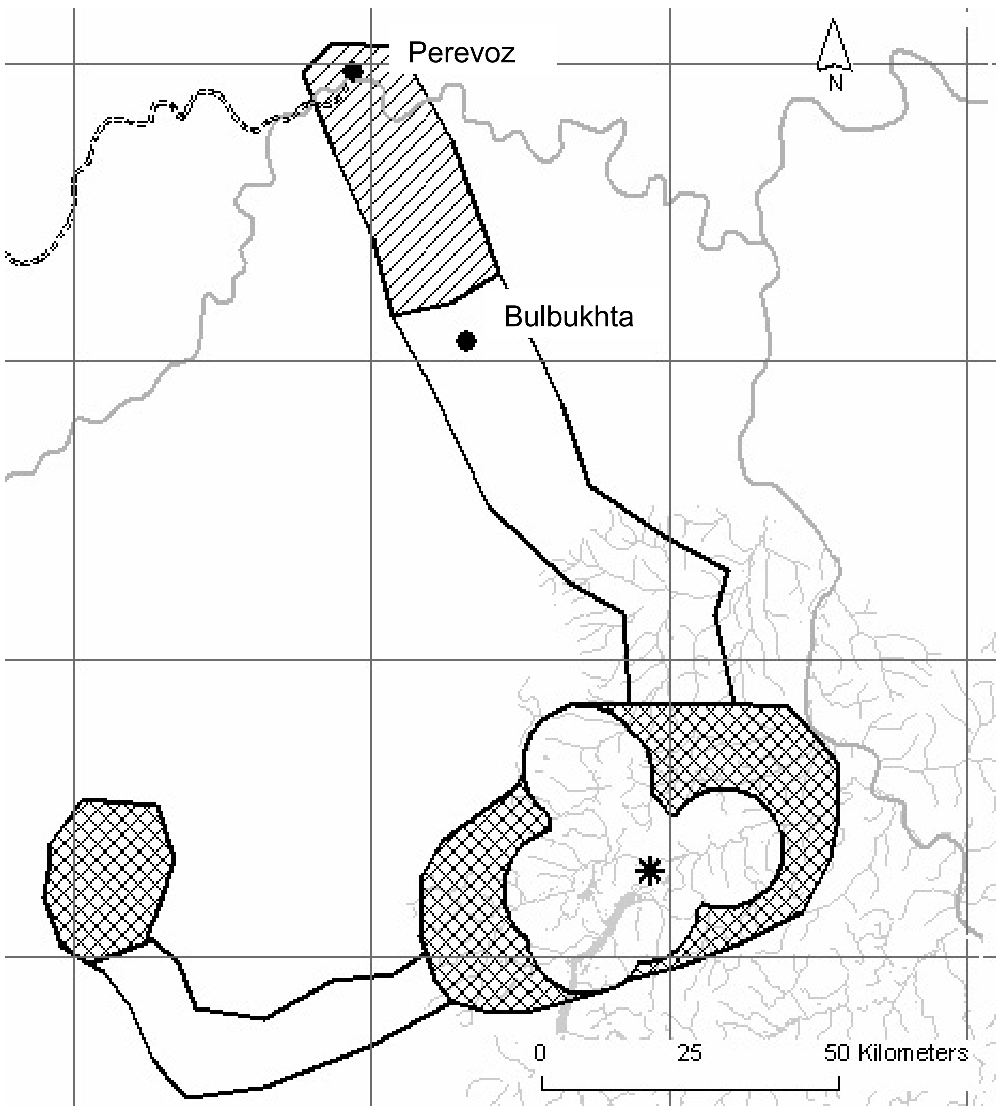
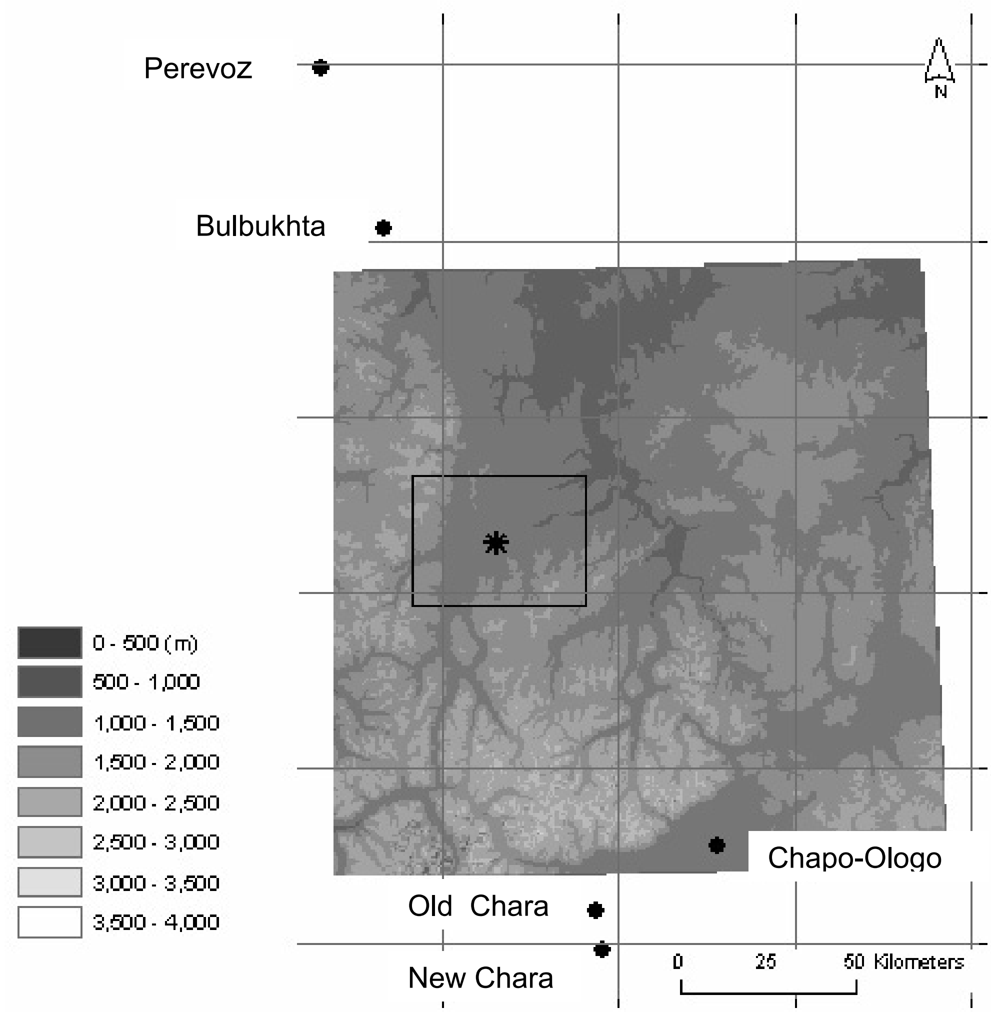
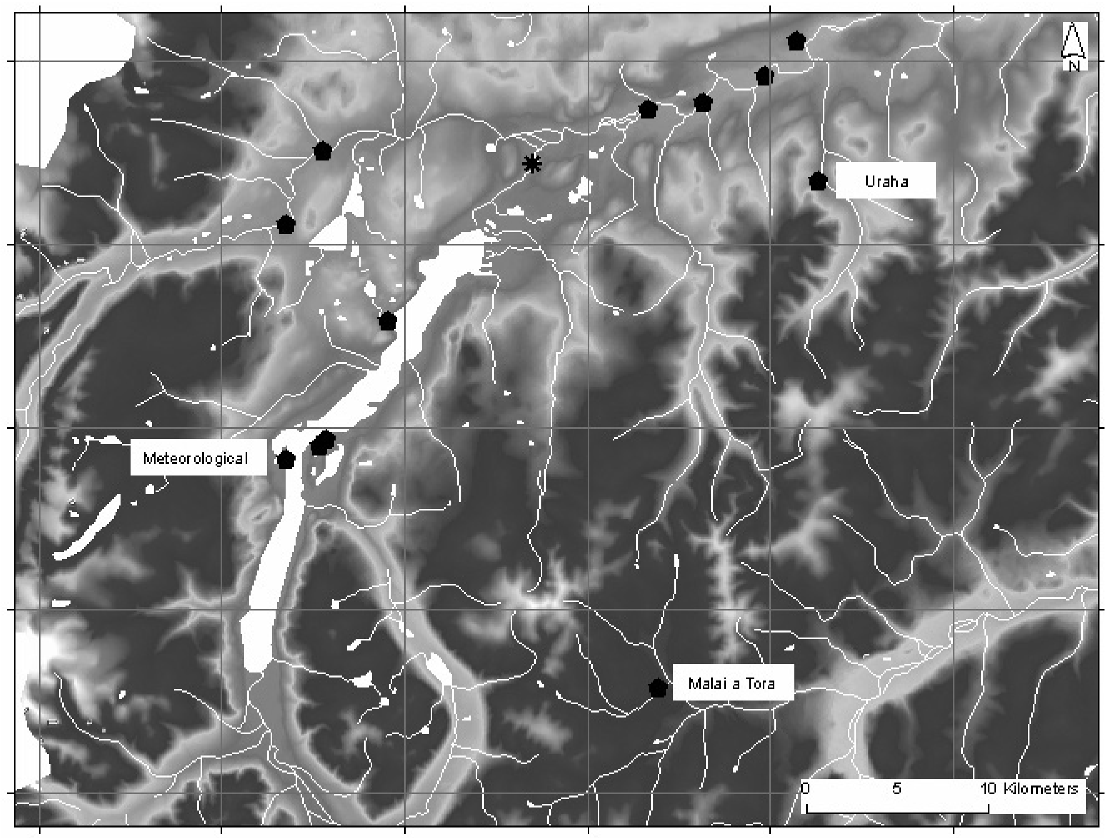


Figure 3.3: Surrounding population.

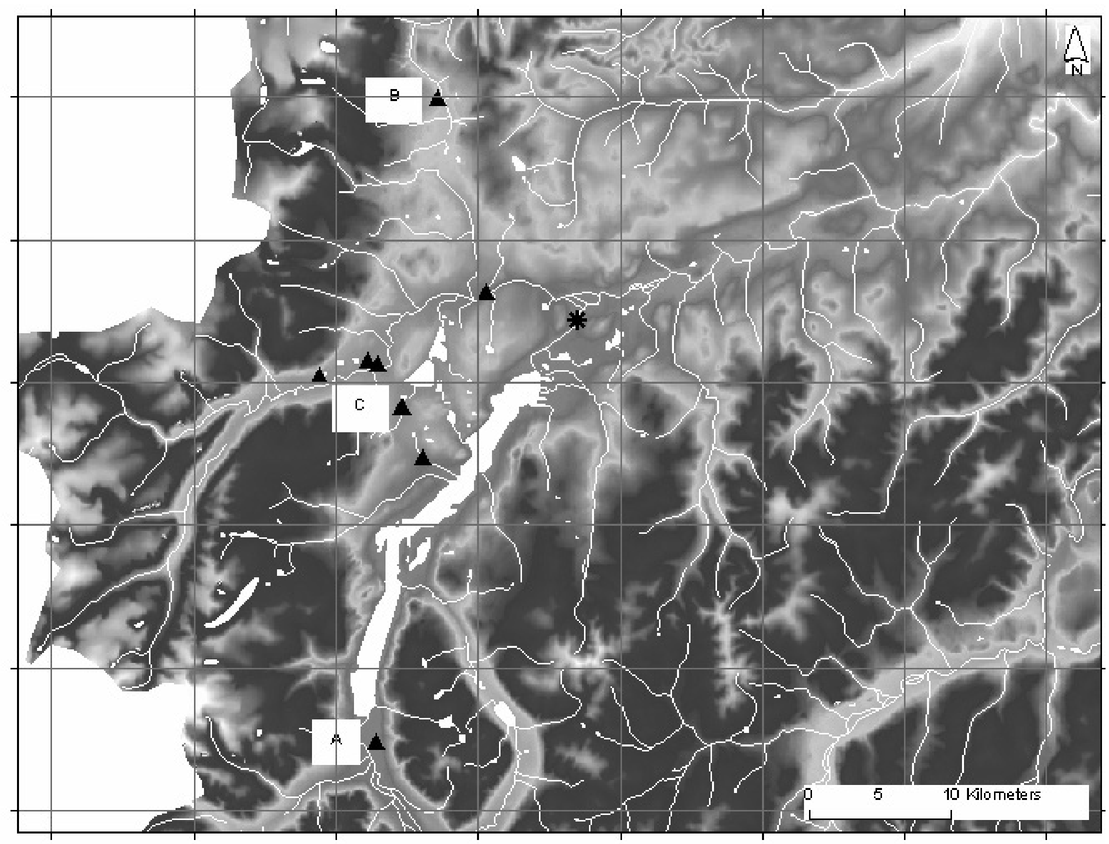
a) Villages and towns near study area.
Star = Main Camp, box = study area (see Figure 3.3).



b) Russian settlements in area.
Star = Main Camp, pentagons = single/multiple Russian-style log cabins.
Labeled settlements are multiple-house settlements.



c) Evenki settlements in area.
Star = Main Camp, triangles = old campsites *not* made by study group. Labeled camps (see text) are long-term large-scale camps belonging to other families. Location of A is approximate.



d) Old sites made and abandoned by study group.
Star = Main Camp, square = Spring Camp, white triangles = abandoned camps.
Shown on CORONA satellite imagery.

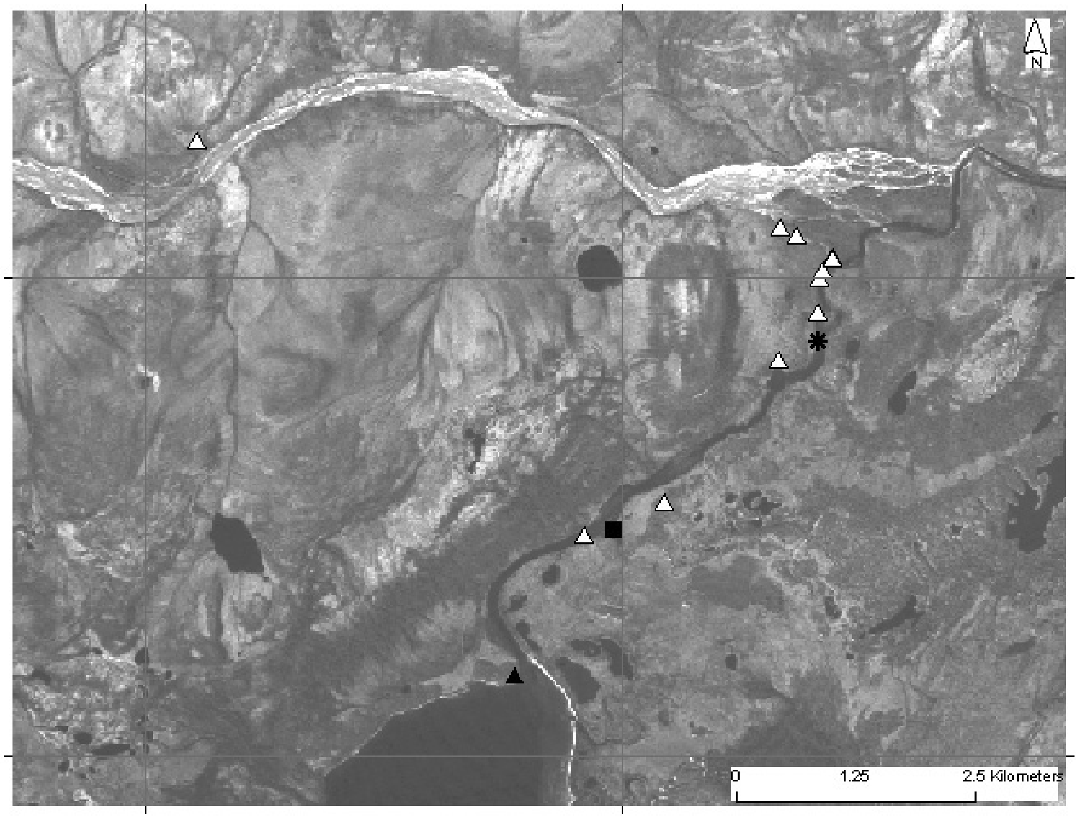


Figure 3.5: Family tree of study group.

Large box: Family tree of core family group (Yakov (YA), Vadim (VD), and Vasili (VS)) and the relationship of Misha (MI). Anna (A) is the mother of Vadim, who later married Vasili, as indicated in this diagram. Yulia (YU) is Vasili's current wife.

Inset: Family tree of Yulia, indicating the relationship of Yulia to Anna. Anna was previously married to Yulia's uncle and Vasili. Vasili was previously married to (and had children with) Yulia's aunt.

Diagonal line indicates deceased individuals.

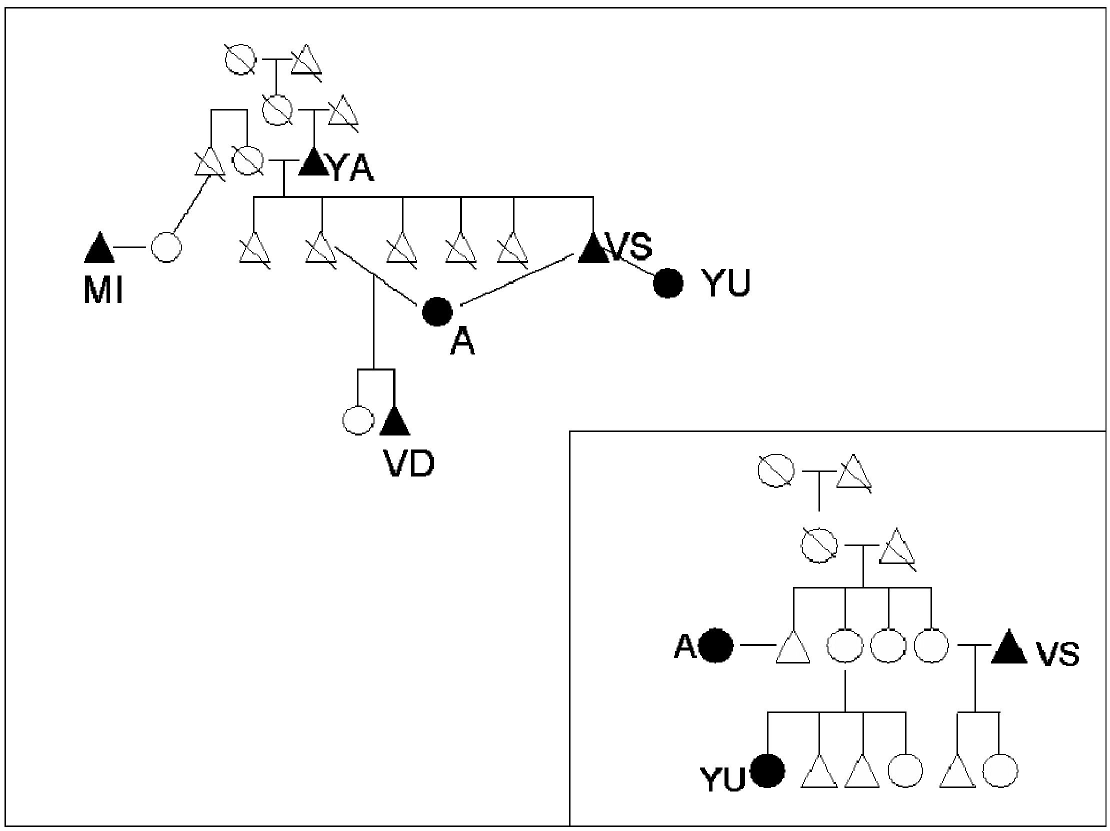
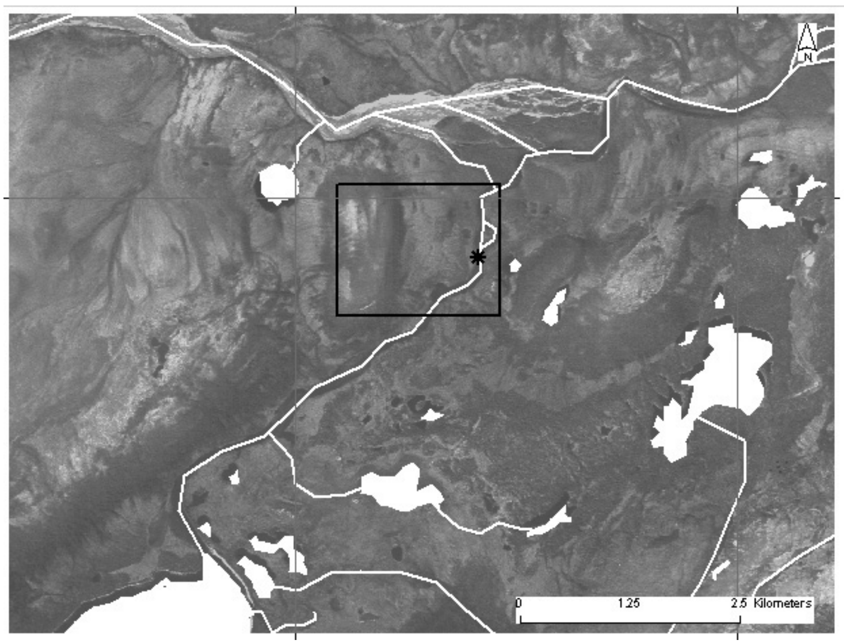


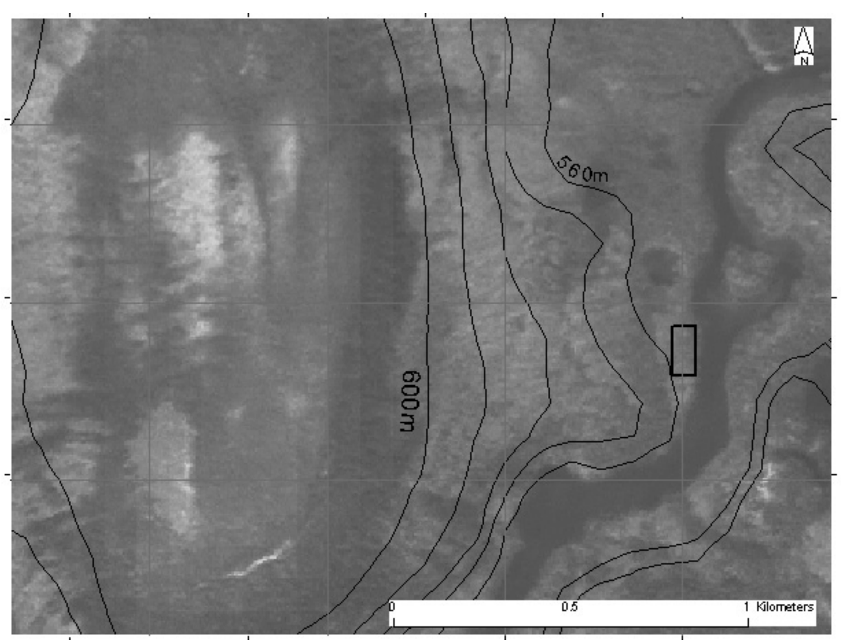
Figure 3.6: Old family photo.
Photo from 1960s(?) showing Yakov, Yakov's wife, and Yakov's mother in front of a pine-bark covered summer *chum* in the study area.

Figure 3.7: Main Camp.

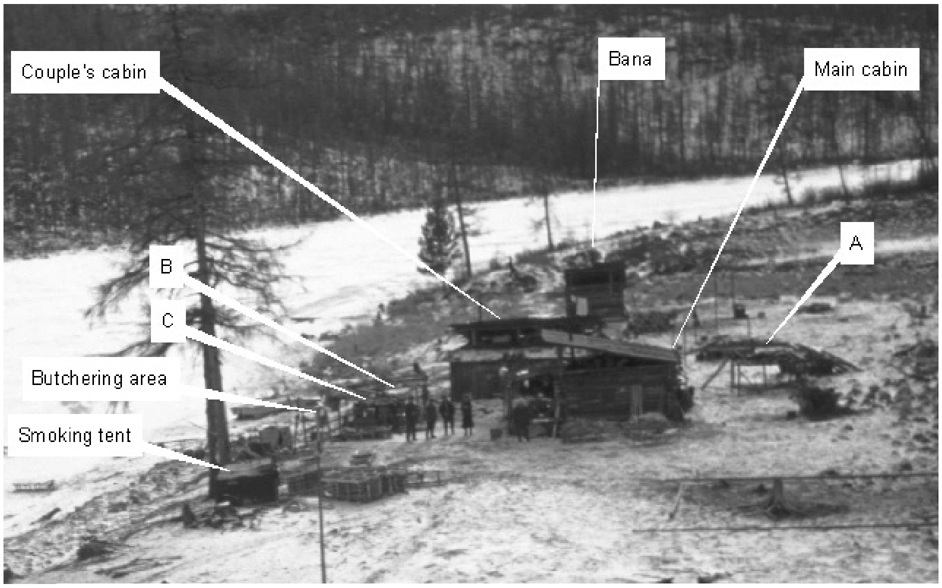
a) Main Camp shown in relation to Lake Nichatka.
Rectangle denotes area enlarged in b).

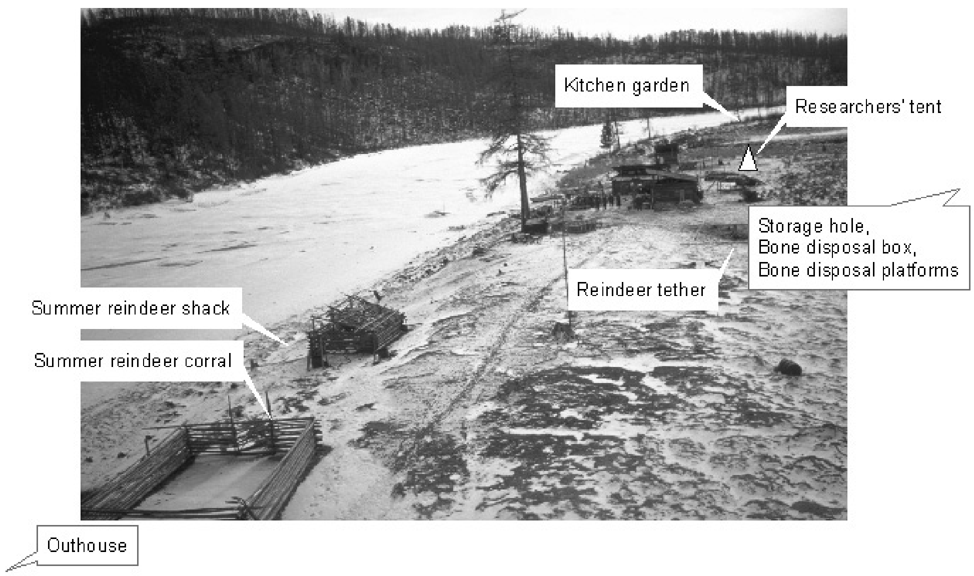


b) Main Camp in relationship to hill and river.
Rectangle shows main occupational area with structures of permanent construction (log cabins, platforms, etc.)



c) Main Camp, looking approximately north to south.
A: unroofed open meat storage platform, B: roofed small open platform, C: Russian oven.





d) Bone disposal box.

Figure 3.8: Spring Camp.
Spring Camp shown in relation to Lake Nichatka. Star = Main Camp, square = Spring Camp, small dots = extent of birthing corral.

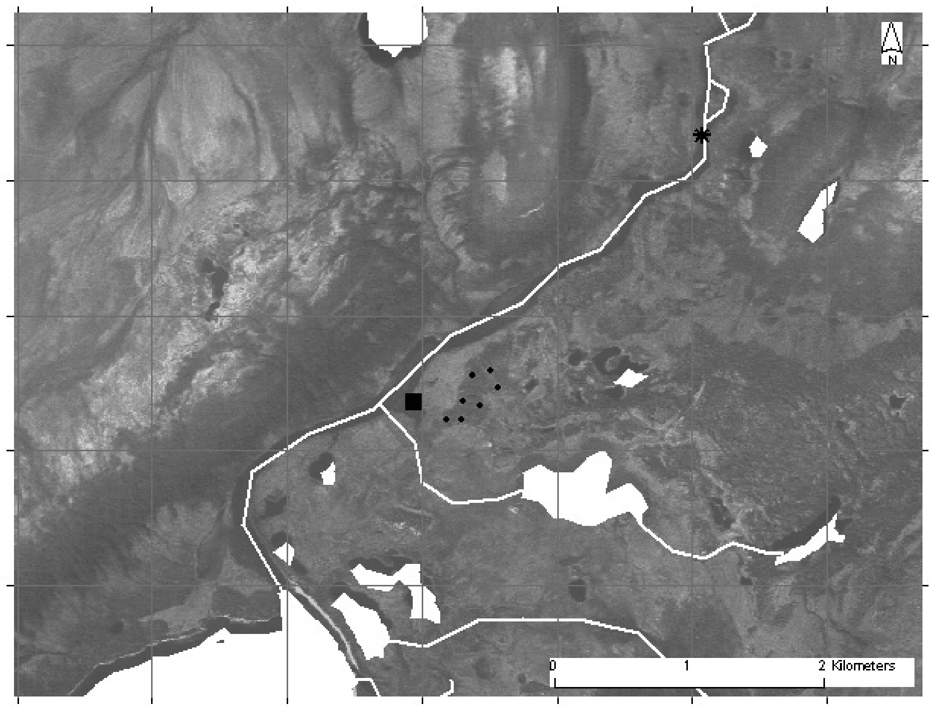


Figure 3.9: Typical overnight camp with canvas tent and outside cooking area (in foreground).

Table 3.10: Ownership of domesticated reindeer.

a) Herd composition, ownership, and exchange of ownership.

Reindeer Name	Sex	Age (10/01)	Owner Fall	Owner (change) Spring	Newborn (5/02) M	F
ШУСТРЕ	C	7.5	MI	YA		
КЭША	C	7.5	MI			
ПАРТИЗАН	C	7.5	MI			
ЖУК	C	6.5	MI	DEAD		
СЕРЕК	C	5.5	MI			
НАРКЛАМАН	C	4.5	MI			
ТЮЛЮЙ	C	4.5	MI			
МАРАХАС	C	3.5	MI			
ГОЛУБОЙ	C	2.5	MI			
ЯПОНИЦ	C	2.5	MI			
КУКЛИН	C	2.5	MI			
БАБУЛЯ	F	9.5	MI			
БЕЛЯНКА aka КОБАКХ	F	8.5	MI			
ТЫЛИНКА	F	7.5	MI			
МАЛЮТКА	F	7.5	MI		DEAD*	
КЛЭРБА	F	6.5	MI		1	
ШУРА	F	6.5	MI			1
ЛЮБЛЮ ЛЮБЛЮ	F	6.5	MI		1	
ШАЙБА	F	6.5	MI			
МОЛДАВАНКА	F	5.5	MI		1	
СЕРЕБРЯНКА	F	5.5	MI		1	
КРАСУЛКА	F	3.5	MI		1	
ТАМАГОЧИ	F	3.5	MI		1	
БУЛОЧКА	F	2.5	MI		1	
СОБАКА	F	2.5	MI			2
ДЛИННАРОГАЯ	F	2.5	MI		1	
АНФИСКА	F	2.5	MI			1
БЛИСТЯШИЯ	F	2.5	MI		1	
БУЛОЧКИНА	F	7mo	MI	YU		
СОБАКАИНА	F	7mo	MI			
БЕЛЯНКА - M	F	7mo?	MI			1
calf of БЛИСТЯШИЯ	F	7mo	MI	DEAD		
КАЧЮША	F	7mo	MI			
ЛЯЛКА	F	7mo	MI			
КАЧУРГАХ	F	7mo	MI			
ХОХОЛЮШ(К)А	F	7mo	MI			
calf of ТАМАГОЧИ	F	7mo	MI			
СОЛДАТ	M	3.5	MI			
АПРЕЛЬ	M	8mo	MI			
БЫК	M	7mo	MI			
ТЫЛИНГЕН	M	7mo	MI			
ШУРАК	M	7mo	MI			
НЕГР	M	7mo	MI			
КОБАКЧАН	C	2.5	VD	VS		
СЛЫШ	F	?	VD			
БОРОНЧЁН	M	7mo	VD			
СУНДУК	C	3.5	VS			
КАТИНКАЛАХ	C	3.5	VS			
НЕНЕЛЮШКА	F	8	VS			1
БЕЛЯНКА - B	F	4.5	VS	VD	1	1
ЧИПА	F	3.5	VS		1	
КАБАРОШКА	F	2.5	VS	YA	1	
ВЯСКА	F	1.5	VS			1
БУРЯТКА	F	7mo	VS			
(А)КУРАК	M	7mo	VS			
КАСТЫЛ	M	2.5	VS			
ЧУРАЙ	C	very old	YA	DEAD		
МАТРЁШКА	F	2.5	YU		1	

b) Total number of reindeer by owner.

Owner	Fall				Spring						
					Adults				Newborn (to 5/19/02)		
	Castrate	Female	Male	**TOTAL**	Castrate	Female	Male	**subtotal**	Female	Male	**TOTAL**
MI	11	26	6	**43**	9	24	6	**39**	5	8	**52**
VD	1	1	1	**3**		2	1	**3**	2	1	**6**
VS	2	6	2	**10**	3	4	2	**9**	1	1	**11**
YA	1			**1**	1	1		**2**		1	**3**
YU		1		**1**		2		**2**		1	**3**
	15	34	9	**58**	13	33	9	**55**			**75**

Notes for a): * sex of dead calf unknown. Spring ownership same as Fall if blank.
Notes for b): subtotal = number of adult animals.

Table 3.11: Dog ownership.

Owner	Number of dogs	
MI	2	Sever - primary hunt dog, M. Vera - young, M.
YA	2	Kobakh - primary hunt dog, F. Baikal - M.
VS	3	Shustre - primary hunt dog, M. Kuistre - M. Chorni - M. Killed.
VD	1	Ulka - primary hunt dog, F.
YU	0	
SA	1	Kesha - young, M.

Table 4.1: Daily activity summary.
Note: search trips were also hunting opportunities as group members always carried a gun.
The percentage value is shown for all fully observed days (% of A) and for days without alcohol consumption (% of B). Taking the latter figure, at least one individual was away on these trips, on over 8 out of 10 days.

	Fall			**Spring**			**Fall and Spring**		
	# days	% (of A)	% (of B)	# days	% (of A)	% (of B)	# days	% (of A)	% (of B)
Total field season	91			90			181		
At study site	68			75			143		
Days completely observed (A)	66			73			139		
Days without alcoholic beverages (B)	59	89.4%		60	82.2%		119	85.6%	
Days on overnight hunt trips*	11	16.7%	18.6%	15	20.5%	25.0%	26	18.7%	21.8%
Days with hunting day-trips	31	47.0%	52.5%	43	58.9%	71.7%	74	53.2%	62.2%
Days with search trips for domestic reindeer	21	31.8%	35.6%	30	41.1%	50.0%	51	36.7%	42.9%
Days with hunts, searches, or moving trips	51	77.3%	86.4%	53	72.6%	88.3%	104	74.8%	87.4%

* The number of days including Istok/Pirivoz trip is 22.

Table 4.2: Items brought in during field season.
Amounts are estimates.

	Fall				**Spring**			
	YO and NI		Trader		YO and NI		Trader	
	Flour	25kg	Flour	100kg	Flour	50kg	Flour	100kg
	Macaroni	10kg	Sugar	25kg	Macaroni	25kg	Sugar	50kg
	Rice	10kg	Rice	25kg	Rice	25kg	Rice	25kg
	Buckwheat		Buckwheat		Buckwheat		Buckwheat	
	Potatoes	some	Macaroni	25kg?	Potatoes	some	Oats*	25kg
	Onions	some	Oats*	25kg	Onions	some	Peas*	25kg
	Sugar	5kg	Peas*	25kg	Sugar	25kg	Millet*	25kg
	Salt	1kg	Millet*	25kg	Salt	10kg	Salt - rock**	25kg
	Tea	20 boxes	Salt - rock**	25kg	Tea		Salt - grain	25kg
	Oil	1 bottle	Salt - grain	25kg	Oil	3 bottles		
	Canned meat	100+	Margarine	40+ tubs	Canned meat	10+		
	Dried apricots		Oil	20+ bottles	Dried apricots			
	Raisins		Soda		Raisins			
	Fruit		Yeast		Fruit			
	Candy	[gift]	Tea		Candy	[gift]		
	Chocolate	[gift]			Chocolate	[gift]		
	Lemons	[gift]			Lemons	[gift]		
	Cigarettes	[gift]			Cigarettes	[gift]		
	Vodka	[gift]			Vodka	[gift]		
					Biscuits	[gift]		
Requested			Soap		Dish soap		Bullets	
			Medicine**		Laundry soap		Clothes	
			Bullets	40 packs	Coffee		Cigarettes	100+ boxes
			Clothes		Condensed milk		Vodka	
			Rubber boots		Matches		Outboard motor	Not delivered
			Cigarettes	100+ boxes			Gasoline	Not delivered
			Vodka					

* for dogs ** for domesticated reindeer 25kg = estimate (one large sack)

Table 4.3: Annual hunting cycle.

Weeks:	Dates (2001-2)	Field	Kabarga	Reindeer	Red deer	Moose	Sable	Birds	Net fishing	Base	Moves
1	9/3 - 9/9										
2	9/10 - 9/16					1					(Hunt 1 day)
3	9/17 - 9/23	9/18/01									
4	9/24 - 9/30		[>5]		[2]						
5	10/1 - 10/7	10/6/01									
6	10/8 - 10/14							W			Fishing
7	10/15 - 10/21										15 days
8	10/22 - 10/28							W			Trade
9	10/29 - 11/4			1				W			18 days
10	11/5 - 11/11						2				
11	11/12 - 11/18				(1)		3	G			Hunt
12	11/19 - 11/25						1				6 days
13	11/26 - 12/2						1				Hunt
14	12/3 - 12/9						6				6 days
15	12/10 - 12/16	12/12/01	1								
16	12/17 - 12/23	12/17/01									
17	12/24 - 12/30		3								
18	12/31 - 1/6										
19	1/7 - 1/13			4							Hunt
20	1/14 - 1/20										
21	1/21 - 1/27										Trade
22	1/28 - 2/3										16 days
23	2/4 - 2/10										
24	2/11 - 2/17			(4)							Hunt
25	2/18 - 2/24			(6)							Hunt
26	2/25 - 3/3	2/26/02	[4]	(1)			[12]				Hunt
27	3/4 - 3/10	3/6/02									
28	3/11 - 3/17						1	G			
29	3/18 - 3/24			2				G			Hunt
30	3/25 - 3/31							G			3 days
31	4/1 - 4/7							G			
32	4/8 - 4/14							G			Hunt 3 days
33	4/15 - 4/21							G			Hunt 4 days
34	4/22 - 4/28			1				G			Hunt 3 days
35	4/29 - 5/5							W			
36	5/6 - 5/12							W			Hunt 3 days
37	5/13 - 5/19	5/19/02		2				W			Hunt 3 days
38	5/20 - 5/26	5/26/02									
39	5/27 - 6/2										
40	6/3 - 6/9										
41	6/10 - 6/16										
42	6/17 - 6/23										
43	6/24 - 6/30	6/28/99*									
44	7/1 - 7/7										
45	7/8 - 7/14	7/11/99*									
46	7/15 - 7/21					1*					
47	7/22 - 7/28	7/24/99*						(W*)			
48	7/29 - 8/4	7/25/00*									
49	8/5 - 8/11	8/11/00*									(Hunt 1 day*)
50	8/12 - 8/18										Hunt**
51	8/19 - 8/25	8/21/00*									16 days
52	8/26 - 9/1										

* from earlier observations (1999-2000) ( ) date estimated
[ ] date could not be estimated – total number at beginning of field season
** annual marmot (*tarbagan*) hunt, reported to take place on 8/15-26

Notes (left to right):
Gray bar in 'field' indicate dates under observation. Number of successful kills indicated on side of bar for each animal. Birds are indicated by W = waterfowl or G = capercaille (*gluhar*). Net fishing does not include ice-net and ice-hole fishing for Arctic char (*gales*). Black bar in 'Base' indicate period where Main Camp was their base camp. Boxes under 'moves' indicate overnight trips.
Black bar for prey species = purpose-specific or observed hunting period. Gray = estimated or reported hunting period.

Table 4.4: Weather and conditions for Fall and Spring field seasons. Temperature from morning (8-10AM): one asterisk = one degree Celsius, numbers 1, 2, 3 and 4 indicate 10, 20, 30, or 40 degrees Celsius. Letters R or S denote precipitation (snow or rain).

Fall Date		Temperature (Celcius): Minus	Plus	Daylight hours	Spring Date		Temperature (Celcius): Minus	Plus	Daylight hours
10/6				11:02	3/6				10:59
10/7		******		10:57	3/7			*	11:04
10/8		***1*********		10:52	3/8		*******		11:10
10/9		1*********		10:46	3/9		*********		11:14
10/10	r		****	10:41	3/10	s	*****		11:19
10/11			0	10:36	3/11		**		11:25
10/12	r		*	10:31	3/12			***	11:30
10/13			*	10:26	3/13		*****		11:36
10/14			***	10:21	3/14	s	**1*********		11:41
10/15		*****		10:15	3/15		********		11:46
10/16		**1*********		10:10	3/16		**		11:52
10/17		********		10:06	3/17	s	********		11:57
10/18	s	********		10:00	3/18		****2*********1*********		12:02
10/19		*******		9:55	3/19		******2*********1*********		12:07
10/20		******		9:49	3/20	s	********		12:12
10/21				9:45	3/21	s	**1*********		12:17
10/22		******		9:40	3/22	s	******2*********1*********		12:23
10/23		**1*********		9:34	3/23		3*********2*********1*********		12:28
10/24		***2*********1*********		9:30	3/24	s	*2*********1*********		12:33
10/25		**1*********		9:24	3/25	s	*****1*********		12:39
10/26	s	******		9:19	3/26		********		12:44
10/27		1*********		9:15	3/27		*******2*********1*********		12:49
10/28		****		9:09	3/28		********2*********1*********		12:55
10/29		*******1*********		9:05	3/29		********		13:00
10/30		2*********1*********		8:59	3/30	s		*********1	13:05
10/31		***1*********		8:55	3/31		1*********		13:15
11/1		***1*********		8:49	4/1		**1*********		13:20
11/2		***1*********		8:45	4/2	s	**		13:26
11/3		******		8:39	4/3			**	13:31
11/4		1*********		8:35	4/4		****		13:36
11/5		********1*********		8:30	4/5	s	****		13:42
11/6		*********		8:25	4/6	s		*****	13:47
11/7	s	****		8:21	4/7	S	******		13:52
11/8		******		8:15	4/8	s	*******		13:58
11/9			0	8:11	4/9		******		14:02
11/10		****1*********		8:06	4/10		**1*********		14:07
11/11		****1*********		8:02	4/11		1*********		14:13
11/12		****1*********		7:56	4/12		********1*********		14:18
11/13		******1*********		7:52	4/13		******1*********		14:23
11/14		****1*********		7:48	4/14		*****		14:29
11/15		***			4/15			*****	14:33
11/16		***		7:41	4/16			*	14:38
11/17			**	7:37	4/17		******1*********		14:44
11/18			***	7:33	4/18	s	*******		14:49
11/19	r		***	7:28	4/19	s	***		14:54
11/20	s	******		7:25	4/20	s	*****		14:59
11/21	s	*********		7:21	4/21	s	****		15:04
11/22		*********		7:16	4/22		*******		15:10
11/23		********1*********		7:12	4/23		1*********		15:15
11/24		2*********1*********		7:09	4/24		***		15:19
11/25		****2*********1*********		7:05	4/25			*********1**	15:25
11/26		********1*********		7:02	4/26			****	15:30
11/27		2*********1*********		6:58	4/27			?	15:34
11/28		2*********1*********		6:55	4/28	rs		?	15:40
11/29	s	*********1*********		6:50	4/29			0	15:49
11/30		******1*********		6:47	4/30	s		0	15:55
12/1		*****1*********		6:45	5/1		*****		15:59
12/2		********1*********		6:42	5/2			*****	16:04
12/3		*2*********1*********		6:39	5/3			*********1	16:09
12/4	s	***2*********1*********		6:36	5/4			*****	16:14
12/5		********2*********1*********		6:33	5/5			****	16:18
12/6		*****3*********2*********1*********		6:31	5/6			*********1*	16:24
12/7		*4*********3*********2*********1*********		6:28	5/7			?	16:28
12/8		4*********3*********2*********1*********		6:26	5/8			*********1***	16:32
12/9		4*********3*********2*********1*********		6:24	5/9			*********1*********2	16:38
12/10		*********3*********2*********1*********		6:22	5/10			*********1*********2****	16:42
12/11		*******3*********2*********1*********		6:20	5/11			*********1*********2**	16:46
12/12		4*********3*********2*********1*********		6:19	5/12			*********	16:50
					5/13	r		*****	16:56
					5/14			*******	17:00
					5/15			0	17:04
					5/16	r		*********1*********	17:08
					5/17			*******	17:12
					5/18			*********	17:16
					5/19	r			17:21

Table 4.5: Activity summary.
Moves = overnight trips. Drink = alcoholic consumption (and shaded gray), Bana = steam baths. Firewood = tree-felling/log transportation (does not include daily chopping). All trips =daily hunt (day trips) + domR search + moves.

a) Fall field season

Date	Moves	Num People	Drink	Bana	Fire-wood	Daily hunt	DomR search	All trips	Kills
10/6		5	Y						
10/7		5 to 7				Y		Y	11fish
10/8		7		Y					23fish, 1duck
10/9		7					Y	Y	
10/10		7	Y				Y	Y	fish
10/11	Istok/Pirivoz	7 to 5						Y	fish
10/12	Istok/Pirivoz	5							9fish
10/13	Istok/Pirivoz	5							5fish
10/14	Istok/Pirivoz	5	Y				Y	Y	73fish
10/15	Istok/Pirivoz	5				Y		Y	K1, SQ1, 1rapchik, 54fish
10/16	Istok/Pirivoz	5				Y	Y	Y	45fish
10/17	Istok/Pirivoz	5				Y		Y	18fish, SQ2
10/18	Istok/Pirivoz	5							121fish
10/19	Istok/Pirivoz	5				Y	Y	Y	K2, 83fish
10/20	Istok/Pirivoz	5				Y		Y	SQ3, 78fish
10/21	Istok/Pirivoz	5							39fish
10/22	Back	5						Y	118fish
10/23	Pirivoz	5		Y	Y		Y	Y	
10/24	Pirivoz	5		Y			Y	Y	126fish
10/25	Back	5 to 8				Y		Y	
10/26		8		Y					1rapchik
10/27		8 to 6							1swan, 20fish
10/28		6				Y		Y	K3, 2rapchik
10/29		6			Y*				
10/30		6 to 8		Y					K4, SQ4, 5fish
10/31		8		Y			Y	Y	23fish
11/1		8			Y*	Y	Y	Y	K5
11/2		8			Y*		Y	Y	R1
11/3		8 to 6				Y		Y	1duck
11/4		6				Y		Y	SQ5
11/5		6							1fish
11/6		6			Y*	Y		Y	5rapchik, 5fish
11/7		6	Y	Y					3fish
11/8		6	Y						
11/9		6			Y*	Y	Y	Y	SQ6, 1rapchik
11/10		6				Y		Y	SQ7-9, S1
11/11		6				Y		Y	S2
11/12		6				Y		Y	SQ10-14, 1rapchik
11/13		6				Y		Y	K6, SQ15, 3rapchik
11/14		6		Y	Y		Y	Y	
11/15		6			Y	Y		Y	K7, SQ16-17
11/16	Emnyak1	6 to 4					Y	Y	
11/17	Emnyak2	4						Y	SQ18, 1gluhar
11/18	Emnyak2	4				Y		Y	S3-4,S6, SQ19-21, 2gluhar, 1rapchik
11/19	Emnyak2	4				Y		Y	K8, SQ22, 3rapchik
11/20	Emnyak3	4				Y		Y	S5, 1krapatka
11/21	Back	4 to 6		Y		Y		Y	K9, SQ23
11/22		6 to 8		Y		Y		Y	
11/23		8	Y						
11/24		8	Y						
11/25		8					Y	Y	
11/26		8	Y		Y		Y	Y	
11/27		8		Y					
11/28		8		Y		Y		Y	SQ24
11/29		8				Y		Y	S7, SQ25, 1gluhar, 1rapchik
11/30		8					Y	Y	
12/1		8 to 6				Y	Y	Y	SQ26
12/2	Imyak/Svetoi1	6 to 5				Y	Y	Y	
12/3	Imyak/Svetoi1	5				Y		Y	
12/4	Imyak/Svetoi1	5				Y		Y	S8-10, 3rapchik
12/5	Imyak/Svetoi2	5						Y	
12/6	Imyak/Svetoi2	5				Y		Y	K10, S11, SQ27
12/7	Imyak/Svetoi2	5				Y		Y	S12-13, SQ28
12/8	Back	5 to 6						Y	
12/9		6		Y	Y		Y	Y	
12/10		6 to 8					Y	Y	M1, SQ29, N1, K11
12/11		8		Y			Y	Y	
12/12		8	Y						

b) Spring field season

Date	Moves	Num People	Drink	Bana	Fire-wood	Daily hunt	DomR search	All trips	Kills
3/6		7	Y			Y		Y	K1
3/7		7				Y	Y	Y	K2 K3
3/8		7	Y						
3/9		7							
3/10		7							
3/11		7					Y	Y	
3/12		7					Y	Y	
3/13		7				Y	Y	Y	G1
3/14		7							
3/15		7	Y	Y					
3/16		7	Y			Y		Y	
3/17		7				Y	Y	Y	
3/18		7 to 8			Y		Y	Y	
3/19		7					Y	Y	
3/20		7				Y	Y	Y	
3/21		7				Y	Y	Y	
3/22	Svetoi	7 to 5				Y		Y	K4 K5
3/23	Tok	5				Y	Y	Y	K8 G2
3/24	Tok	5				Y	Y	Y	R1 R2 G3-5
3/25	Back	5 to 7	Y	Y		Y		Y	K6 K7
3/26		7							
3/27		7				Y		Y	K9
3/28		7					Y	Y	
3/29		7			Y	Y	Y	Y	
3/30		7		Y					
3/31		7							
4/1		7					Y	Y	
4/2		7							
4/3	Metrostation	7 to 3					Y	Y	
4/4	Back	3,7,11						Y	
4/5		11			Y				
4/6		11 to 7				Y	Y	Y	K10
4/7		7				Y	Y	Y	K11
4/8		7				Y	Y	Y	K12
4/9		7					Y	Y	
4/10		7		Y					
4/11	Tok	7 to 5				Y	Y	Y	K13 G6
4/12	Galsekoe	5				Y	Y	Y	G7-8
4/13	Back	5 to 10				Y		Y	K14 K15 G9
4/14		10 to 7	Y						
4/15		7							
4/16		7		Y					
4/17		7				Y	Y	Y	G10
4/18	SPR CAMP	7 to 6						Y	
4/19		6				Y		Y	
4/20		6				Y		Y	
4/21	Garilii	6,5,3				Y	Y	Y	K16
4/22	Garilii	3				Y		Y	G11
4/23	Garilii	3				Y		Y	
4/24	Back	3 to 6				Y		Y	
4/25		6 to 7				Y	Y	Y	
4/26	Shirik	7 to 3				Y	Y	Y	G12-16
4/27	Shirik	3				Y		Y	R3
4/28	Back	3 to 7	Y			Y		Y	
4/29		7	Y						
4/30		7	Y						
5/1		7	Y						
5/2		7	Y			Y		Y	K17 1duck
5/3		7	Y						
5/4		7	Y			Y		Y	2ducks
5/5		7				Y	Y	Y	3ducks
5/6		7				Y			2ducks
5/7	Nichatka	7, 3, 2				Y	Y	Y	4ducks
5/8	Gales	2 to 3				Y	Y	Y	K18 K19 3ducks
5/9	Back	3 to 7	Y						
5/10		7				Y		Y	
5/11	Bear	7, 4, 7				Y		Y	3ducks
5/12		7				Y	Y	Y	
5/13		7				Y		Y	7ducks
5/14		7				Y		Y	
5/15		7				Y		Y	1ducks
5/16	VD-SA, VS-YO	7 to 2				Y	Y	Y	R4
5/17	VD-SA, Back	2 to 5				Y		Y	R5
5/18	Back	5 to 7						Y	
5/19		7							

Table 4.6: List of species used.
All of the following species were utilized by the study group.

	Transcribed name	English name	Latin name
Large mammals	Olen', Sogdoi	Reindeer	*Rangifer tarandus*
	Kabarga	Musk deer	*Moschus moschiferus*
	Sahati	Moose/Elk	*Alces alces*
	Izubr	Red deer	*Cervus elaphus*
	Medvech'	Brown bear	*Ursus arctos*
Fur mammals	Sobel'	Sable	*Martes zibelina*
	Belka	Squirrel	*Sciurus vulgaris*
	Norka	American mink	*Lutreola (Mustela) vison*
		Ermine*	*Mustela erminea*
		Red fox*	*Vulpes vulpes*
	Tarbagan	Siberian marmot*	*Marmota sibirica*
Birds	Gluhar	Capercaille	*Tatrao urogarus*
	Rapchik	Hazel grouse	*Bonasa bonasia*
	Krapatka	Willow grouse	*Lagopus lagopus*
	Rebits	Bewick's swan	*Cygnus bewickii*
Waterfowl	Gogol	Goldeneye	*Bucephala clangula*
	Krikash	Mallard duck	*Anas platyrhynchos*
	Harhal	Goosander	*Mergus merganser*
	Berginyah	Smew	*Mergus albellus*
	Hanai	Tufted duck	*Aythya fuligula*
	Dlinnasheik	Pintail	*Anas acuta*
	Chilok	Common teal	*Annas crecca*
	Chibiz	Lapwing	*Vanellus vanellus*
	Krasnogolova	European widgeon	*Anas penelope*
	Harhal	Red-breasted merganser	*Mergas serrator*
Fish	Harus	Grayling	*Thymallus*
	Shuka	Pike	*Esox*
	Gales	(Arctic char)	*Salvelinius*
	Sig	Whitefish	*Coregonus*
	Nalim	Burbot, eel-pout	*Lota*
	Okon	Perch	*Perca*
Trees	Sosna	Pine	*Pinus sylvestris*
	Kedr	Cedar	*Pinus sibirica*
	Slanik	Scattered spruce	*Pinus pumilla*
	Yolki	Spruce	*Picea*
	Listvennitsa	Larch	*Laryx daurica, gmalina?*
		Willow	*Salyx*
	Ocina	Aspen	*Populus tremula*
		Broombrush	*Potentilla*
	Beryoza	Birch	*Betula pendulus*

* Hunting not observed (but e.g. recently procured furs or unsuccessful trapping activity seen).

Table 4.7: Meat animal use.

		Reindeer	Musk deer	Red deer	Moose
Food	*Meat*	All meaty parts All of head (cooked)	All meaty parts All of head (cooked)	All meaty parts All of head (cooked)	All meaty parts All of head (cooked)
	Marrow	Lower limb marrow, raw Upper limb marrow, cooked Mandible marrow, cooked	Lower limb marrow, raw Upper limb marrow, cooked Mandible marrow, cooked	Lower limb marrow, raw Upper limb marrow, cooked Mandible marrow, cooked	Lower limb marrow, raw Upper limb marrow, cooked Mandible marrow, cooked
	Fat	Abdominal fat (from intestines) Bone grease boiled (spring)	-	Abdominal fat (from intestines)	Abdominal fat?
	Other	Liver (raw/cooked) Kidneys (raw) Heart (cooked) Lung (cooked) Teats (cooked) Tendons (cooked) Stomach (raw/cooked) Intestine (raw/cooked) Blood (cooked) Hooves (cooked) Antler (seasonal) Tongue (cooked) Brain (cooked) Eyeball (raw)	Liver (raw/cooked) Kidneys (raw) Heart (cooked)	Same as reindeer?	Same as reindeer?
Raw material	*Fur*	Body fur (bedding) Kamus (boots) Head skin (seat/saddle cover) (backpack padding)	All fur (one piece) (sled seat-cover)	Body fur? Kamus (boots)	Body fur? Kamus (ski brakes)
	Antler	(saddle-horn) (trade item)	n/a	(trade item)	(trade item?)
Special use			Musk gland (trade item)	Penis, scrotum, tail (medicinal, flavoring)	

Note: red deer and moose part use were observed more than a few weeks after the hunt, and thus parts that spoil easily were not seen. Red deer fat was observed because it was dried and in storage.

Table 4.8: Seasonal trends observed during the Fall and Spring field seasons.
[Table on next page]

Notes for Fall: Open water net-fishing concluded on 10/31. Some nets set in ice-holes until 11/6. Peak whitefish (*sig*) spawning season resulted in increased daily catches (>10 fish, many with eggs).

Notes for Spring: January to March was unusually warm in year of observation, affecting seasonal indicators. Domesticated reindeer also started to give birth early in the observed year, and only one pregnant female remained at 5/12. Milking began shortly after birthing and continued into late summer. Open water net-fishing began in earnest on 5/15 while sporadic net-setting activity was observed earlier. The mating/hunting season of capercaille (*gluhar*) usually starts in March, but mating calls were heard as early as December in the observed year. A *gluhar*-specific hunt was first observed on 3/13. Waterfowl hunting season for a usual year was described as “4/25 to May”.

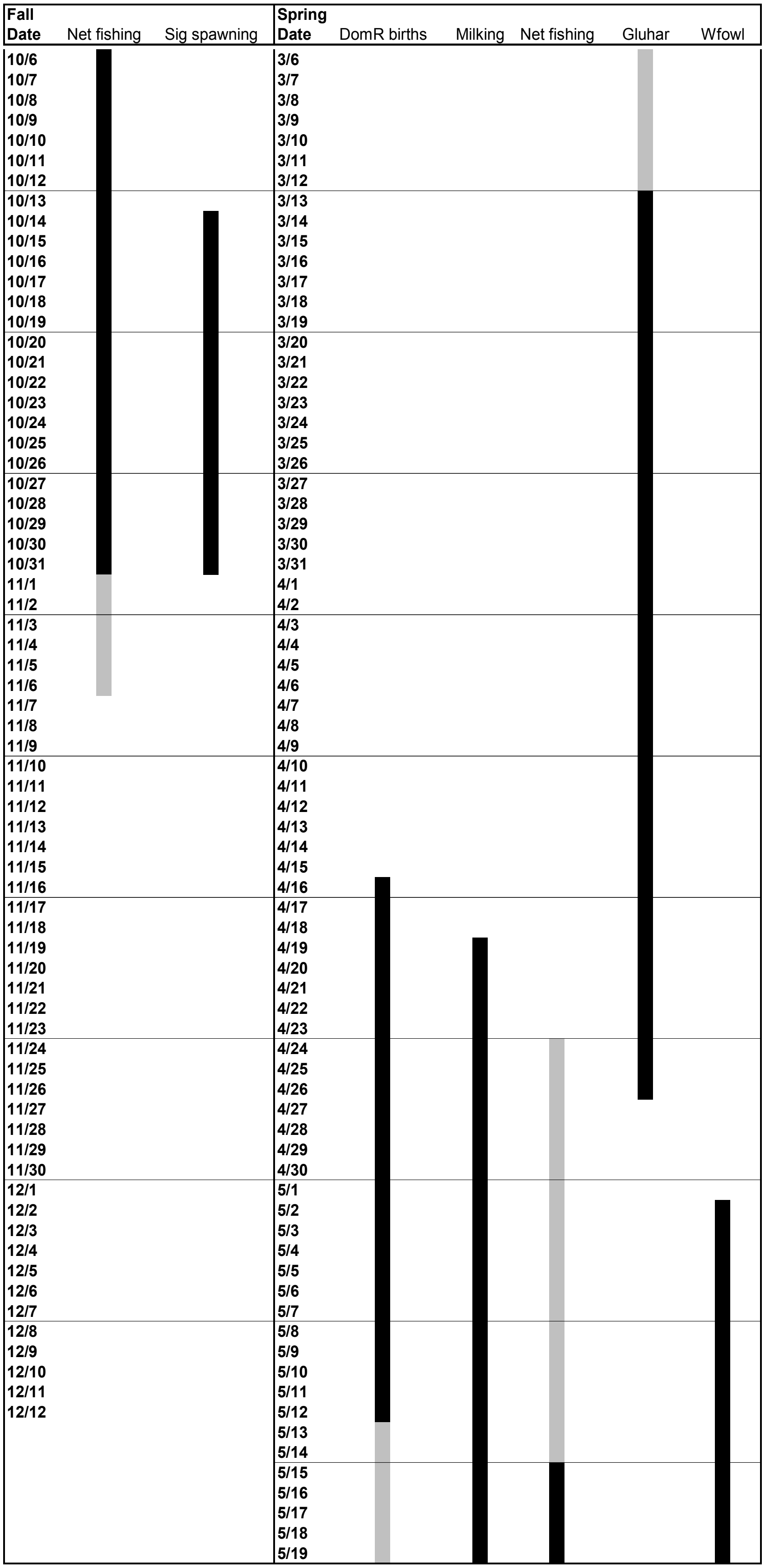

Fall
Date
Net fishing
Sig spawning
10/6
10/7
10/8
10/9
10/10
10/11
10/12
10/13
10/14
10/15
10/16
10/17
10/18
10/19
10/20
10/21
10/22
10/23
10/24
10/25
10/26
10/27
10/28
10/29
10/30
10/31
11/1
11/2
11/3
11/4
11/5
11/6
11/7
11/8
11/9
11/10
11/11
11/12
11/13
11/14
11/15
11/16
11/17
11/18
11/19
11/20
11/21
11/22
11/23
11/24
11/25
11/26
11/27
11/28
11/29
11/30
12/1
12/2
12/3
12/4
12/5
12/6
12/7
12/8
12/9
12/10
12/11
12/12
Spring
Date
DomR births
Milking
Net fishing
Gluhar
Wfowl
3/6
3/7
3/8
3/9
3/10
3/11
3/12
3/13
3/14
3/15
3/16
3/17
3/18
3/19
3/20
3/21
3/22
3/23
3/24
3/25
3/26
3/27
3/28
3/29
3/30
3/31
4/1
4/2
4/3
4/4
4/5
4/6
4/7
4/8
4/9
4/10
4/11
4/12
4/13
4/14
4/15
4/16
4/17
4/18
4/19
4/20
4/21
4/22
4/23
4/24
4/25
4/26
4/27
4/28
4/29
4/30
5/1
5/2
5/3
5/4
5/5
5/6
5/7
5/8
5/9
5/10
5/11
5/12
5/13
5/14
5/15
5/16
5/17
5/18
5/19

Table 4.9: Summary of kills.

a) Fall field season

Hunts	Date	Reindeer	Kabarga	Moose	Sobel	Squirrel	Norka	Gluhar	Kedrovka	Krapatka	Rapchik	Gogol	Krikash	Swan	Harus	Shuka	Sig	Nalim	Okon	Saroga	Taimen	Valyok	Linok	unrecorded	Fish TOT
	10/6																								
	10/7														10	1									11
	10/8											1			22		1								23
	10/9																								
	10/10																							+	
Istok/Pirivoz	10/11																							+	
	10/12																9								9
	10/13																							5	5
	10/14															5	68								73
	10/15		1			1					1						53	1							54
	10/16								1							2	42	1							45
	10/17					1										1	17								18
	10/18															7	112			2					121
	10/19		1													4	78			1					83
	10/20					1										3	74	1							78
	10/21															1	38								39
End Istok	10/22															5	110	1	1	1					118
	10/23																								
	10/24														2	3	121								126
End Pirivoz	10/25																								
	10/26										1														
	10/27													1										20	20
	10/28		1								2														
	10/29																								
	10/30		1			1									3							1	1		5
	10/31															1	21	1							23
	11/1		1																						
	11/2	1																							
	11/3												1												
	11/4					1																			
	11/5																					1			1
	11/6										5				3		1				1				5
	11/7														1							1	1		3
	11/8																								
	11/9					1					1														
	11/10				1	3																			
	11/11				1																				
	11/12					5					1														
	11/13		1			1					3														
	11/14																								
	11/15		1			2																			
Emnyak	11/16																								
	11/17					1		1																	
	11/18				3	3		2			1														
	11/19		1			1					3														
	11/20				1					1															
	11/21		1			1																			
	11/22																								
	11/23																								
	11/24																								
	11/25																								
	11/26																								
	11/27																								
	11/28					1																			
	11/29				1	1		1			1														
	11/30																								
	12/1					1																			
Imyak/Svetoi	12/2																								
	12/3																								
	12/4				3						3														
	12/5																								
	12/6		1		1	1																			
	12/7				2	1																			
	12/8																								
	12/9																								
	12/10		1	1		1	1																		
	12/11																								
	12/12																								
	TOT	1	11	1	13	29	1	4	1	1	22	1	1	1	41	33	745	5	1	4	1	3	2	25	860

b) Spring field season

Hunts	Date	Reindeer	Kabarga	Sobel	Squirrel	Norka	Gluhar	Rapchik	Harahal	Gogol	Krikash	Smew	Hanai	Diinnasheik	Chirok	Krasno	TOTAL	Harus	Shuka	Sig	Nalim	Okon	Fish TOT	Gales
	3/6		1																					
	3/7		2																					
	3/8																							
	3/9																							
	3/10																	4					4	
	3/11																							
	3/12			2																				
	3/13						1																	
	3/14																							
	3/15																							
	3/16																							
	3/17																	16					16	
	3/18																							
	3/19																							
	3/20																	12					12	
	3/21					1																		
Svetoi	3/22		2																					
	3/23		1				1																	
	3/24	2					3																	
	3/25		2																					
	3/26																							
	3/27		1			1																		
	3/28																							
	3/29																							
	3/30																							
	3/31																							
	4/1																							
	4/2																							
	4/3																							
	4/4																							
	4/5																							
	4/6		1																2				2	
	4/7		1																					
	4/8		1															1	2				3	
	4/9																							
	4/10				1													4					4	
Tok	4/11		1				1																	
	4/12						2																	16
	4/13		2				1																	27
	4/14																							
	4/15																							
	4/16																							
	4/17						1																	
Spr Camp	4/18																							
	4/19																							
	4/20							1										23					23	
Garilii	4/21		1																					
	4/22						1	1																
	4/23																							
	4/24																							
	4/25							1																
Shirik	4/26						5																	
	4/27	1																						30kg
	4/28																							
	4/29																							
	4/30																							
	5/1																							
	5/2		1						1								1							
	5/3																							
	5/4									1	1						2							
	5/5										3						3							
	5/6								1			1					2							
Nichatka	5/7									1	2		1				4							
	5/8		2								1			1	1		3							20kg
	5/9																							
	5/10																		1				1	
	5/11									1	2						3							
	5/12																							
	5/13									2	2	1			1	1	7							
	5/14																							
	5/15								1								1		15	14			29	
Nichatka/Bear	5/16	1																	13	14	1	3	31	
	5/17	1																2	8	13	1	4	28	
	5/18																		15	12		1	28	
	5/19																							
	TOT	5	19	2	1	2	16	3	3	5	11	2	1	1	2	1	26	62	56	53	2	8	181	est 200+

Figure 4.10: Fur preparation.
Left: inverted squirrel skin fitted on drying board.
Right: inverted sable skin fitted on drying frame. Paper is used to stretch and dry the limbs.

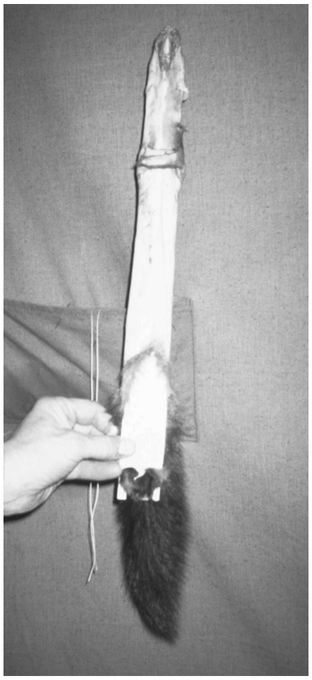


Table 5.1: Count of kills by season and species.
The numbers for 'Dec-Mar' are reported kills for the months between field seasons. The numbers for 'Sep' are animals killed prior to the Fall field season.

a) Meat animals

		Female	Male	Unknown	TOTAL
Reindeer	Fall		1		**1**
	Dec-Mar	4	3	8	**15**
	Spring	3	2		**5**
	TOTAL	**7**	**6**	**8**	**21**
Kabarga	Fall	8	2	1	**11**
	Dec-Mar	5	1		**6**
	Spring	13	6		**19**
	TOTAL	**26**	**9**	**1**	**36**
Moose	Sep		1		**1**
	TOTAL		**1**		**1**
Red deer	Sep			2	**2**
	TOTAL			**2**	**2**

b) Fur animals

		Female	Male	Unknown	TOTAL
Sable	Fall	2	4	7	**13**
	Dec-Mar			12	**12**
	Spring			2	**2**
	TOTAL	**2**	**4**	**21**	**27**
Squirrel	Fall	1	2	26	**29**
	Spring			1	**1**
	TOTAL	**1**	**2**	**27**	**30**
Norka	Fall			1	**1**
	Spring	1		1	**2**
	TOTAL	**1**	**0**	**2**	**3**

c) Birds

		Female	Male	Unknown	TOTAL
Gluhar	Fall	1		3	**4**
	Spring	1	12	3	**16**
	TOTAL	**2**	**12**	**6**	**20**
Rapchik	Fall	1	1	20	**22**
	Spring			3	**3**
	TOTAL	**1**	**1**	**23**	**25**
Krapatka	Fall			1	**1**
	TOTAL			**1**	**1**
Waterfowl	Fall			2	**2**
	Spring	2	16	8	**26**
	TOTAL	**2**	**16**	**10**	**28**
Swan	Fall			1	**1**
	TOTAL			**1**	**1**

Table 5.2: Estimate of meat yield

a) Average recorded weight (kg).
The values below mix both males and females, and variable weighing conditions (e.g. plucked bird and bird with feathers). 40% yield is a conservative meat yield for ungulates (Whitehead 1993).

	Average weight	40% yield	Notes
Reindeer	97.32	38.93	N=5
Kabarga	11.59	4.63	N=25
Gluhar	2.74	1.10	N=9
Rapchik	1.79	0.14	N-5
Squirrel	0.35	0.14	N-5

b) Meat per person per day (kg), calculated from what the study group obtained in hunts.

Fall	# kills			meat yield		person x days		Per person/day
	Reindeer	1	x	38.93	/	7 x 68	=	0.082
	Kabarga	11		4.63		7 x 68		0.107
						Fall average		**0.189**

Spring	# kills			meat yield		person x days		Per person/day
	Reindeer	5	x	38.93	/	7 x 75	=	0.371
	Kabarga	19		4.63		7 x 75		0.168
						Spring average		**0.538**

Meat yield value is from a) ‘40% yield’.

Table 5.3: Successful and unsuccessful hunting attempts.
Record codes: 1 = high quality record (hunter accompanied by observer), 2 = hunter recounted hunt in detail, x = poor quality record (hunter account unspecific), t = traps, b = blind.
[ ] = intended prey for unsuccessful hunts: K = *kabarga*, R = reindeer, RD = red deer. For large mammal hunts (R, RD), intended prey is the species that were ultimately tracked.

a) *Kabarga* hunting attempts.

		Record	Hunter	Date	Kill	No kill
Fall	K01	2	YU	10/15	Y	
	K02	1	VD	10/19	Y	
	K03	x	VS VD	10/27	Y	
	K04	x	MI?	10/28?	Y	
	K05	x	YU	11/1	Y	
	K06	1	VS	11/13	Y	
	K07	x	YA	11/15	Y	
	K08	x	YA	11/21	Y	
	K09	1	VS	12/6	Y	
	K10	2	VS	12/10	Y	
	K11	1	VS VD	12/10	Y	
Spring	K01	x	VD	3/6	Y	
	K02	1	YU	3/15	Y	
	K03	2	SA	3/17	Y	
	K04	t	VS	3/20	Y	
	K05	1	VS	3/22	Y	
	K06	t	SA	3/7?	Y	
	K07	t	SA	3/7?	Y	
	K08	x	YA	3/23	Y	
	K09	1	VS	3/27	Y	
	K10	1	YU	4/6	Y	
	K11	2	YA	4/7	Y	
	K12	2	YA	4/8	Y	
	K13	2	YA	4/11	Y	
	K14	1	VS	4/13	Y	
	K15	1	VD	4/14	Y	
	K16	x	YA	4/21	Y	
	K17	2	SA	5/2	Y	
	[K]	1	VS	5/7		Y
	K18	1	VS	5/8	Y	
	K19	1	VS	5/8	Y	

b) Large mammal hunting attempts (red deer, reindeer, or moose).

		Record	Hunter	Date	Kill	No kill
Fall	R01	2	SA	11/2	Y	
	[RD]	1	VS	11/10		Y
	[RD]	1	VS	11/11		Y
Spring	[R]	1	VS	3/23		Y
	[R]	2	VD	3/23		Y
	[R]	2	SA	3/23		Y
	R01 R02	2	VS	3/24	Y	
	[R]	1	VD	3/24		Y
	[R]	2	SA	3/24		Y
	[R]	1	VS	4/20		Y
	[R]	2	SA	4/20		Y
	[R]	1	VS	4/22		Y
	[R]	2	SA	4/22		Y
	[R]	1	VS	4/23		Y
	[R]	1	VS	4/27		Y
	R03	2	SA	4/27	Y	
	[R]	1	VS	5/14		Y
	[RD]	b	VS	5/16		Y
	R04	2	VD	5/17	Y	
	[R]	2	SA	5/17		Y
	[R]	2	SA	5/16		Y
	R05	2	VD	5/16	Y	

Figure 5.4: Istok trip (Fall 10/11-22).
Star = Main Camp, triangle = logistical camp, black circle is 5km radius from logistical camp.

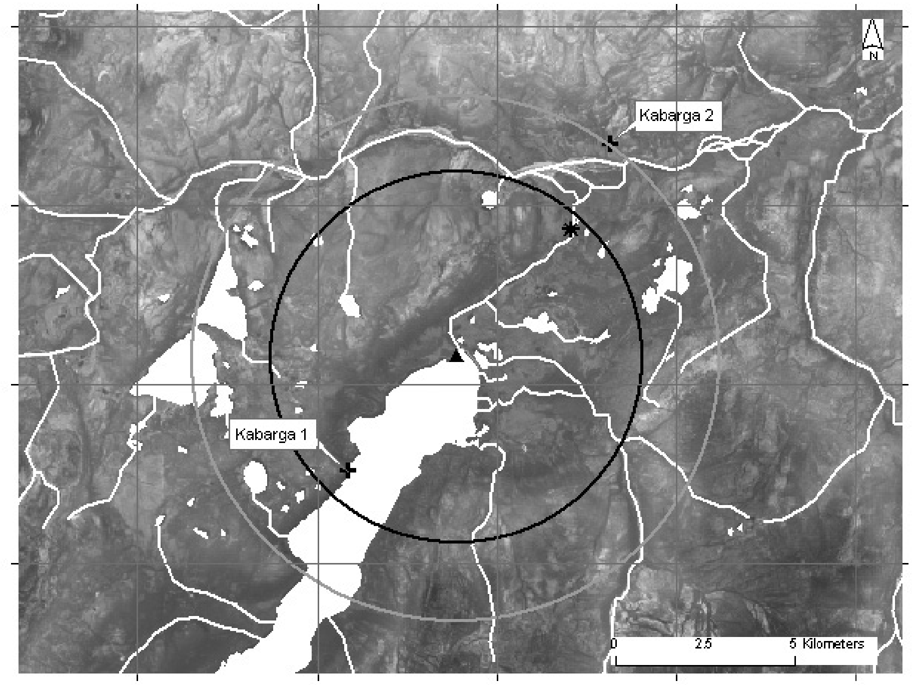


Figure 5.5: Emnyak trip (Fall 11/16-21).
Star = Main Camp, triangle = logistical camp, black circle is 5km radius from logistical camp. Solid line = hunting trips, dotted line = move between camps.

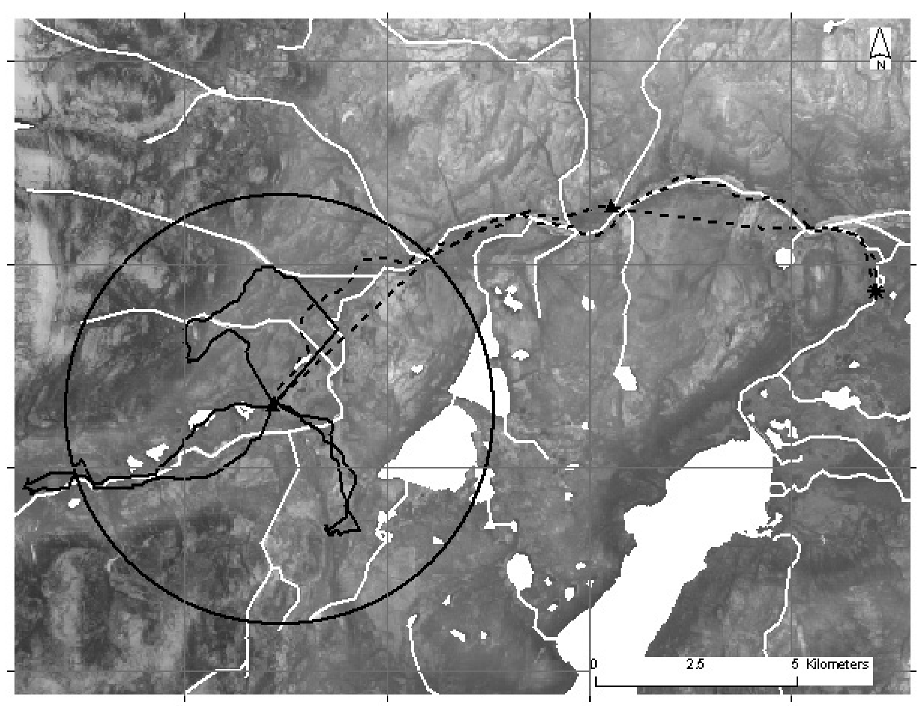


Figure 5.6: Imyak/Svetoi trip (Fall 12/2-8).
Star = Main Camp, triangle = logistical camp, black circle is 5km radius from logistical camp. Solid line = hunting trips, dotted line = move between camps.

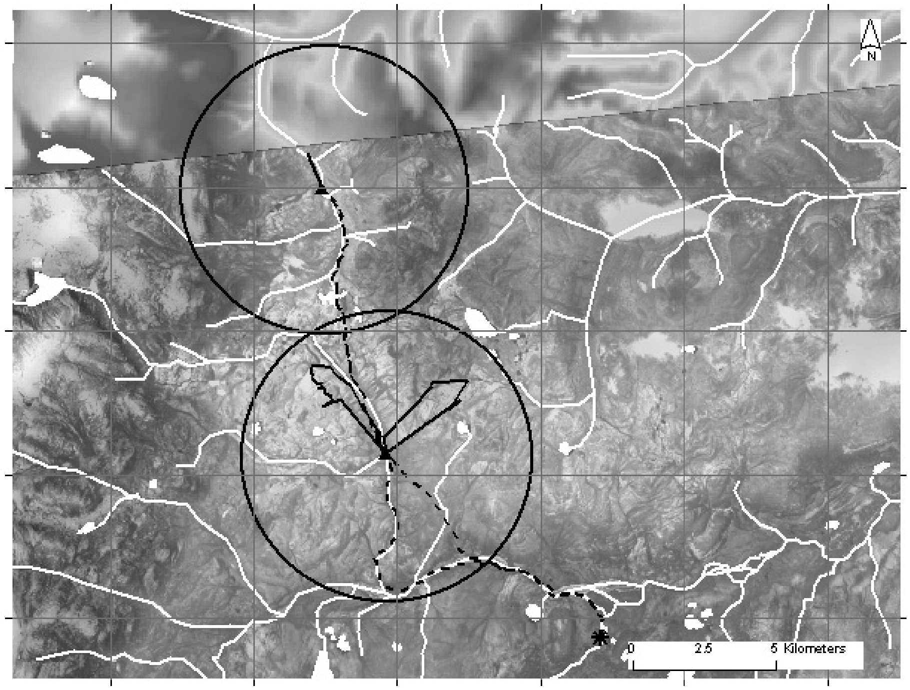


Figure 5.7: Svetoi trip (Spring 3/22-25).
Star = Main Camp, triangle = logistical camp, black circle is 5km radius from logistical camp. Solid line = hunting trips, dotted line = move between camps.

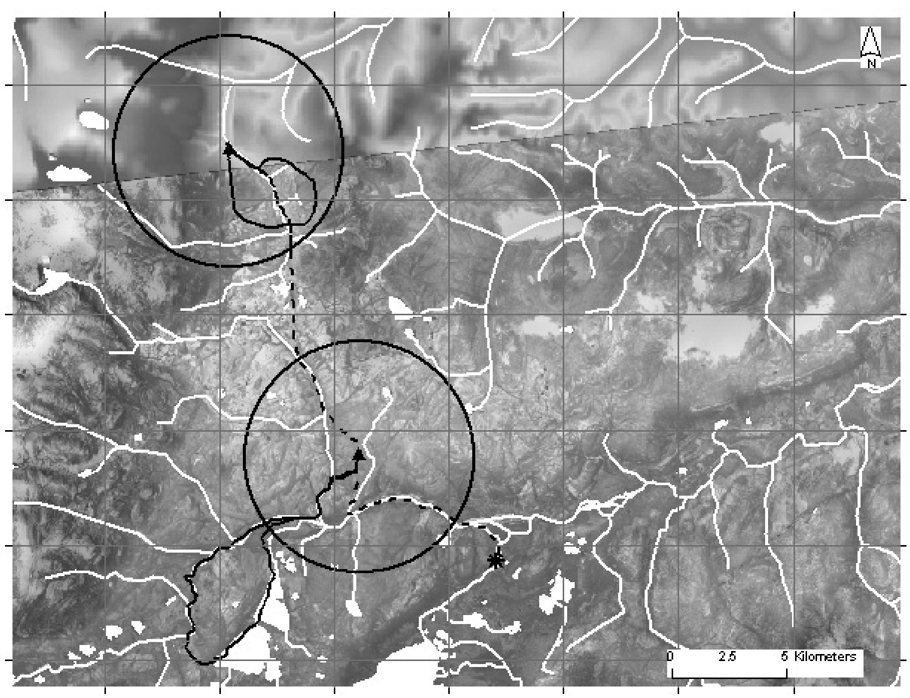


Figure 5.8: Tok trip (Spring 4/11-13).
Star = Main Camp, triangle = logistical camp, black circle is 5km radius from logistical camp. Solid line = hunting trips, dotted line = move between camps.

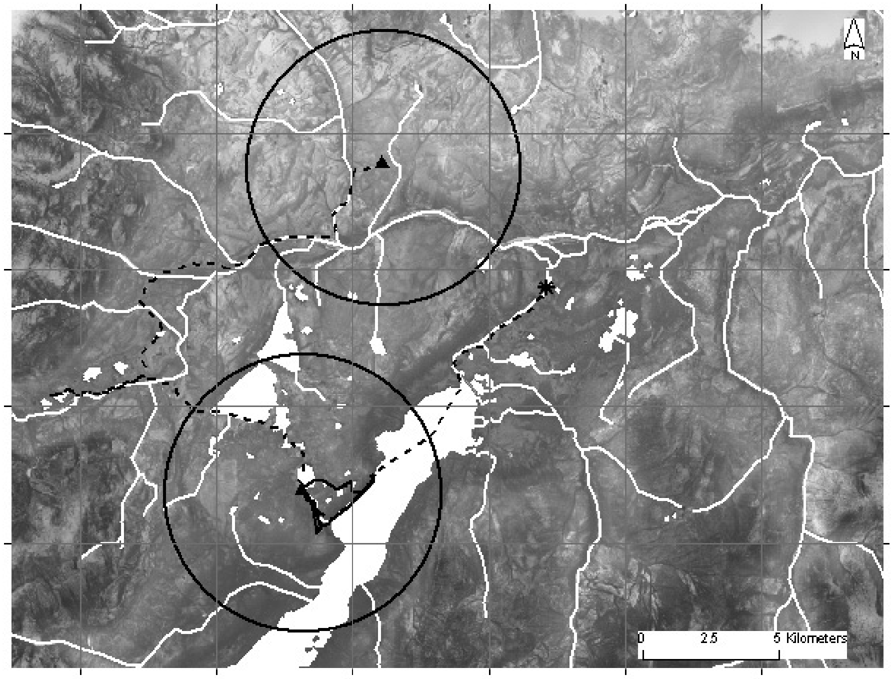


Figure 5.9: Garillii trip (Spring 4/21-24).
Star = Main Camp, square = Spring Camp, triangle = logistical camp, black circle is 5km radius from logistical camp. Solid line = hunting trips, dotted line = move between camps.

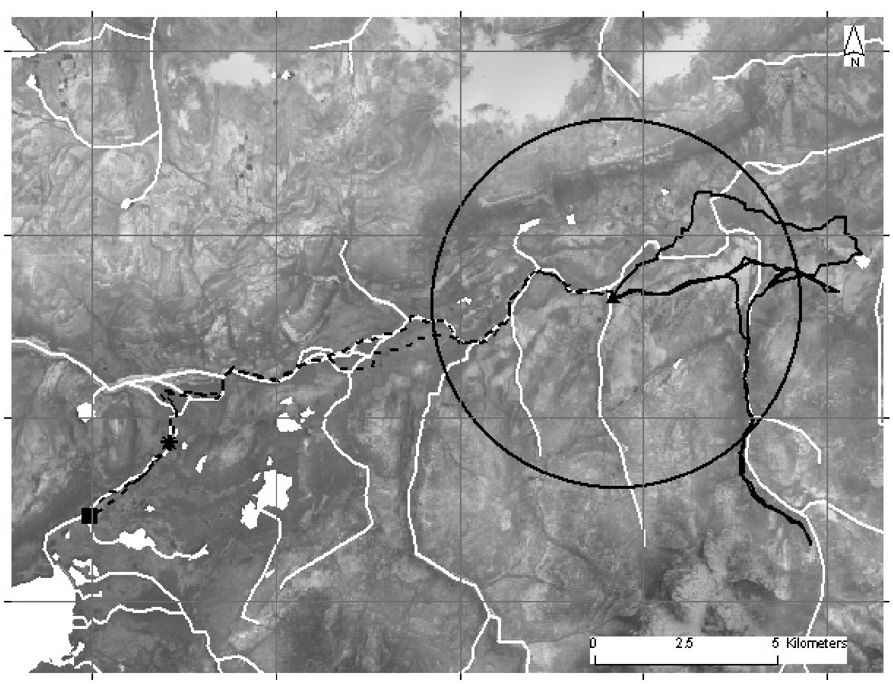


Figure 5.10: Shirik trip (Spring 4/26-28).
Square = Spring Camp, triangle = logistical camp, black circle is 5km radius from logistical camp. Solid line = hunting trips, dotted line = move between camps.

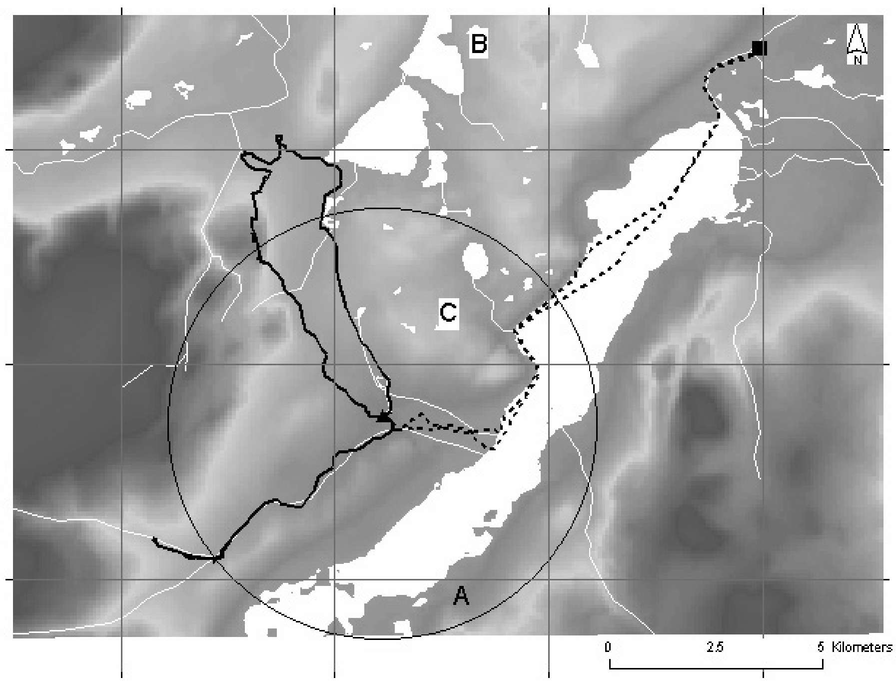


Figure 5.11: Nichatka trip (Spring 5/7-9).
Square = Spring Camp, triangle = logistical camp, black circle is 5km radius from logistical camp. Solid line = hunting trips, dotted line = move between camps.

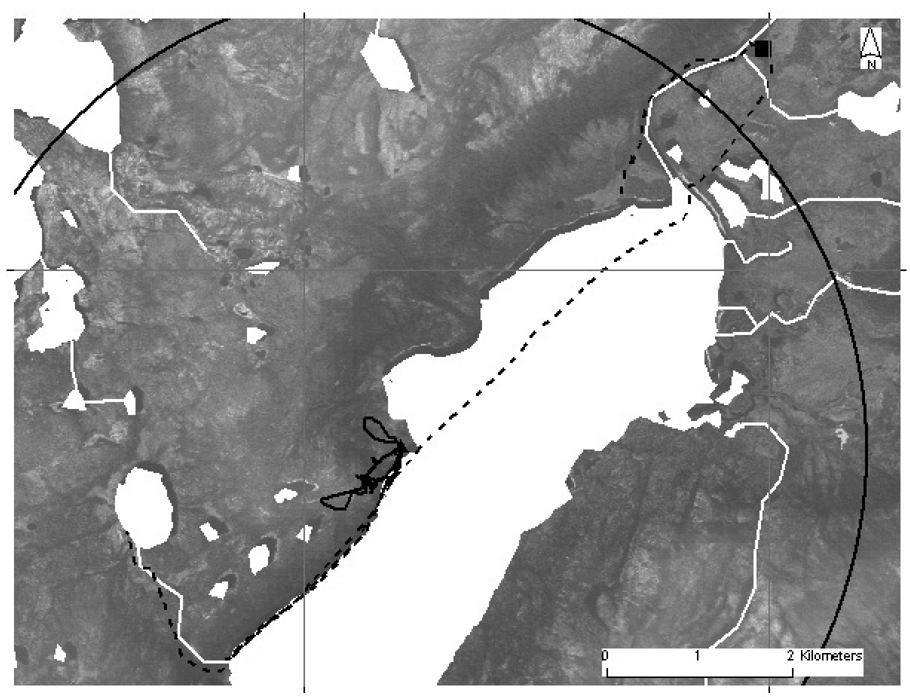


Figure 5.12: Nichatka/Bear trip (Spring 5/16-18).
Square = Spring Camp, triangle = logistical camp, black circle is 5km radius from logistical camp. Solid line = hunting trips, dotted line = move between camps.

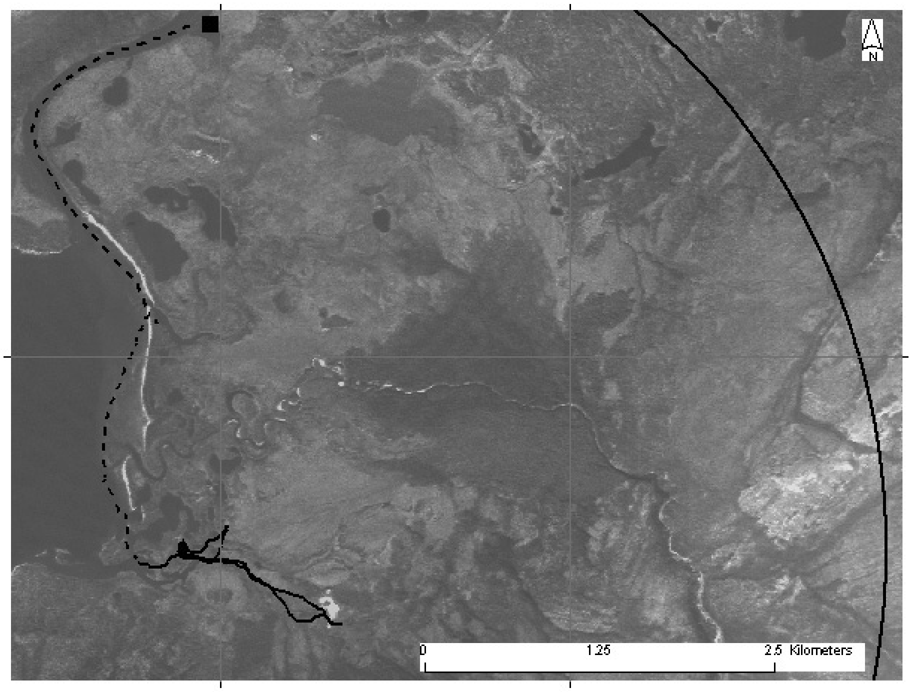


Figure 5.13: *Kabarga* hunt locations.
Kabarga kill sites shown by black squares. Main *kabarga* hunting grounds (high cliffs where dogs corner the animal) are labeled with letters and ellipses. Areas A1 and A2 are continuous cliffs but distinguished by the study group. Area C has been generally described but not observed, and thus the location is approximate. Star is Main Camp.

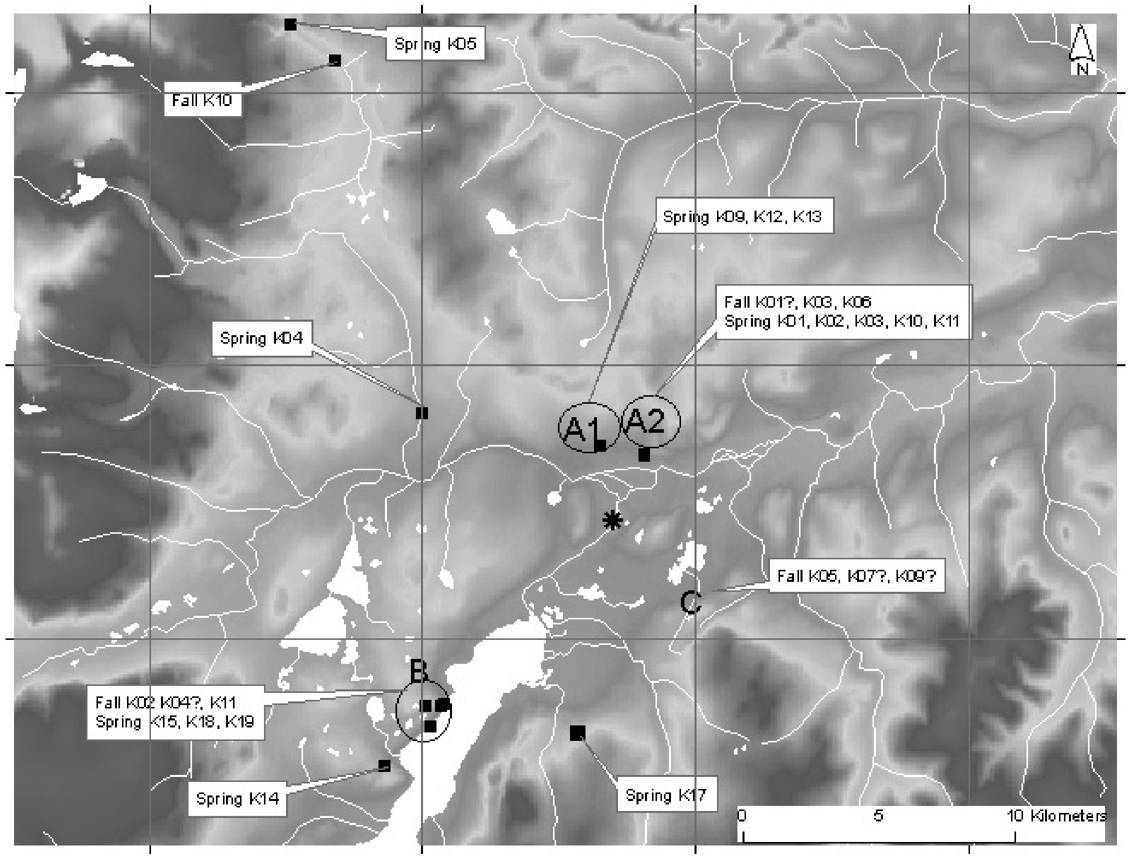
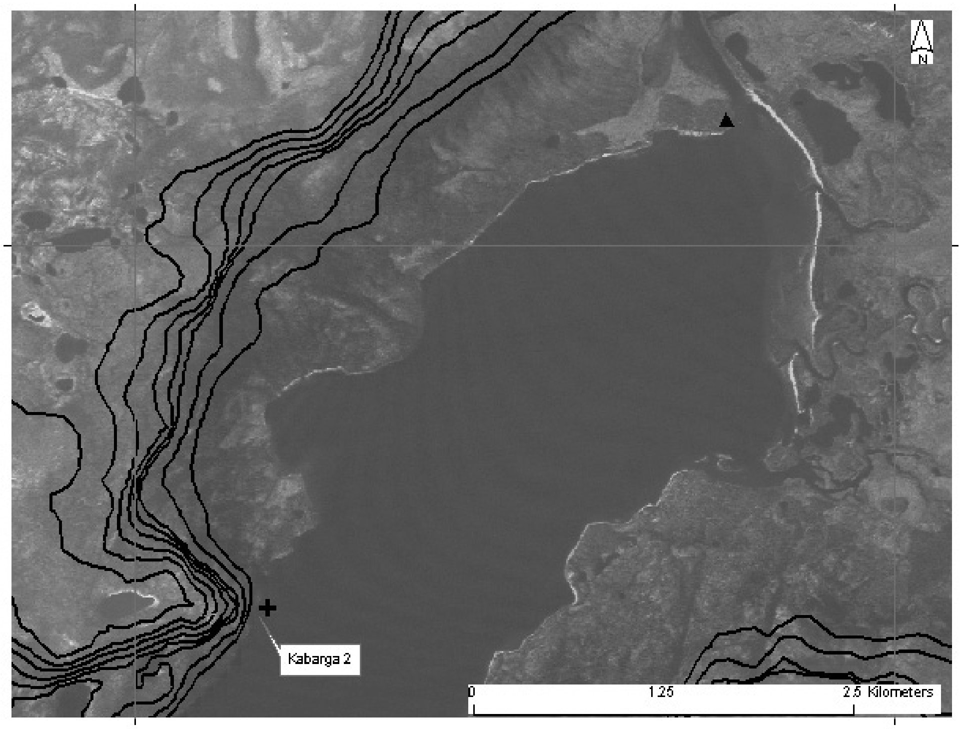
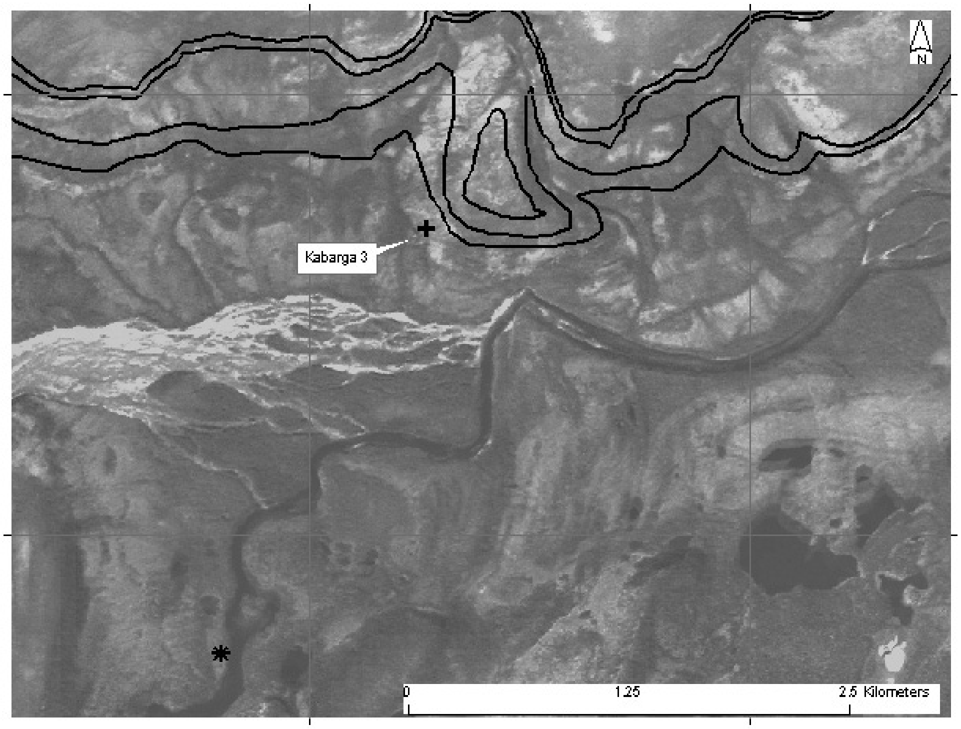


Figure 5.14: Fall K02 from Istok camp



Elapsed	Event Description
	YU NI VD out checking nets on boat (80+ fish), dogs follow on shore to lake and disappear.
0:00	Later in afternoon, hear dogs bark.
0:06	Left camp.
0:09	On boat and row down to lake. 3 one-minute breaks to hear barking.
1:11	Go near bank, sight dogs (very near bank)
1:09	VD in position. About 25 m distance?
	Camcorder started and took K footage.
	1st bad ammunition-click.
	2nd bad ammunition-click.
	3rd bad ammunition-click.
1:15	Shot K.
1:25	Back on boat.
2:32	Back in Istok

Figure 5.15: Fall K03 from Main camp



Elapsed	Event Description
0:00	Off to hunt - cross rivers to cliff 1.
	Cliff 1 - observing (dogs searched whole cliff for about 5 min) and waiting.
	Discovered rapchik (VD) and each shot one bird each.
	Plucked both birds.
	Dogs team-searched upper-and lower parts of cliff.
	Went to cliff 2 (1/2 hour).
	Same procedure (10-15min, dogs search upper/lower parts)
	Started walking uphill into forest.
	Discovered fresh izubr tracks - 2 animals (or going and back?) - tracked for 1/2 hour.
	Heard dogs barking - but stopped (K got away). Then after 20-30 min, barking again.
	Walk back (very fast) to cliff 2 - 4-5km.
	Went to cliff, sighted animal.
	VD on cliff bottom, VS NI upwards on cliff (VS w/o gun)- climb 5 minutes - observed K from 40-50m away.
	4-5 shots missed.
	Then VD hit K03 (twice?)
	VS took animal down.
	Field butchery
	Check two metal traps for sable. (One trap not sprung, other had lost its bait)
	Shot at rapchik (1 shot)
7:00	Came back, opened backpack immediately (film).

Figure 5.16: Fall K06 from Main Camp.
No GPS records (map).

Elapsed	Event Description
0:00	VS VD NI off w/ Ulka, Shustre to cliffs for kabarga hunt.
0:45	releases dogs
1:00	At 1st cliff. Shortly after arrival, kill 3 rapchik (2 shots VS, 2 shots VD) at 1st cliff, plus 1 squirrel. Then cut 6 poles (willow) for sled-making.
1:55	Listen for dogs, and leave cliff around 12:45. VD heads home with 6 poles.
2:25	VS NI at second cliff. Get more poles - 8 poles (4 VS 4 NI).
2:40	VD back at camp.
3:00	VS NI give up and heads home
3:20	VS NI back at camp
4:00	Baikal takes off - probably heard Shustre.
4:10	VS NI hear dogs and leaves for cliff.
4:40	Shustre is back - we assume hunt has failed.
4:40	VS NI at 2nd cliff. Hear dogs at river (but not cornering kabarga)
4:50	VS spots K06 without dogs, and shot K06. (animal runs away and not killed cleanly)
5:25	VS NI head back home.
6:00	VS NI back w/ K06.

Figure 5.17: Fall K10 from Imyak/Svetoi camp.
No timeline.

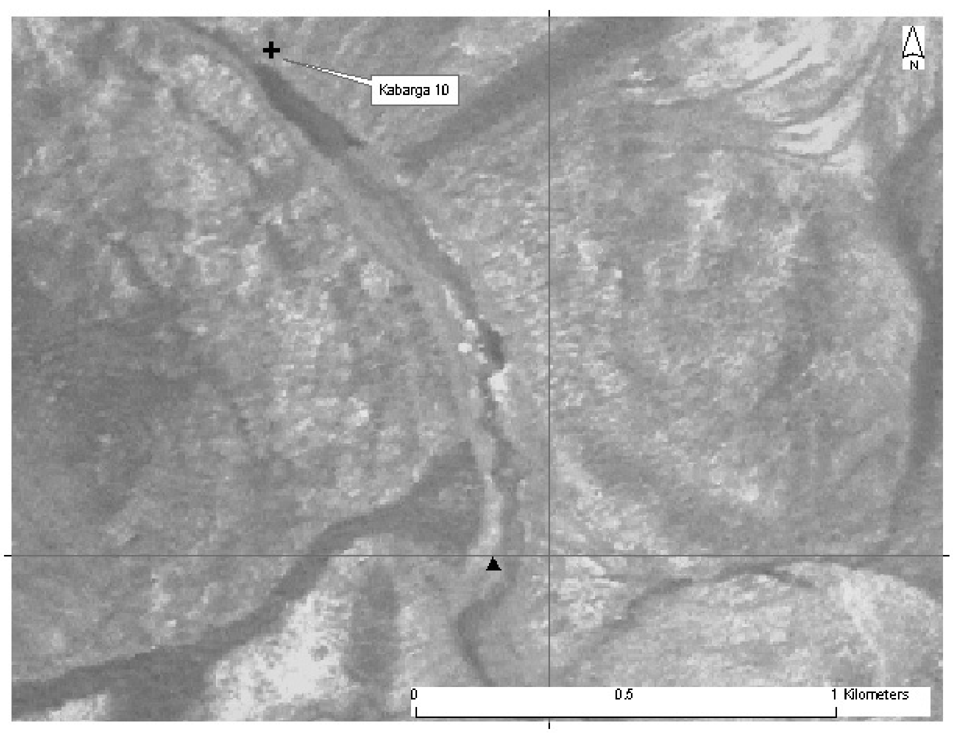


Figure 5.18: Fall K11.
Killed on way back from moose meat stash (killed September 2001) to Main Camp. No GPS records (map).

Elapsed	Event Description
0:00	Start
	Early on, before reaching the mouth of river, Ulka barks and VD goes to look.
0:14	VD gets squirrel.
	Follow river almost to mouth, but cut across spit of land on east side, to lake surface (shortcut). Go up the lake, stop at cliff.
0:59	Dogs at cliff for kabarga - watch and wait. Then leave.
	Go inland on west shore of lake, after passing second cliff.
1:54	Arrive at moose meat stash (in box constructed of logs). Lid weighed with rocks. Collect all pieces of moose, including fur, See wolverine tracks. Some discussion about setting sable and wolverine traps (wolverine for pest control, not for fur), but they did not - perhaps because moose meat was not damaged.
	Have tea.
2:34	Leave moose stash.
2:54	Ulka went off hunting (after appearing at moose stash.)
	Pack up, take sleds to cliff, and wait for Ulka.
3:39	Leave after 5-10 min wait, but hear Ulka bark. VD turns back to hunt, VS YO go on.
3:54	Hunt finished (K11).
4:09	VD catches up to VS YO, halfway down river.
4:24	Stop at trap set about 100m upstream of main camp, and find a live mink, ,which VS VD carry back alive.
4:34	Home.

Figure 5.19: Spring K04 on way to Svetoi camp.
X is closest point on riverbank, approximate area of traps shown by oval. Dotted line shows route on Imyak/Svetoi trip when traps were indicated. No timeline.

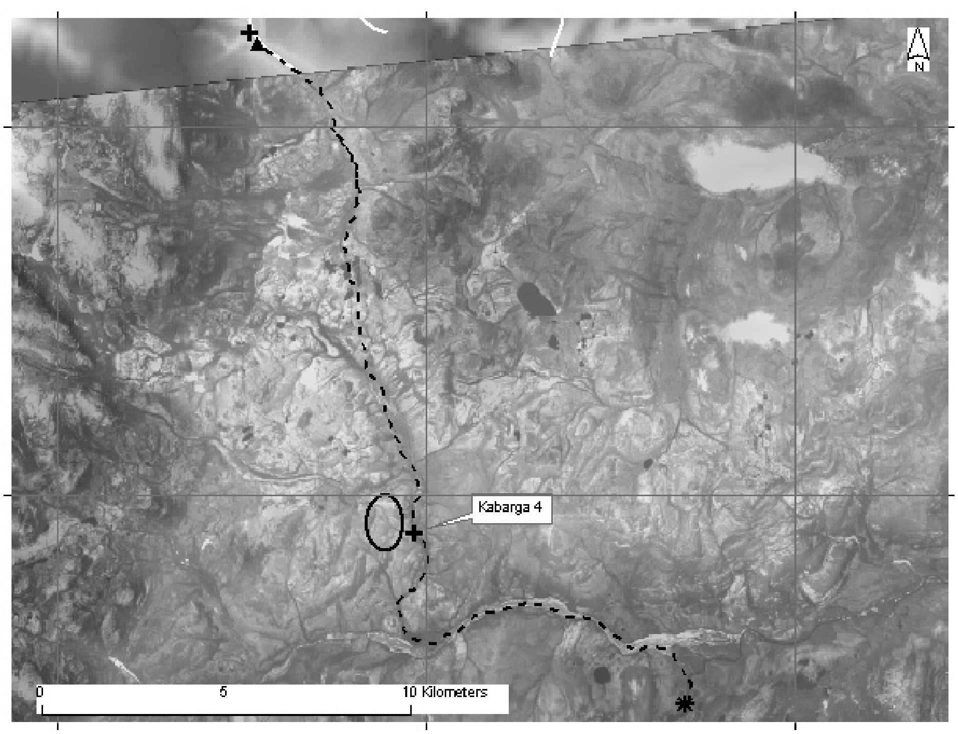
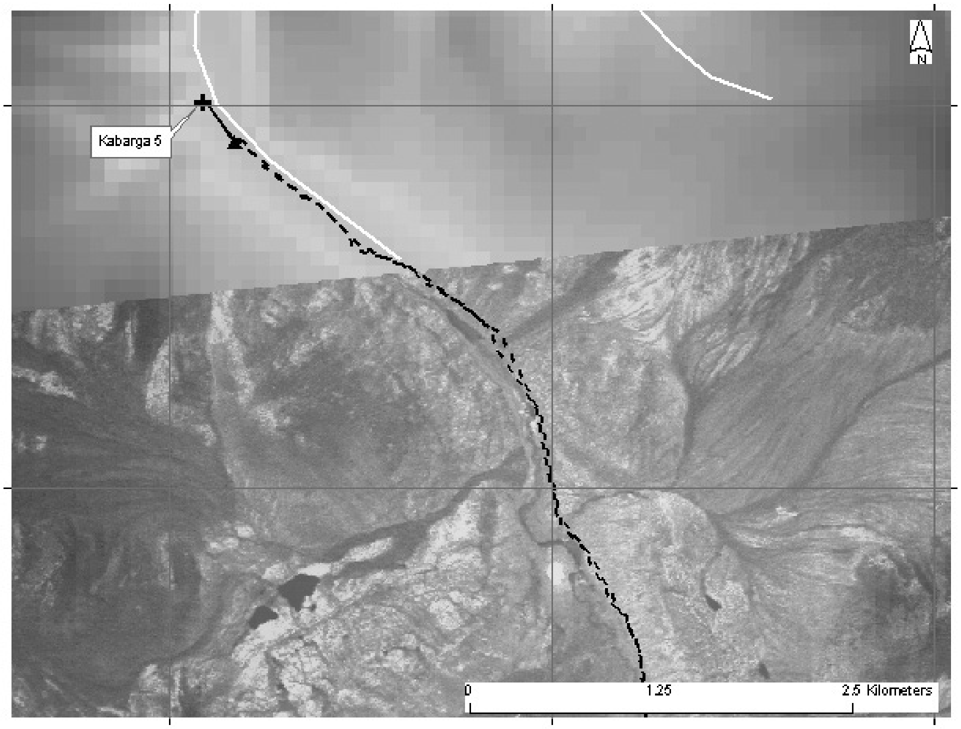
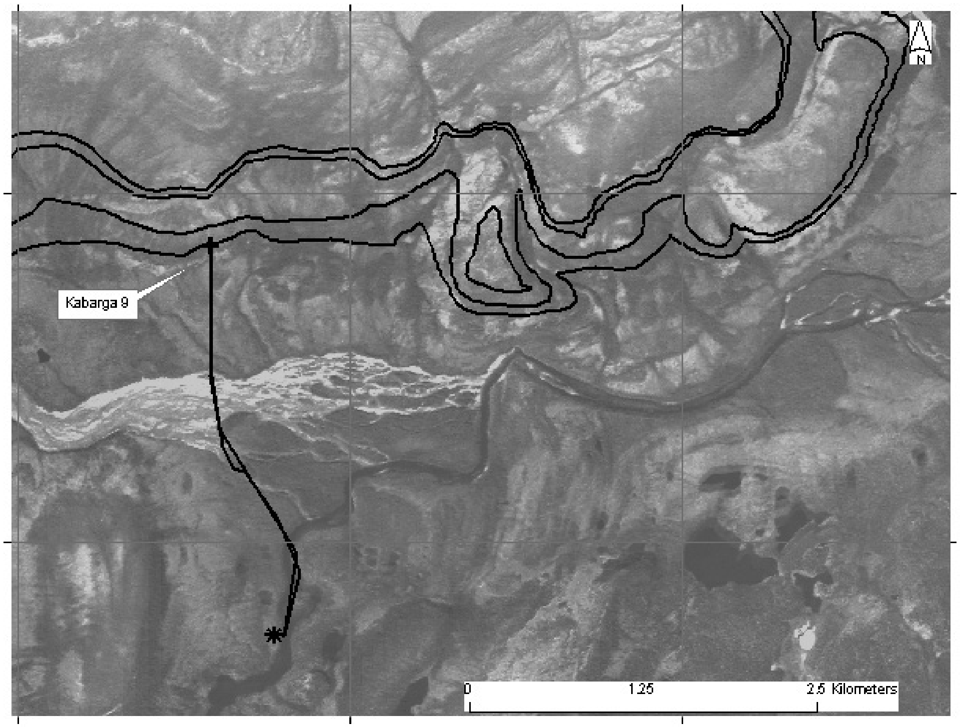


Figure 5.20: Spring K05 from Svetoi camp.



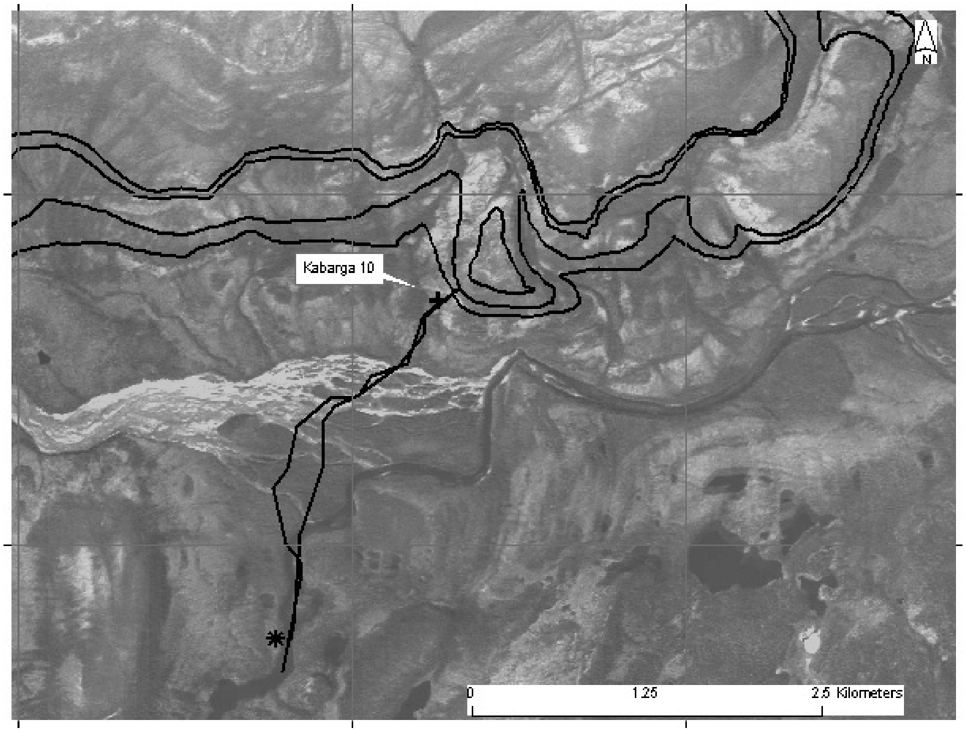
Elapsed	Event Description
	Dogs start to bark
0:00	Start out of camp [dogs still barking]
0:10	Kill. 2 shots by VS.
0:25	Back at camp
	Take out innards.

Figure 5.21: Spring K09 from Main Camp.



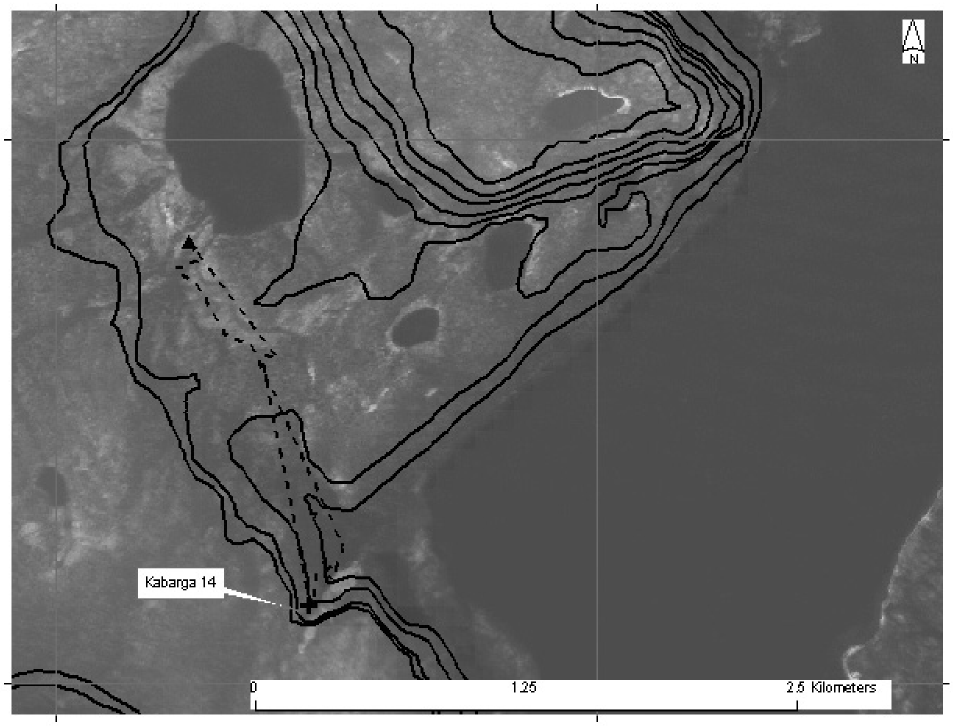
Elapsed	Event Description
	Dogs bark at breakfast
0:00	Set off from main camp
0:27	Pick up Norka (mink) 2 from VD's trap, on way - 330g, F. Stopped when norka in trap was seen along river, on other side. Took trap off, set it on road (for later
	Went to cliff, spotted K09 and dogs
	Went up cliff, closer to K09.
0:47	Shot once, killed
	Pulleld it down cliff.
	Had a smoke, gave dogs the innards, (Ulka came late, all dogs growled but VS gave her a share anyway)
0:55	Start back - the sled-road used. Dragged K09 back.
	[picked Norka 2 and trap up]
1:34	Back at main camp

Figure 5.22: Spring K10 from Main Camp.



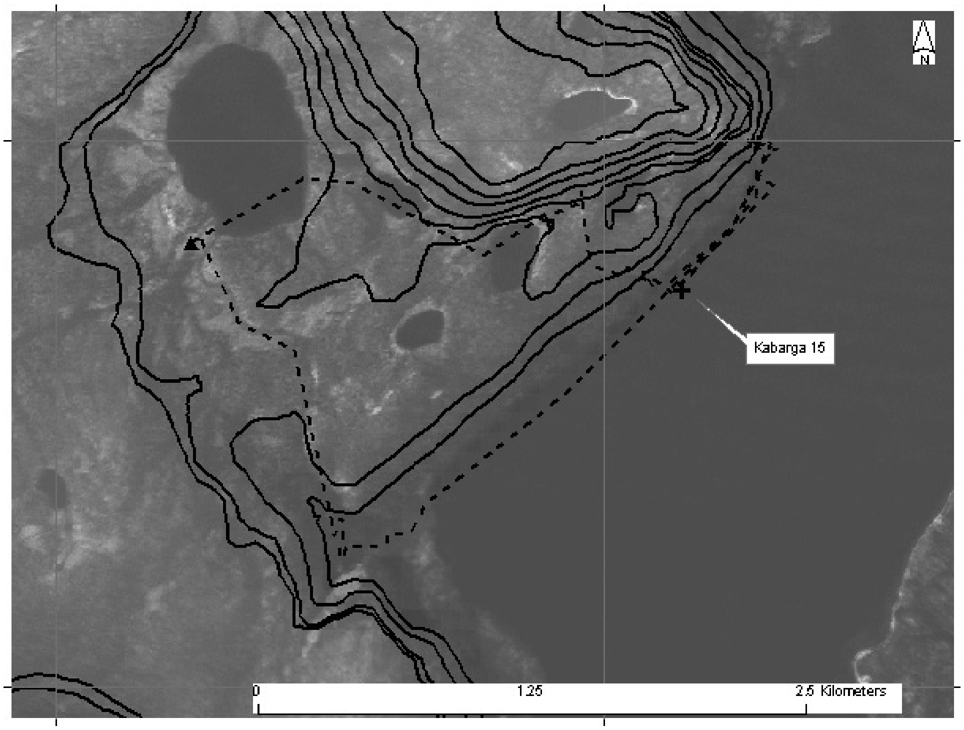
Elapsed	Event Description
	Dogs bark
0:00	NI YU leave on foot - walk straight to cliff. Baikal and Ulka (only Ulka was barking) and Kuistre were barking, Kobakh joined later (during the shooting).
0:40	Spotted K10 on cliff - big boulder/scree down cliff and blocking way. Had to climb before shooting. YU climbed and waited for NI and camera. NI thinks YU had to climb further, but she didn't. 2 clicks (bad ammunition). 3rd shot missed. 4th shot hit but only injured. 1-2 more shots hit animal, 2 more misses - i.e. 3 or more hit animal, 3 misses. K10 lay down without falling - they waited. K10 rose again - and fell down. Fell lower than NI's position. Dogs finished it off. 1/2 hour for hunting.
1:10	Started butchering on cliff (boulder). 1) weighed. 2) gland (100g) w/ fur and genitals taken off - YU was not sure where to cut, to take only musk gland off 3) opened up and gave innards to dogs (equally).
1:30	NI carried K10 down to bottom of cliff. Drag transport method from forest to main camp.
2:20	Back.

Figure 5.23: Spring K14 from ice-fishing camp.



Elapsed	Event Description
	8:42 dogs bark. Baikal, Ulka, Shustre, Kecha - Shustre was not there in morning - probably was hunting.
0:00	9:03 VS, YO off.
0:37	Spot K14, 9:52 kill K14 (almost fell on YO!).
0:52	Start field butchery.
0:58	Struyu (musk gland) cut and plucked clean, kishki (innards) given to dogs - to Ulka b/c she's old, and to Shustre because he did the hunt, other 2 just had to watch.
1:10	Packed K14 for transport on back - plucked "to make it smaller" - tied to a board backpack, 11kg.
1:16	Smoke a bit, and go off back to camp.
1:22	Take a break on slope - dogs go off on 2nd hunt (all 4 dogs), listen for barking and direction - squealing of kabarga heard - head over back near kill site but no more sounds heard.
1:30	Give up and go back home.
1:50	Smoke and rest break (by creek), Baikal and Kesha comes back. VS carries backpack all the way.
2:07	Another break.
2:25	Back in camp.

Figure 5.24: Spring K15 from ice-fishing camp.



Elapsed	Event Description
0:00	VD and YO leave. Pass Lake 1, pass Lake 2.
0:40	Pass Lake 3.
1:23	On surface of Nichatka lake (climbed down cliff), hear Ulka bark.
1:43	Hear more barking and home in on cliff - 1 dog barks up high, more dogs seen
1:45	4 shots, miss.
1:48	5th shot - down.
1:55	Throw carcass down to lake shore.
2:00	White dog ran to other shore - some hunters from Chara? we wondered. The dog high up on cliff looks like Sever - maybe MI is here? Butchery: open up belly, give to all dogs the intestines, foetuses to Ulka. Drain blood from carcass.
2:11	Hide meat under boulders.
2:16	Leave.
2:28	Have tea while visually tracking dog on other shore, spot a black spot - man on reindeer sled.
2:36	Go see the person.
6:06	Meet man at kill site - MI's friend Gosha. Arrived yesterday, will leave tomorrow, fishing - had put in nets today, came to find dog. Go back to where we had tea, and rest 5 min.
3:34	At hunting-shed (Russian hunter's) at mouth of creek (that runs from ice-fishing lake to main lake). Collect tea-brewing-fungus/plant [knob growing on birch tree].
3:48	Rest at creek.
4:23	Back in camp.

Figure 5.25: Spring K17 from Spring Camp.
No timeline.

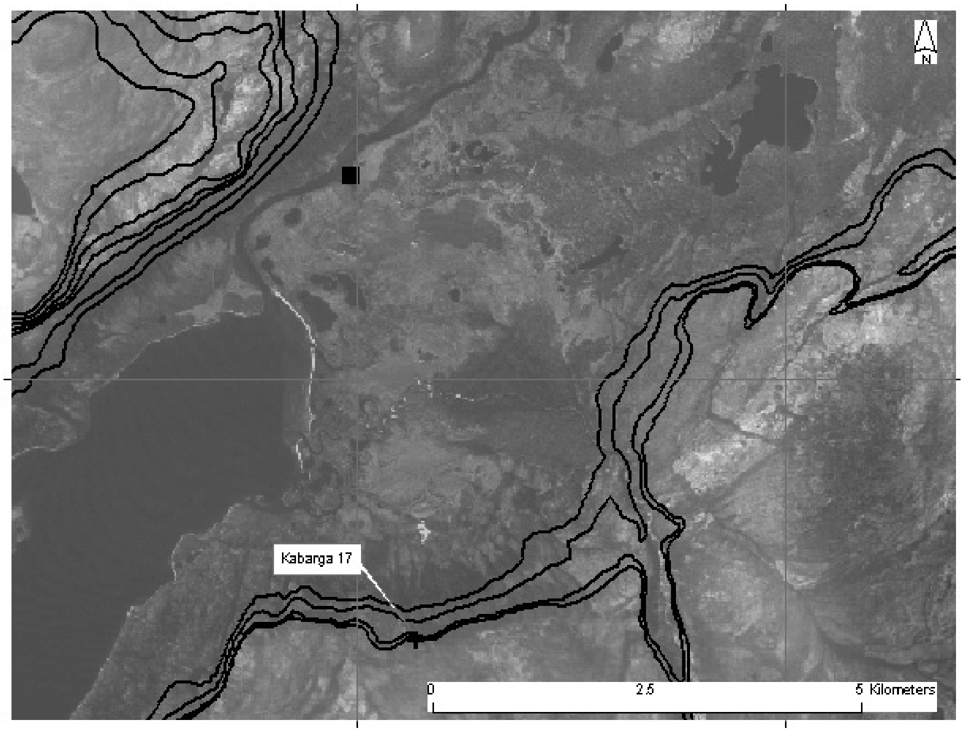
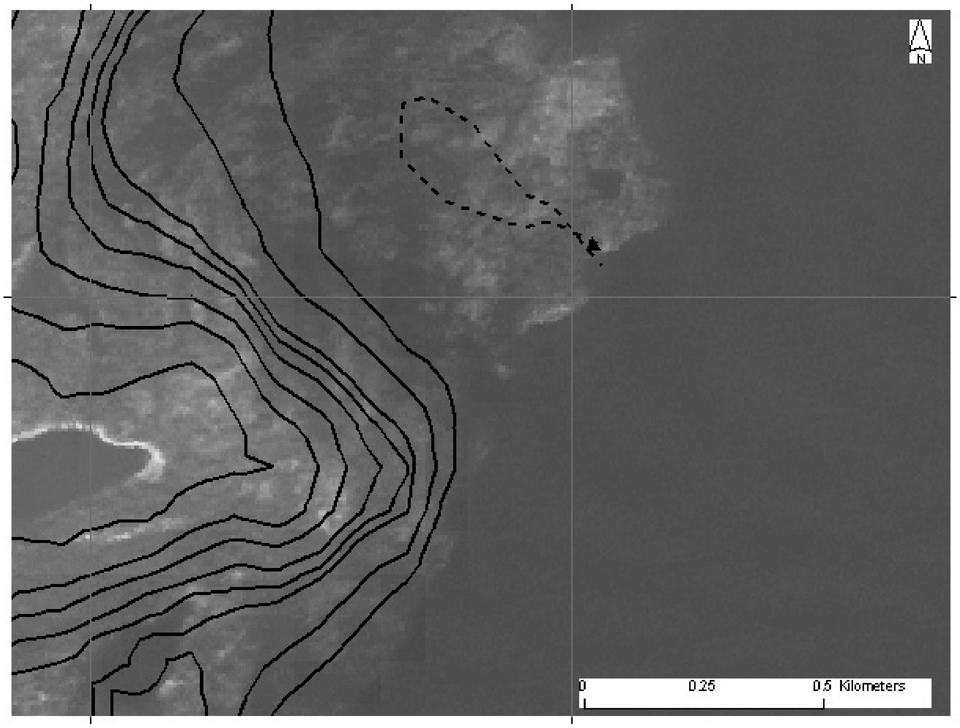
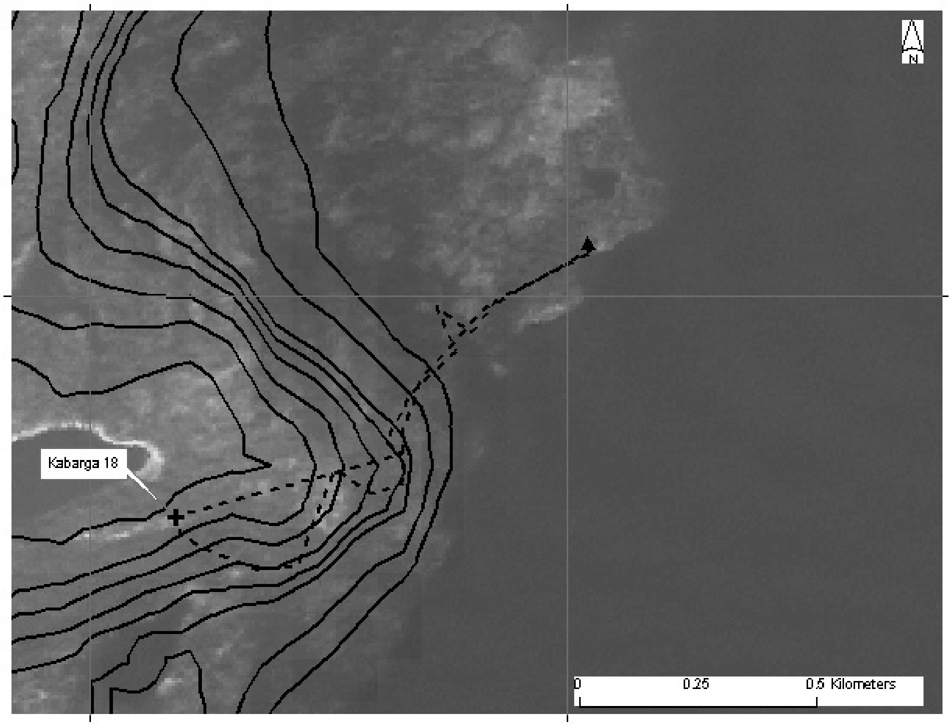


Figure 5.26: Kabarga hunt on 5/7, on Nichatka trip.



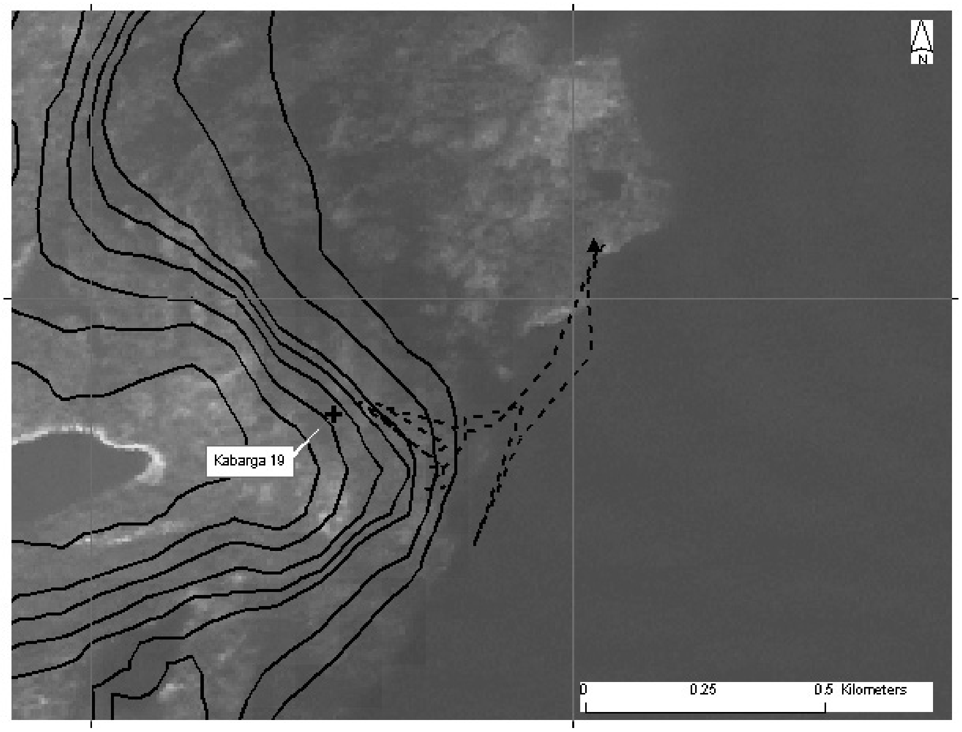
Elapsed	Event Description
- 1:30	Dogs freed on way to cliff.
	At cliff - no barking heard.
	Move along cliff, leave cliff.
	Look for campsite.
	Find camp location - leave R and sleds, make campfire, have tea - dogs came back.
0:00	Off to hunt - dogs go w/ us but won't run. Kabarga tracks seen.
0:03	R tracks seen, not followed.
0:22	Back to camp b/c dogs won't hunt. YO roasts meat on open fire - firewood - at least 6 big (>20cm diameter, >2m length) logs cut for firewood (all with axe). VS waters R.

Figure 5.27: Spring K18 from Nichatka camp.



Elapsed	Event Description
0:00	Hear dogs bark, get up. Build up open fire, have tea and meat.
0:00	Off - someone's traps for kabarga seen everywhere.
0:38	Find K18 - tie Shustre away from drop zone.
0:43	1 shot, K18 down. (VS knew it was a female before shooting).
	Butchery starts - make a hanging-tree. Skin off, innards out, head/lung off, liver out, cut body in half.
1:13	Smoke. Pack bag.
1:15	Leave.
1:17	Dogs take off. VS YO stop to taste 'dikii remen' (a vine that can be used as food when flowering, or to flavor braashka). Check birch sap - running, must place bottles, VS says.
1:40	Shustre back briefly and off again.
1:53	Kisha definitely barking but we go back to camp first.
1:56	Back at camp.

Figure 5.28: Spring K19 from Nichatka camp.



Elapsed	Event Description
0:00	Off for K19. Pass old camp where VS stayed on 5/9/01 - VS stayed in tent and hunted 2 kabarga in a day. Go to lakeshore, climb up rock slope - VS forgot 'road', he hasn't been actually on the cliff for 15 years. He checked position of dogs by binocular from camp - did not take binoculars to K19 site.
0:35	10 shots, 10 bad clicks (bad ammunition), no hits.
0:46	Change position - 6-7 more good shots, most hit the animal but K19 did not fall until last.
0:52	K19 (F) down but alive. Run off, dogs chase, after 1 minute or so, seem to be dead (calls heard). But still somewhere on cliff. Follow dogs.
1:09	Give up following dogs, and decide to get down cliff to lakeshore. Finally get down cliff. Find correct 'road' and shave tree-bark to mark road [for next time].
1:15	Walk along lakeshore and spot dogs - still high up, in bad position. Cliff dangerous and K19 is a female (no musk) - so give up K19, although she was 'big matka'.
1:27	Back at camp. Kecha fed a lot of meat [as he did not get rewarded for the hunt].

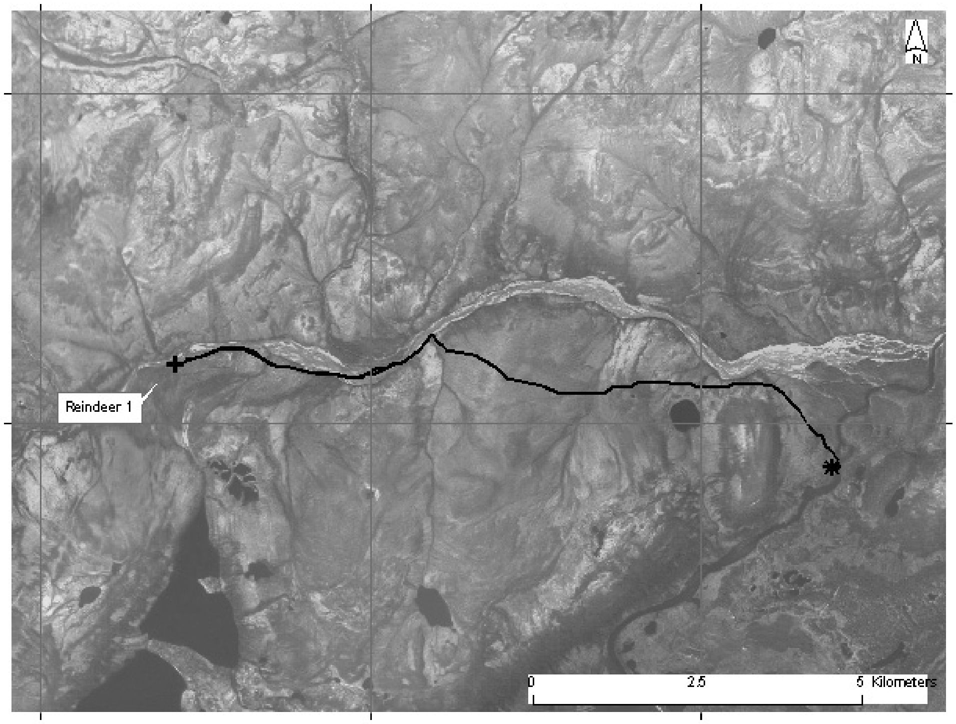
Table 5.29: *Kabarga* hunting patterns.
Summary of the time it took to kill an animal after sighting the animal ('Kill'), and the total elapsed time for the hunt ('Total elapsed'). The listed hunts were either successful in hunting *kabarga*, or were purpose-specific *kabarga* hunts. Only hunts that was observed (Table 5.3: Record = '1') shown here.

Animal	Date	Hunter	Transport	Kill site	Base camp	Kill	Total elapsed	Dog?
K02	10/19	VD	Boat	Lakeside	Main Camp	0:04	2:32	Y
K06	11/13	VS	Foot	Cliff	Main Camp	0:10	3:50	Y
K09	12/6	VS	Sled	Cliff	Main Camp		0:45	Y
K11	12/10	VS VD	Sled	Lakeside	Main Camp	0:15	0:55	Y
K02	3/15	YU	Foot	Cliff	Main Camp		2:30	Y
K05	3/22	VS	Foot		[other]		0:25	Y
K09	3/27	VS	Foot	Cliff	Main Camp	0:07	1:34	Y
K10	4/6	YU	Foot	Cliff	Main Camp	0:20	1:50	Y
K14	4/13	VS	Foot		[other]	0:15	2:07	Y
K15	4/14	VD	Foot		[other]	0:03	3:53	Y
-	5/7	VS	Foot	Lakeside	[other]		1.52	Y
K18	5/8	VS	Foot	Lakeside	[other]	0:05	2:03	Y
K19	5/8	VS	Foot	Lakeside	[other]	0:17	1:09	Y

Table 5.30: Sex and age distribution of *kabarga*.
Age: estimate given by hunter, or made from dental eruption and marrow color.
Est. age: Estimated age from weight (kg).
Age classes: 1 = juvenile, 2 = young adult, 3 = adult, 4 = old adult.

Animal		Sex	Age	Est. age	Weight	Weight notes
Fall	K01	F		3	15.85	
	K02	F	2		7.45	w/o innards
	K03	F		3	17.55	sum of parts
	K04	-			-	
	K05	M	1		7.75	w/o innards
	K06	F	2		15.15	whole
	K07	F	3		13.15	w/o innards
	K08	F		3	15.25	
	K09	M	1		10.45	whole?
	K10	F		2	10.75	w/o innards
	K11	F		3	14.60	whole
Spring	K01	F		2	9.10	w/o innards
	K02	F	3		15.20	whole
	K03	F	2		11.75	w/o innards
	K04	F			-	
	K05	F	4		14.40	w/o innards
	K06	M	3		10.20	whole, thawed
	K07	F			15.00	whole frozen
	K08	F	1		-	
	K09	F		1	7.90	sum of parts
	K10	M		2	11.90	w/o innards
	K11	M		2	10.20	w/o innards
	K12	M		2	10.75	whole
	K13	M		1	7.40	sum of parts
	K14	M		2	12.25	w/o innards, plucked of fur
	K15	F		1	9.50	w/o innards
	K16	F	3		-	
	K17	F	3		11.00	w/o innards
	K18	F	1		6.04	sum of parts, no fur
	K19	F				

Figure 5.31: R01 from Main Camp.
Route shown in map is not from the hunt, but from the carcass retrieval trip.



Elapsed	Event Description
0:00	search for domR by VD and NI.
0:49	find 4 domR.
1:44	back
0:00	VS VD NI start.
0:30	VS VD on riding reindeer (after 20 minutes, get off, walk for 15 minutes, ride for 15 minutes)
1:30	Cross vehicle-track. Walk for 10 minutes, ride for 15 minutes, walk for 45 minutes, ride 5 minutes.
2:35	Arrive at carcass - found way to carcass by following domR tracks?
3:20	Unloaded all pack domR, tie them to tree.
	Make fire and have tea.
	VD cut meat off for roasting-snack (FE and CE)
	Butchery, weighing, packing (everything) into bags, but bags still on ground.
3:51	Load bags onto pack domR.
3:51	Start back on foot. Walk after 14 minutes, ride for 5 minutes, walk for 20 minutes.
4:47	Cross vehicle-track. Ride for 7 minutes, walk for (VD/VS) 8/13 minutes, rides for 13/20 minutes, walk for 17/25 minutes, ride for 20/10 minutes, walk for 25/10 minutes, then both ride.
6:20	Back.

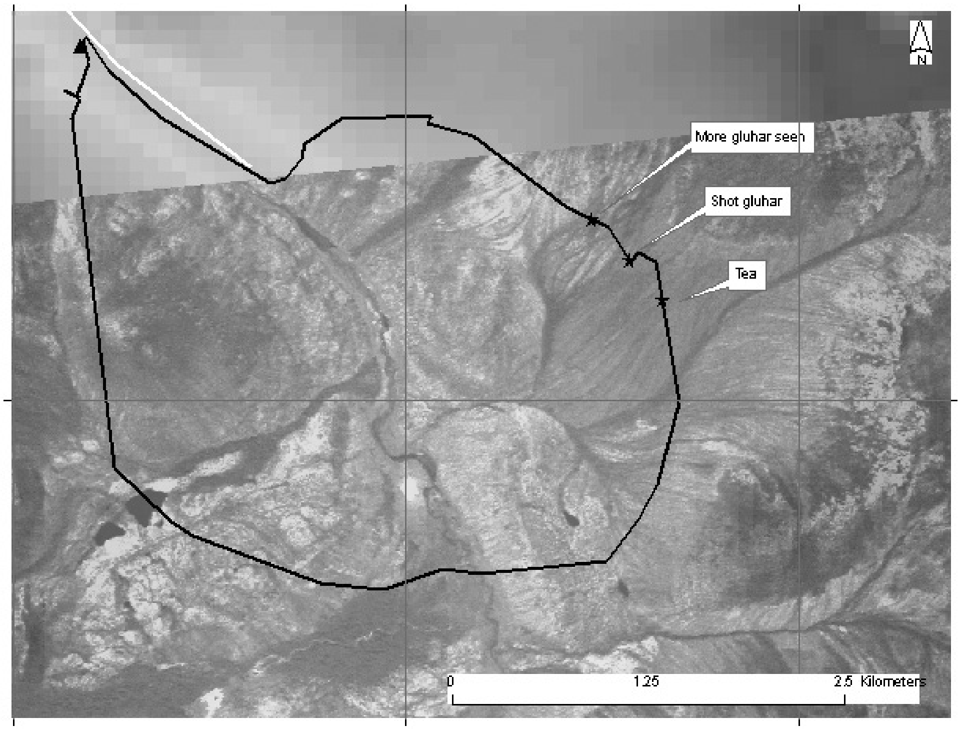
Figure 5.32: Red deer hunt on 11/10, from Main Camp.
No GPS record (map).

Elapsed	Event Description
0:00	Start. Crossed river and went into hills. Went w/ 2 guns - VS carried big gun.
0:52	Spot tracks of red deer.
1:20	1/2 hour into izubr chase, heard dogs barking - Ulka and Chorni [from VD's hunt]. Chase away dogs, but abandoned chase (?). Chorni re-appeared just before shooting Sable 1.
1:45	Found sable track, definitely abandon red deer.
2:05	Found sable in hollow trunk (dog sniffs air, dog released, dog indicates location) - hit trunk w/ axe to make sound, start to cut trunk, sable chased out, goes 10-15m away from tree.
2:10	Sable 1 shot, start home.
4:10	Back in camp.

Figure 5.33: Red deer hunt on 11/11, from Main Camp.
No GPS record (map).

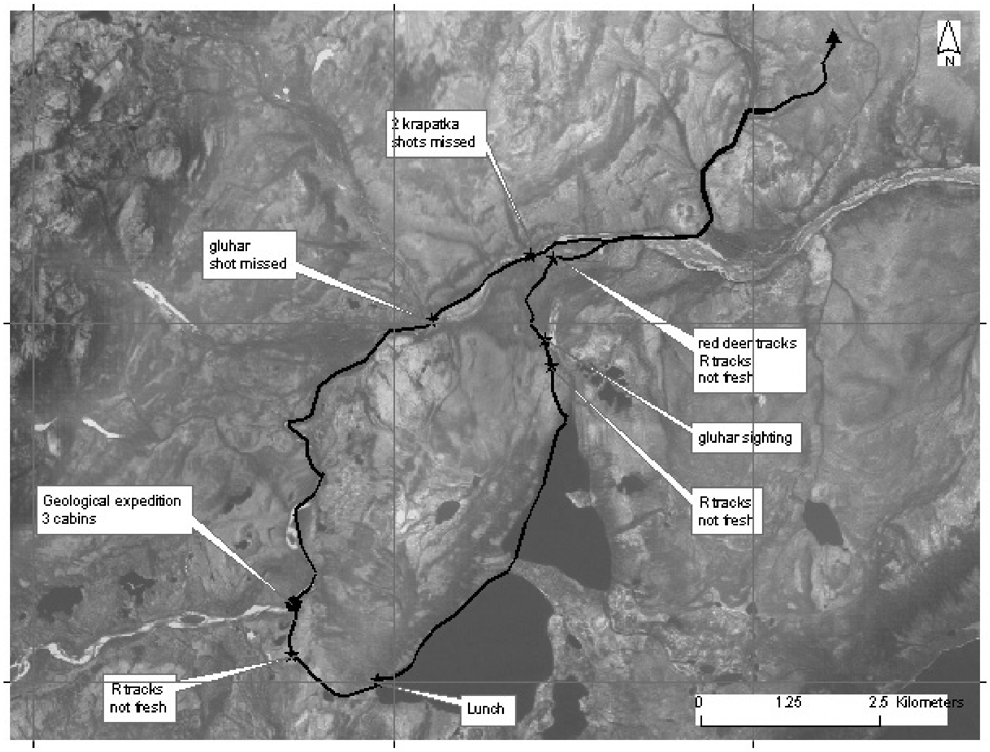
Elapsed	Event Description
0:00	Went out on same path as 11/10. But only had small gun.
1:50	Came across fresh sable tracks - search for 2.5H
4:20	Start to walk back b/c was already far away from camp - was at further side of big hill. On top of hill, saw very fresh tracks of red deer. Ttrack for 1/2 hr, came where animal was resting/eating, and scared out by VS/NI - at that point released dog, dog ran fast. Tracked further for 1H15min.
5:35	Gave up - would be dark.
7:25	Back in camp. Also shot at grouse somewhere.

Figure 5.34: Hunt on 3/23 on Svetoi trip.



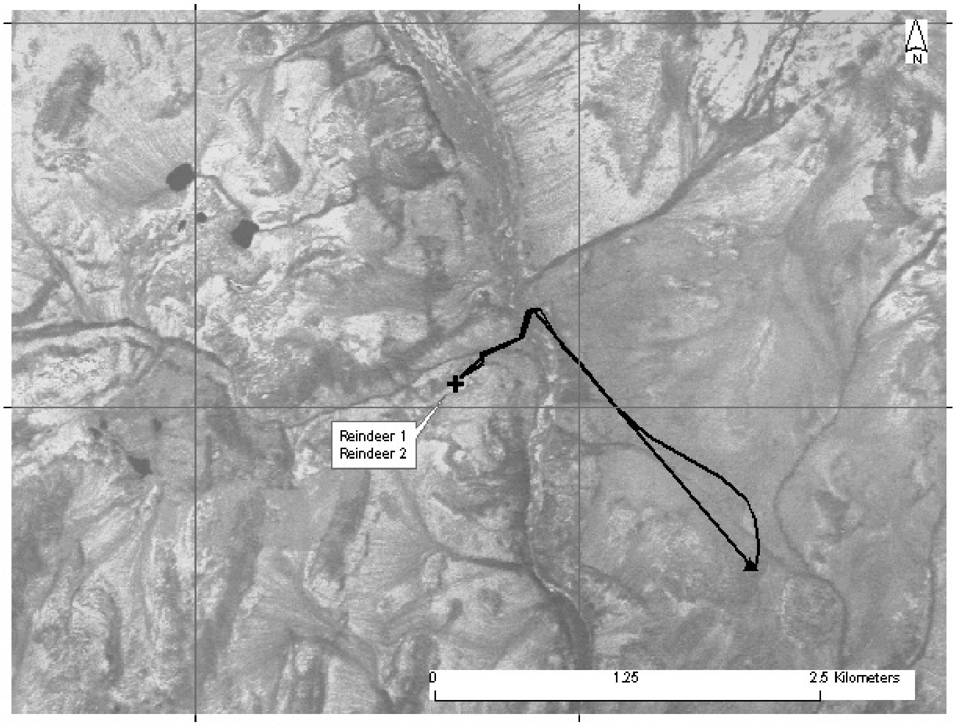
Elapsed	Event Description
0:00	Start - went uphill on same side of river as camp, then crossed over plateau and go along river [go upstream].
1:40	Crossed river to other side, then take a 5 minute break.
2:30	5 minute break (after heavy snow conditions).
2:45	Crossed sable track - completely fresh, but not even considered by VS.
3:20	Tea break.
3:55	End tea break.
4:20	Shot gluhar and plucked it (capercaille).
4:30	Start moving again.
4:35	See track of wolves - fresh - 2?
5:05	Gluhar seen, possible mating ground found.
5:10	Track of wolf and carcass of R - dug out of snow - wolf killed, stored, and went back?
5:25	Crossed sable track - fresh - no chase.
6:00	Back in Svetoi camp.

Figure 5.35: Hunt on 3/24 on Svetoi trip.



Elapsed	Event Description
0:00	Start. Go along watercourses. Cross one river.
1:00	See track of 3 red deer, not really fresh, and then tracks of 3 R.
1:20	Crossed open area, spotted gluhar on ground, 2 other gluhar seen also (capercaille). Tried to hunt them on foot, but flew away. No shots fired.
1:38	Tracks of 5-6 R, 1 day old, R went downstream direction, parallel to river.
2:10	First big lake. Travel on shore of lake, on north shore, pass small stream.
2:35	Second lake. NI saw tracks of otter - on [stream] mouth. Traveled close to shore [but on lake-ice] to check for fur animal tracks.
2:45	Lunch break - eat bread, tea, sleep. To 15:15.
4:30	Leave.
4:50	Crossed tracks of 5-6 R again.
4:55	Reached river, where there was small cabin on shore of Bogoyukta (seen in Fall?). Went downstream, traveled in forest where there was ice.
5:50	Reached the three large Russian log cabins.
6:20	Shot at gluhar on shore of river (capercaille). Not successful.
6:25	Shortly afterwards, 2 grouse shot at, but missed.
7:15	Back in camp.

Figure 5.36: Spring R01 and R02 from Tok camp.
Route shown in map is not from the hunt, but from the carcass retrieval trip.



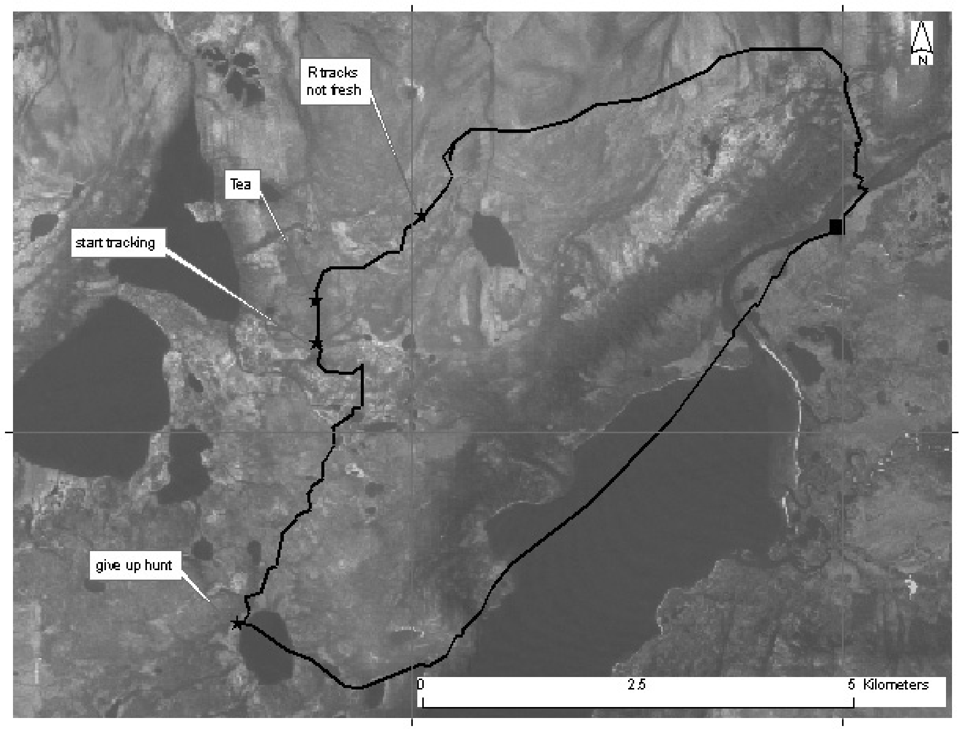
Approximate timeline of the hunt:

Elapsed	Event Description
0:00	Off to hunt.
	Shustre chased a sable very early into day. Tried to smoke it out - sable runs away, snow deep so dog can only chase slowly - dog goes back to camp on own [16:55]
5:20	Shot gluhar (capercaille) - killed.
5:30	Went over hill in sled and there was a whole herd of R - 11 females.
	Shot from sled and R ran away.
	Chased some down - follow tracks. R ran in one group, with 1 leading, and others following.
6:50	Found them standing, so tied up sled and shot on foot. Shot and got 2, maybe could have gotten one more but no, rest got away. R01 was biggest matka in herd. [3/27 notes - was about 5m from sled, no on-foot approach in this hunt]. R01 and R02 both shot in side. They ran about 50m and died.
	Field processing of R02.
8:05	Back in camp with R01.

Timeline for carcass retrieval of R02:

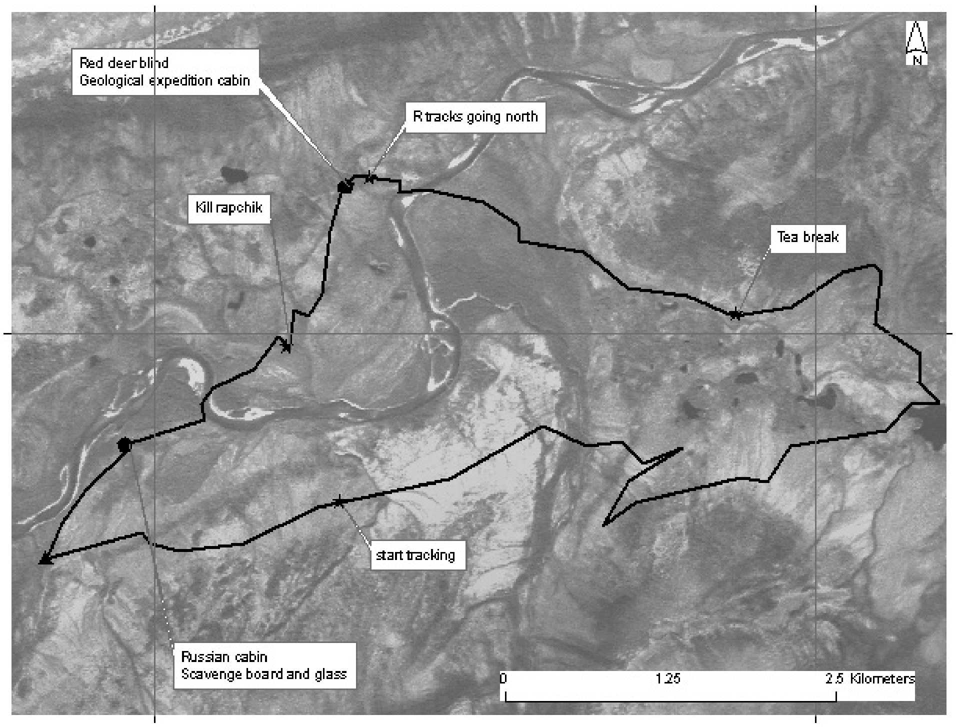
Elapsed	Event Description
0:00	All domR harnessed for trip.
0:10	Start trip - 3.3km from camp across creek, up steep slope overlooking creek.
0:32	Arrive. Start butcher sequence.
0:52	Leave.
1:19	Back at camp.

Figure 5.37: Reindeer hunt on 4/20, from Spring Camp.



Elapsed	Event Description
0:00	NI VS off to hunt.
	Tracks of 2 R seen, but old.
3:20	1 grouse shot (no GPS point).
3:25	Stop for tea - have tea and roasted grouse.
4:30	Leave tea-break.
4:40	Find track of 3R, fresh.
6:20	Track to ice-fishing lake (and take short break) - and gave up after break (from the track, R walked, then ran 1km or so (smelled the hunters?) - close to lake at this point - tracked for 300m or so and gave up.
6:25	Stop tracking.
7:35	17:30 down at lake.
8:50	Back at camp.

Figure 5.38: Hunt on 4/22 from Garilii camp.
Note: 'start tracking' on figure corresponds to 1:43 in timeline.



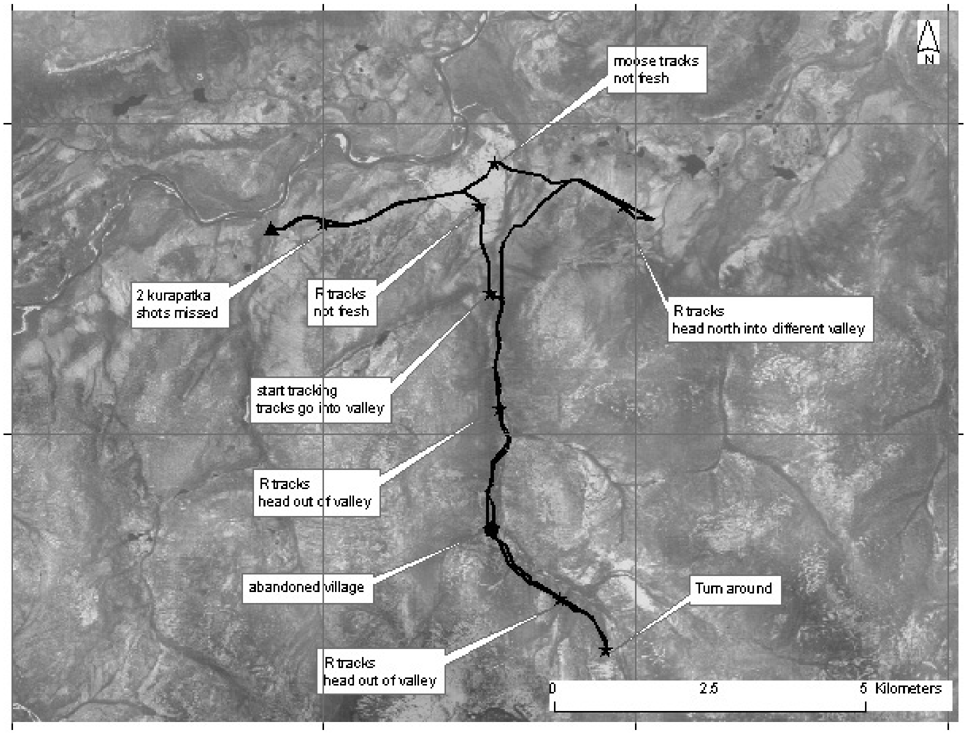
Elapsed	Event Description
0:00	Off to hunt.
0:08	
	Sable tracks - 3 times or more, same sable, from last night = [the sable's] home is near.
0:14	Look out for gluhar (capercaille) - (saw 3+ female gluhar and 2+ male gluhar tracks, plus 4+ grouse tracks) - but no gluhar.
0:28	Binocular survey for R tracks.
0:36	Wolf tracks (also seen later) - 1 wolf. (binocular work every 10-15 minutes - scan for R and R tracks in all directions).
	Pass south of red deer salt lick location (on opposite shore of river) - VS explained that SA killed 3 red deer w/ Russian hunters last spring, and VS killed 3 R on this shore w/ an Evenki hunter who came with the Russians. Teh hunters took all the meat after the study group kept a bit for themselves.
1:00	More binocular work. Road split to Russian settlement. Take road that parallels river.
1:10	See R track - 1 R headed north to river yesterday. Pass small mountain-landmark and river.
	Look among rocks for mummified hamsters for some time (medicine for broken bones, everything, very very strong). VS hasn't seen one himself but Russians had asked him to look for them.
1:20	Smoke break (5 min).
1:36	See 2 tracks of wolves.
1:43	See tracks of 9R. Going back west - wind is going that way (we will be downwind) - and it's relatively fresh (yesterday's tracks). At this point VS guesses that they would either head upstream (the snow is thicker), or double back to where we are (we are in big open flat area) - decide to check this area first.
2:00	Serious scanning - no R in area.

Elapsed	Event Description
2:05	Decide to go back to tracks (NB: partly because of my input? - he asked me, and I tried to be noncomittal, but who knows. He might have favored other choices)
2:15	Tracks of 3 R (incl. 1 yearling) goes west - upwind, and today's fresh track! - different from previous 9R track. Switch to this track.
2:37	Break (sit and smoke) - and check w/ binoculars (also check every 5 min (approx) while walking, and when new view-line opens up).
3:11	Pass little lake on N shore (not too close to shore).
3:30	Give up - R always on move, never grazing or sleeping (they usually sit and sleep, which is reason for binoculars - hard to spot) - VS thinks they might be running from SA, very frightened and will not stop.
3:35	
	Think about stopping for tea - gluhar (capercaille) spotted but flies before VS in position.
3:45	Track the gluhar - 10 shots - injured but flies away
4:00	Can't find the injured gluhar (goes to right tree but no bird...?)
	Long tea break. VS smoked gun, b/c he missed gluhar - finaly he gets superstitious - and said/mumbled something w/ 'rooi' and 'burlah', then smoked binoculars (so they would see better) and jokingly told me to smoke myself too, to walk better! He threw short rododendrons into open fire to make the smoke.
5:20	Little away from tea-break area, found R tracks going back W - the ones we were following.
5:50	Cross river.
	Go up opposite shore, straight up on rocks. Look for mummified hamsters.
6:05	R track on opp shore - the tracks we saw first probably crossed over.
6:13	Russian log cabin with red deer salt lick/blind on premises, but all broken down. No signs of red deer - checked. Good area before (ground contained salt) but no recent tracks now.
	Rest at blind, binocular work (10 minutes). See rabbit tracks on way back.
6:39	Two grouse seen at close range, kill one. Male - red above eyes.
7:12	Cross river and go to Russian cabin (single cabin) - a Russian lived here and fished (hole in ground for storage, pechka, smoking-structure (burnt), lots of usuable garbage). We scavenge board (table) and lamp-glass (jar). Go back along shore of river on top of steep cliff.
7:40	Back in camp.

Figure 5.39: Hunt on 4/22 by SA, from Garillii camp.
The following timeline is a composite of two retellings that conflicted in some details.

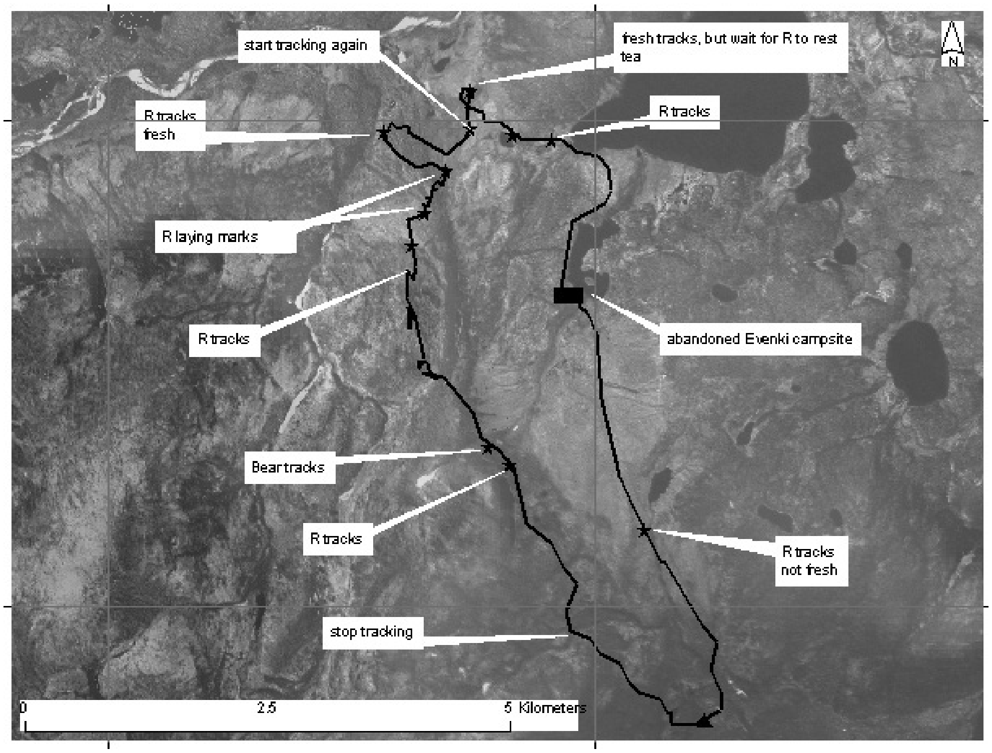
Elapsed	Event Description
0:00	SA goes up little river, find 3-4R - see them thru binoculars - tie up riding reindeer, go on foot. [2nd story: riding reindeer left because of snow condition]
-	Snow icy - "say krrr, krrr" - R hear and run off. [2nd story: never saw R, SA was saying "R could hear me and run off"?] SA follows them [2nd story: follow tracks], see our tracks following them, and decides to go after the older track of 9R.
-	By tracks, the 9R are being chased by 1 wolf - the track we saw - so they move far and fast.
-	SA sights R thru binoculars - tie up riding reindeer, go on foot.
-	Go closer - sits down, look w/ binoculars. Oh no! Grouse feeding right in front of him! - Sits close to 1H - "what to do, what to do..." They frighten at some other smell/sound and go off. [2nd story: was in open area, there were grouse, R ran away a bit but started to feed again downstream, SA followed]
-	SA follows, finds R feeding. Go closer on foot. 150m, too far for very robust lead female w/ great antlers, just go for the last one. One black one sniffs his tracks - and he wandered off alone and runs off close. Shot at the stray male, shots hit once, definite hit but they all run off. Follow - the one that is hit stops, he shoots again, hits again, but it runs off, he follows. [2nd story: hit a follower female, all R ran away]
-	At river (or creek), R splits into 3 groups, 2 group of 3-4, 1 goes off alone, one 3-4 herd goes downstream (YO VS saw the 1 loner track, YO VS also saw the 3-4 downstream track on opp shore after killing grouse), SA follows the 3-4 that went upstream. [2nd story: R splits into many little groups (1 group stray left, 1 up, 1 down). R eventually re-grouped and fed]
-	R go up and up mountain - higher and higher - very deep snow, up to thigh. SA sees them lying down near top of mtn, sneak up (up mountain - on foot), they run away. [2nd story: SA followed tracks all the way up mtn. Saw R lying just on this side of top of mtn, but R saw SA too, no time to count, do not know if the hit R was there or not. Shot again from very far (b/c they saw him anyway) - 200-300m. Probably hit one but did not see any blood on ground. They all ran up[stream?] -- probably will follow tomorrow?]
-	VS YO probably saw the tracks (after tea), they ran back towards VS. SA heads back.
11:45	So, 3-4 went downstream and probably to different major river valley, VS and SA estimate - too far to chase [from this camp]. The 3-4 that ran away (and we saw tracks) could be in tributary valley - YO thinks they might go after them tomorrow. VS and SA regret not bringing skis. If only they had SKS [rifles] - they say (they talked about this gun yesterday) they say they would've killed 8 and let 1 live.

Figure 5.40: Hunt on 4/23 from Garilii camp.



Elapsed	Event Description
0:00	Off to hunt.
0:09	Two grouse walk on ground - shot at one, both fly away.
0:35	See R track - continuation of yesterday's single R track?
0:52	This morning's R track (2-3R). Tracks follow road to mountain-landmark and probably the tributary river, although banks are rocky and hold no tracks. [SA VS covered all other locations, so this is the last possible place to check]
1:08	See R track going east (6+) - VS says yesterday's SA's R - go down E to large clear area. Lots of sable tracks, squirrel tracks.
1:23	Track of 1 R. See squirrel cross.
1:28	Reach Russian village. 8 houses - abandoned in '85. A magazine from '97 - someone came by later. Scavenge 3 houses (wire, dog-bucket, seat-cushion, magazines)
1:59	Leave and go upstream.
2:20	3-4R tracks head down E also (downstream and east) = probably cross to different river system.
2:38	No more tracks in this valley.
2:52	Rest, smoke, turn back.
3:35	VS collects birch-tea-fungus (already checked out location on way in)
3:50	Take route in forest, not riverbank.
4:19	Binocular break.
4:30	R track - cross river, follow track 15 minutes [then give up] - VS says later that "[he] can't get interested until he sights reindeer, can't keep searching like SA".
4:45	Stop following tracks, head back to camp.
5:11	See 2 moose tracks that crossed our tracks yesterday after we went home - later VS asks why SA didn't chase them. Didn't see these tracks?
5:26	Start fire on road, burn undergrowth for greener grass.
5:42	Back in camp. Why there was no serious tracking: 1) we were upwind towards chase area, 2) VS can't get interested until he sights R, 3) thought of missing R in tributary valley yesterday and was angry.

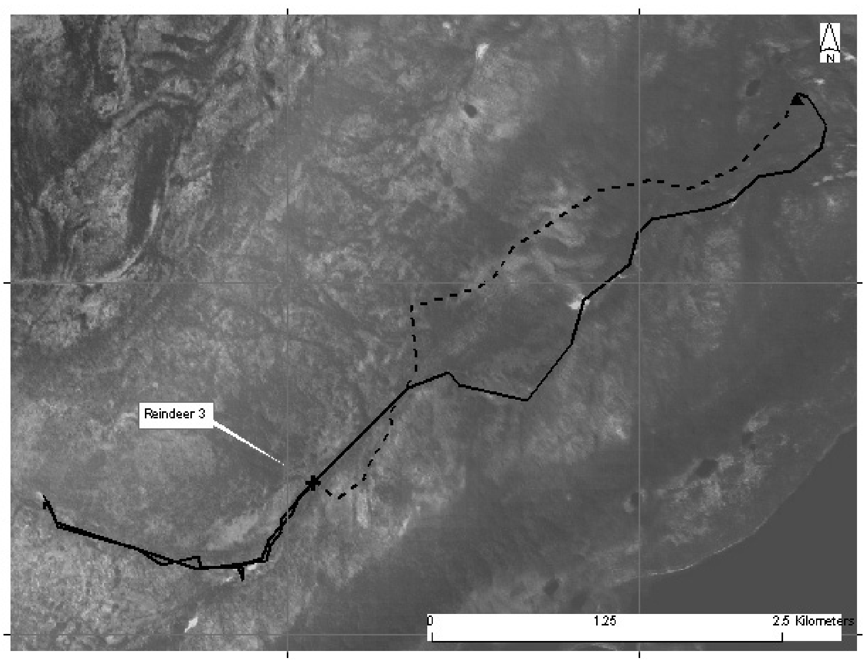
Figure 5.41: Hunt on 4/27 from Shirik camp.



Elapsed	**Event Description**
0:00	Off to hunt.
0:10	Passed old summer-night camp (open fire remains).
0:33	Binocular check - in open area, every 10-15 minutes (especially check valleys between two mountains - from every angle - for tracks). Avoid snow - makes sound. Check for tracks and eat-marks in moss, droppings. Basically doing a scan in open areas.
0:36	Old track of R.
0:59	2 grouse surprise us. No shots.
1:18	Eat berries - 3 minutes.
1:32	Lake (little) - helicopter field made by another Evenki.
1:34	Evenki site.
1:47	1 grouse scares us again and flies away.
2:19	Pass little lake.
2:22	R tracks heading in other direction.
2:39	R tracks - today's.
2:45	Serious trackng (open area at little lake).
2:51	Determine that R headed south. R sleeps until 3-4pm - decide to have tea and wait.
4:34	Leave again. See kabarga (or R calf) tracks as we left.
4:45	R tracks head back, but we passed no new tracks. Follow original track's direction towards lakes, and circle around if no result.
5:05	Old Evenki storage structure, falling apart.
5:10	Turn around.
5:24	Follow track to hill - binocular work. Snow knee to thigh deep, and steep slope.
5:46	6 laying-marks [where R laid down to rest] - more tracks.
5:47	Another lying-place.
6:26	Tracks split - take left one going down to open area.
6:35	Collect a plant good for back and kidney pains. Go over watershed.
6:55	Binocular break on steep 'cliff' - head down.
7:00	Long binocular work and smoke.

Elapsed	Event Description
7:10	Down in flatter area, see two kites.
7:25	See bear track that just came out (several hours ago). A 'small' bear. Also see R tracks.
7:32	Re-find the R tracks after losing them on ice This morning's tracks? [Lost the tracks from lying-place]. Follow track.
7:42	Count 9-10R tracks on lake - keep following.
8:06	Rest on side of small river. R seems to be heading up[hill, stream?]. VS says he will go that way if SA hasn't killed them. [note: SA saw these tracks, but he did not chase (probably had killed R03 already)] Decide to check a little further but basically head back.
8:20	Break.
8:45	Back in camp

Figure 5.42: Spring R03 from Shirik camp.



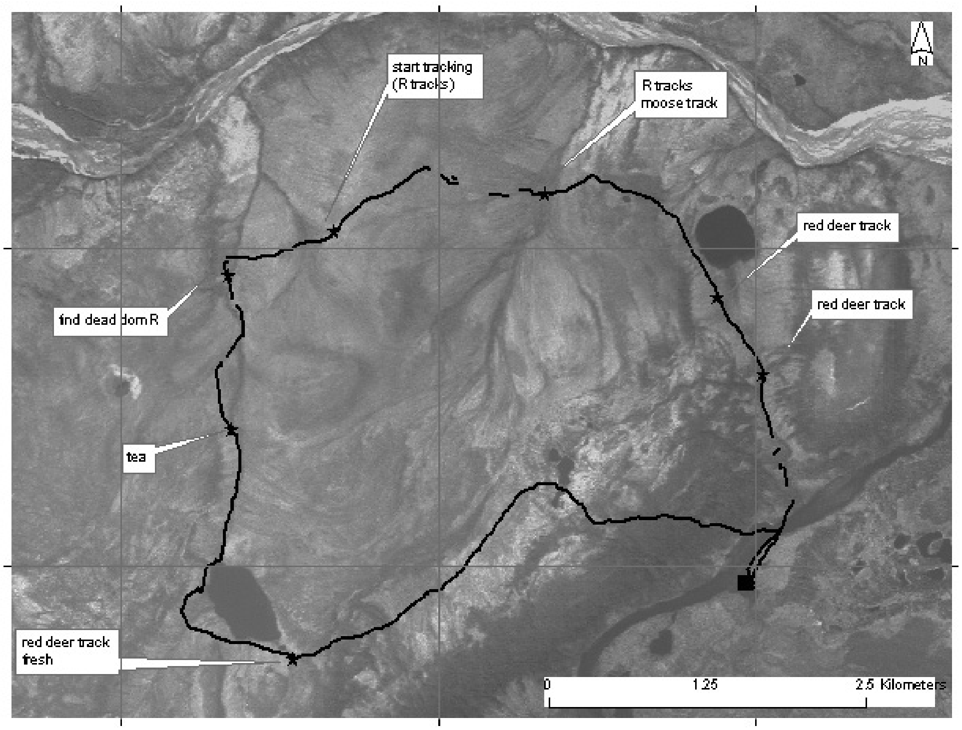
Approximate timeline of the hunt:

Elapsed	Event Description
0:00	SA off on hunt.
6:00	SA rested and had tea - one R came (a male) and said 'shoot me!'. Specifics: SA lay down, tea (water) was boiling. Cerik (riding reindeer) snored (he always snores). He threw a snowball [in direction of Cerik] - Cerik ran out and stood close to SA, and looked at a wild reindeer - so he shot.
7:00	One hour to skin, dig snow, hide, take out innards, etc. Then went upstream a bit, then went home.
8:21	Back at camp.

Timeline of carcass retrieval (shown in figure):

Elapsed	Event Description
0:00	Start packing for trip (2 bags, bottle, canvas tarp, scales).
0:20	Finish packing, have tea.
1:00	Off.
1:18	Grouse seen but let go.
1:36	Smoke-break (Shustre runs away, Baikal was free all along) - comment "oh no, all wild R will be scared off". Dogs caught and tied up in next 15 minutes.
2:01	See domR tracks - 6 or more. Go upstream and to left side. (2 tracks of R seen earlier - is ignored, old?)
2:23	Arrived at kill site - immediately go to work. Rotten ice on creek, hard traveling to site.
2:56	Sled packed. Fur left, as well as esophagus, genitals, testicles - left on trees. Dogs [tied] to sled.
3:07	Forgot stomach for dogs - get it, put in canvas.
3:10	Off. Sled order changed, talk a bit about which way to go. VS, SA drive together over very bad ice part.
3:35	VS go off on riding reindeer w/ Shustre (5.3km, 1H13min, move ave. 4.3km/h) - came back to camp b/c R tracks ran off up and away.
3:35	Change sled order after VS leaves on riding reindeer.
4:16	Back to camp.

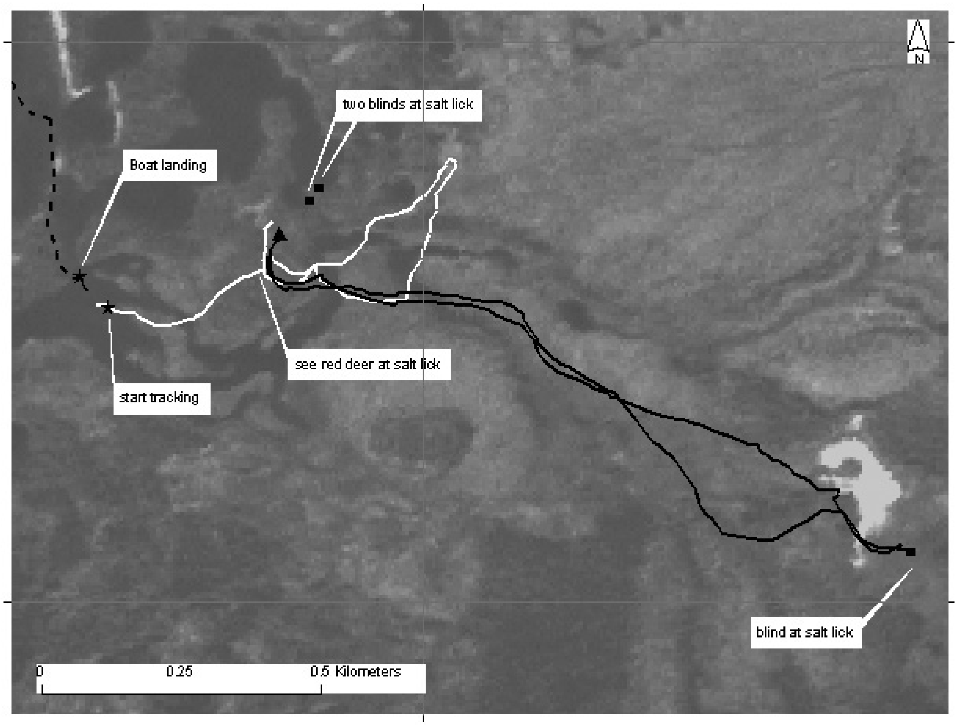
Figure 5.43: Hunt on 5/14 from Main Camp.



Elapsed	Event Description
0:00	VS YO Shustre off by boat - off to about 100m downstream, 'wild garlic hill'.
0:26	See kabarga track.
0:29	See red deer track.
0:40	See red deer track.
0:52	Binocular work along big lake (saw R here last year, but let go b/c no need of meat - VS)
0:55	Finish binocular work. Pass little lake.
1:10	Binocular work at ridge into ex-marsh. SA saw 7 R here last year, shot but didn't hit.
1:18	Finish binocular work.
1:25	R tracks, moose too (Shustre sniffs footprint of moose).
2:00	R tracks - fresh. Moose, red deer tracks followed if 'on the way' but not pursued (only binocular work), but R tracks we divert after it. [possibly because dog is not reacting to fresh scent of red deer or moose??]
2:20	Moose track again, on other side of creek.
2:21	Carcass of lost domR found - fur patch seen and investigated. No sign of fight - natural death? Wolves scavenged carcass - lots of scats. Antler picked up (attached to crania) - and put up on tree.
2:48	Tea break. Eat lots of berries. Berries eaten 2-3 times on way - hot and thirsty.
5:15	Leave: find fresh R tracks, eat marks. Red deer tracks too - follow, binocular work.
5:34	By lake. Cross a bit on ice, then follow aruond about 2/3 of lake looking for tracks, then leave lake.
6:05	Break - dog sniffs something. Follow dog's lead - red deer track! But not followed (only 2 min maybe). Going in wrong direction? Because of YO's presence and late hour?
6:22	Go downhill on good lookout, try kabarga whistle (1-2min) - but no kabarga. Whistle imitates kabarga calf call. VS had past success with whistle (2M, 1F), VD got bear (coming after calf), MI works well with whistle.

Elapsed	Event Description
6:41	Break.
7:05	Stop for water on little lake.
7:17	Follow dog's lead - smells something.
7:27	Dog freed - possibly fooled us? Just runs around.
7:42	On river bank across camp.
7:50	Collect wild leek.
8:00	Back in camp.

Figure 5.44: Hunt on 5/16-17 at red deer blind.



Hunt on arrival (5/16):

Elapsed	Event Description
0:00	VS YO on hunt by boat - w/ 2 guns, bedclothes, binoculars, food.
	Take 5-10 minutes each to put in nets (b/c YO rows badly) - 2 nets.
0:39	At river mouth, 16+ ducks seen - 1 shot, miss. Other ducks on lake - 1 at river mouth, 50+ on lake, not shot at.
0:55	Net in little creek 'where pike runs'.
1:25	Almost crossed breadth of lake, toilet/smoke break (5 min).
1:34	Land in inlet. A duck defends territory, flies around.
1:36	Off to check blind, left bags in boat - very very fresh tracks seen.
1:45	See red deer through binoculars (VS) - finished salt-licking and was just going away. 'Why so early?' - asks VS - rain, got cooler early? From boat landing onwards, care taken when walking (more so than scan-and-search hunts) - not step on sticks, etc. Binocular-scan at every sight-line clearing.
1:58	Long binocular search of upriver - but wind direction bad. Go back to original sighting location and set up hide-tent (decide on location, cut trees that are in way, hide tarp with more branches, set up gun-propping stick).
	Set-up of hide complete.
	Head back to boat for bags.
	At boat. Have tea and break.
	Leave to hide - carry pot of tea, all bags, axe, tarp. Set up hide (for rain).

Hunt in morning (5/17):

Elapsed	Event Description
0:00	Leave to check up-stream salt lick area.
0:16	Serious binocular work.
0:24	Some tracks seen, but not new. Smoke. Give up and go back - no more stealth.
0:53	Back at hide. Shoot once at bird that "calls snow".

Figure 5.45: SpringR04 and R05 from Spring Camp.
No GPS record (map).

Date	Time (est.)	Event Description
5/16	14:50-15:10	SA VD get ready for 2 night trip.
5/16	-	Have tea.
5/16	15:15	Off. We sit to see them off. Everything they carry was smoked to purify. Sitting to see them off, smoking - all good-luck charms - desparate for meat? 5 empty saddles (incl. riding) - can carry 2 R, says VS. 2 day trip, probably close down bear trap afterwards. All male domR tied to prevent them from following.
5/16	19:00-20:00	They arrive at campsite (no tents). They aim to hunt more 'uphill/upstream' than where SA NI went on 5/11.
5/16	20:30	VD notices lone matka (R05) on opposite side of campfire. Lots of shots fired (maybe 25 bullets).
5/16		R05 runs about 200m and dies.
5/16		Carried R05 back to campsite.
		Have tea.
5/16		VD SA butchered R05 completely into parts that night. Only used knife, except for IN/SA separation.
5/16		Antler, fur, innards, foetus left on site. Foetus about 4 more days until birth, VD estimates.
5/16		Kidneys, some meat, some liver eaten.
5/16	[9PM or 10PM]	SA VD both go off on hunt, on foot [or SA on riding R?]
5/16	23:00	VD returns to camp.
5/16	24:00:00	SA returns to camp.
5/17	7:00	VD SA on hunt (VD on foot, SA on riding R)
5/17	[12:00]	VD see through binoculars a herd of 8 R w/ one big male and one small male, about 5km from campsite. Chased for one hour, came to a clear place, shot (20 shots or so). VD chased herd, shot again, male [biggest male?] ran again, chased again.
5/17	13:00	R04 dead [big male that was chased]. R04 FE broken at midshaft, antler tip also broken.
5/17		VD skins and butchers R04. Innards thrown away, fur, legs taken off. Everything else left as one part.
5/17		Then cut body up into parts, for pickup [only had knife]. Packed parts under fur and snow.
5/17		VD went back to camp. Packed up camp. [Unknown whether SA came back earlier or later]
5/17	14:00-15:00	SA VD get R04 meat on the way back. Load 6 domR with meat (4 other domR - 10 total).
5/17		Go further and camp. No more hunting.
5/18	8:00	SA VD left camp.
5/18		Closed bear trap.
5/18	9:45	Back at spring camp.

Figure 5.46: Reindeer kill locations and tracks from some unsuccessful hunts. All hunts shown were from Spring field season. Star is Main Camp.

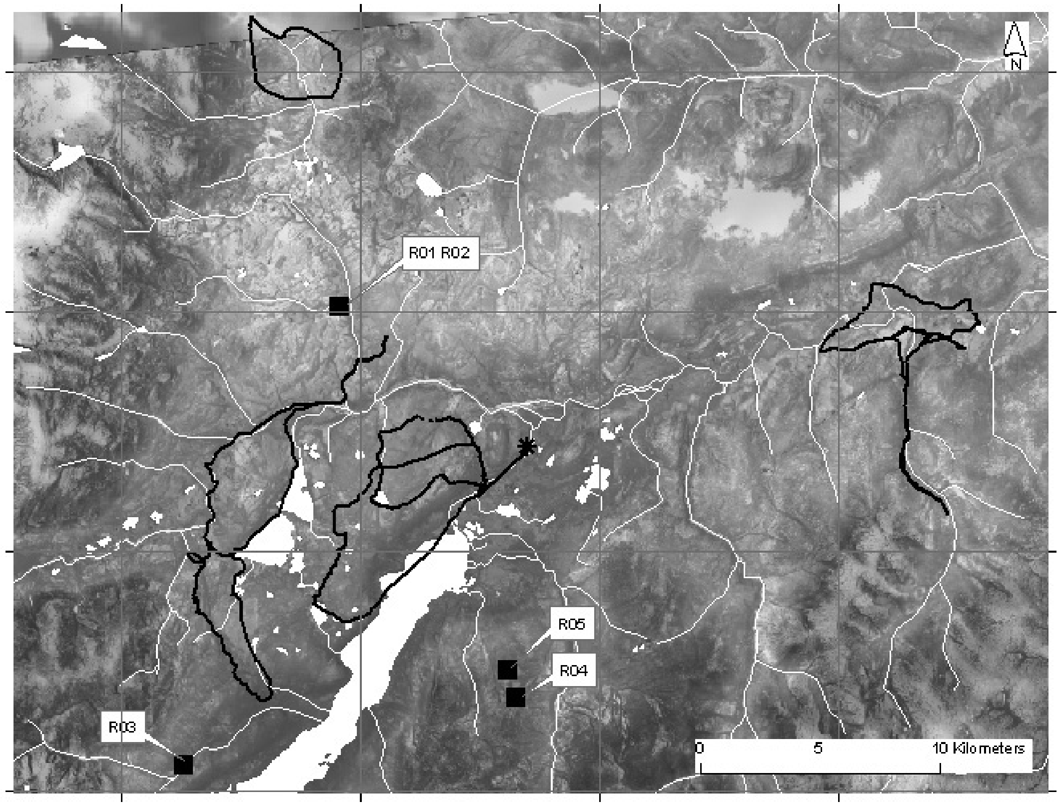


Table 5.47: Reindeer hunting patterns.

a) Hunt for meat animals.
None of these hunts were successful. Only hunts that was observed (Table 5.3: Record = 1) is shown here.

Date	Hunter	Transport	Total elapsed	Search for track	Tracking	Dogs?
11/10	VS	Foot	4:10	0:52	0:28	N
4/20	VS	Foot	8:50	4:40	1:45	N
4/22	VS	Foot	7:40	1:42	3:38	N
4/23	VS	Sled	5:42	0:52	3:38	N
4/27	VS	Foot	8:45	2:39	5:27	Y
5/14	VS	Foot	8:00	2:00	4:05	Y

b) Actual reindeer kills.

	Date	Hunter	Transport	Total elapsed	Search for track	Tracking	Dogs?	Anomaly
R01	11/2	SA	Verhavoi	11:00			N	Found R01 with domesticated herd
R01	3/24	VS	Sled	7:05	-	2:00	Y	Surprised herd when cresting hill
R02	3/24	VS	Sled	7:05	-	2:00	Y	Surprised herd when cresting hill
R03	4/27	SA	Verhavoi	10:21			N	R03 walked up to SA as he had tea
R04	5/17	VD	Verhavoi	-			N	R04 noticed across campfire
R05	5/16	VD	Verhavoi	4:00	3:00	1:00	N	-

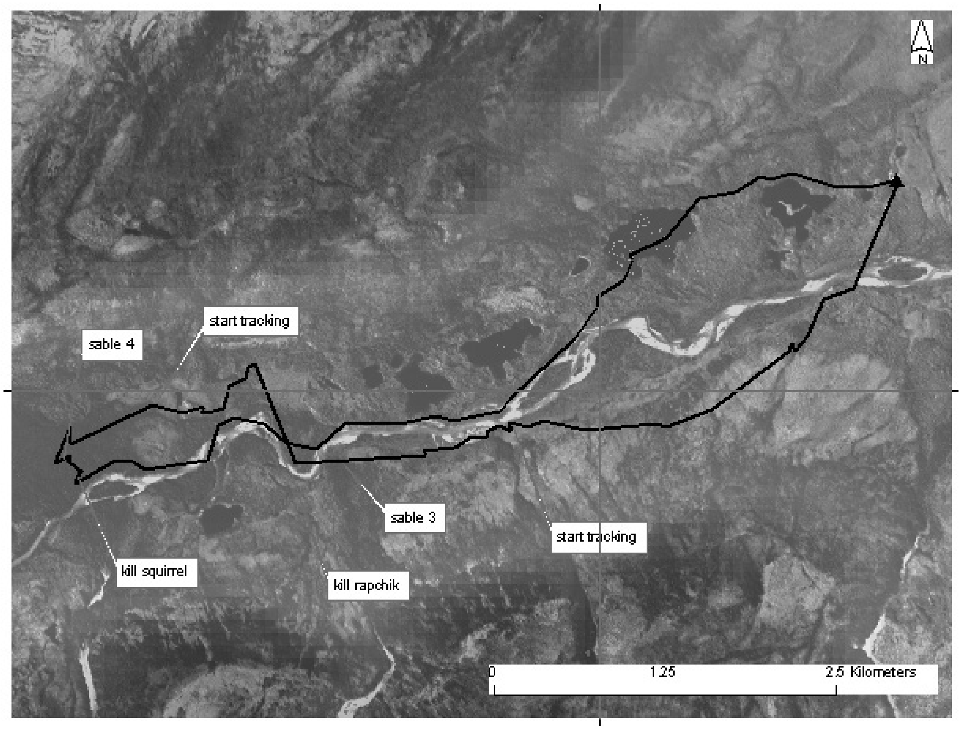
Table 5.48: Transportation type, distance, and speed.
From GPS distance/speed records.

		Distance (km)	Speed (km/h) Max.	Ave.
Foot trips	1	18.5		4.0
	2	18.8		3.8
	3	15.9		
	Average	**17.7**		**3.9**
Sled trips	1			8.7
	2		20.2	6.6
	3	28.3	18.3	8.7
	4	46.2	16.7	8.8
	5	32.7	18.8	7.5
	6	26.0		4.1
	7	20.0	16.8	8.2
	8	30.5	27.0	6.7
	9	16.4		8.7
	10	15.8	17.0	8.8
	11		20.3	10.7
	Average	**27.0**	**19.4**	**8.0**

Table 5.49: Sex and age distribution of reindeer.
Age: estimate given by hunter, or made from dental eruption and marrow color.
Est. age: Estimated age from weight (kg).
Age classes: 1 = juvenile, 2 = young adult, 3 = adult, 4 = old adult.

Animal		Sex	Age	Est. age	Weight
Fall	R01	M	2		
Spring	R01	F	4		116.38
	R02	F	4		114.95
	R03	M	2		105.05
	R04	M		2	102.15
	R05	F		1	48.05

Figure 5.50: Sable hunting on 11/18 from Emnyak camp.



Elapsed	Event Description
0:00	Start on hunt.
	Cross river, spot cliff on other shore, could be a good point to check on way back for kabarga.
0:30	After some old tracks, find good track. Track sable for about 20 minutes and find nest - sable found and shot (VS shustre). Shustre finds lair and sits to signal to VS. 1 shot. Young female - easy to kill - careless. Short tail.
-	Shoot grouse (just spotted one on tree).
-	Cross river at cliff.
-	Find sable track on foot of cliff - track it upstream.
2:37	Squirrel killed during tracking of sable. 1 shot.
-	Dog freed after sniffing at fresh sable track. First the dog helped but fell on squirrel scent, then it fell on a kabarga scent (when it crossed spot where kabarga was resting). Dog started barking 1.5H later when we were at the sable lair and wanting the dog (sable might run out and away - dog was needed, as VS didn't bring a kapkan/trap). Track for about 2H without dog.
-	VS finds sable-hole, a root-hole w/ tracks leading in but not out. First wait for dog, then flush out with smoke. Took long time (hole was big). YO hears scratches and VS decides to wait for sable, and not go for kabarga (Shustre barking at that point).
4:22	Call dog using gunshots. Sable killed - smoked out. 2-3 shots. Sable pokes head out, second time it pokes head out it was shot, then third time it was caught. Dog arrive about that time. Rest after shooting sable - fix shoe.
4:35	On way back, squirrel was found by dog. Shot 10 times, and killed. Tree was big and dense, wasted many shots.
-	Signs of other hunters (hung-up pechkas) in area, on way back.
6:50	Back. Maybe 3 rests on whole trip, mostly on way back.

Figure 5.51: Day trip range.
White = sable hunts, black = large game, white dotted = domesticated reindeer search, and black dotted = *kabarga*.

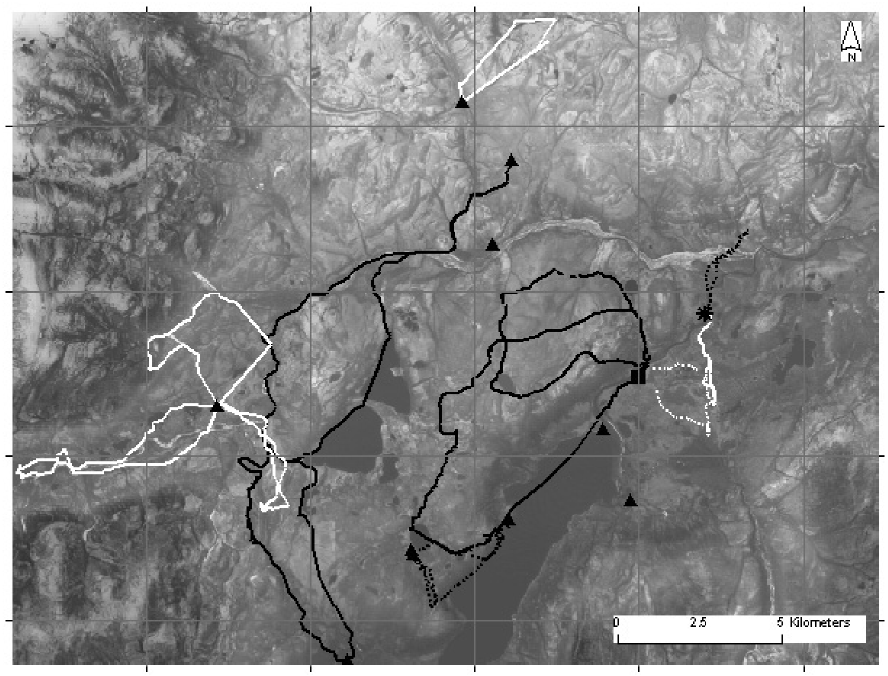


Figure 5.52: Study group territory.
Dark gray = 5km, light gray = 10km radius from camps.
White circle = heavily used area. Black circle = 5km from Main Camp
Star = Main Camp, square = Spring camp, triangles = logistical camps.

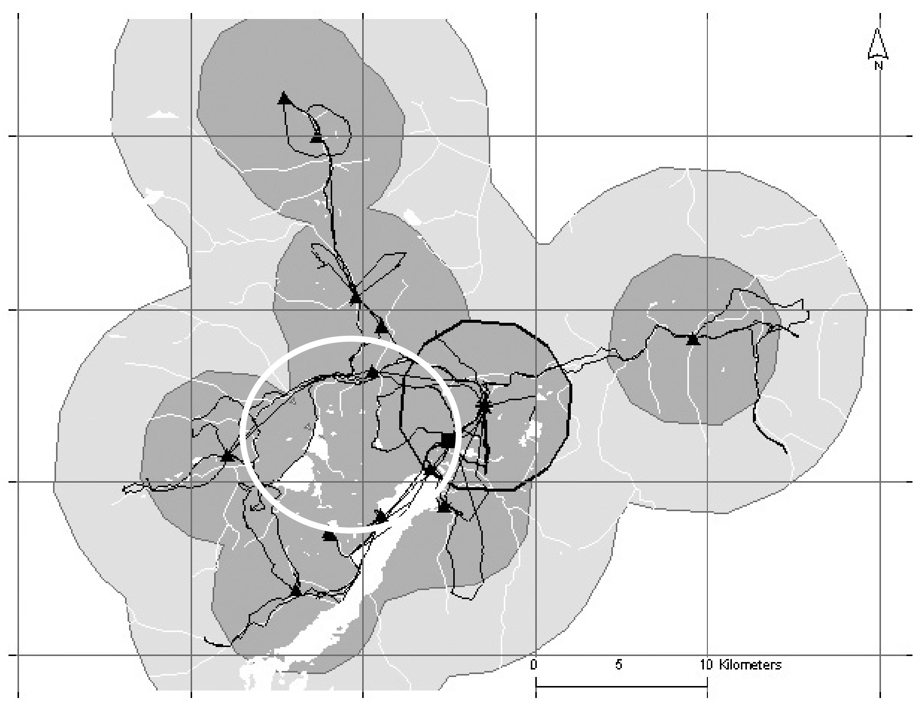


Figure 5.53: Elevation and territory use.
Dark gray = 500-1000m, light gray > 1000m above sea level.
Star = Main Camp, square = Spring camp, triangles = logistical camps.

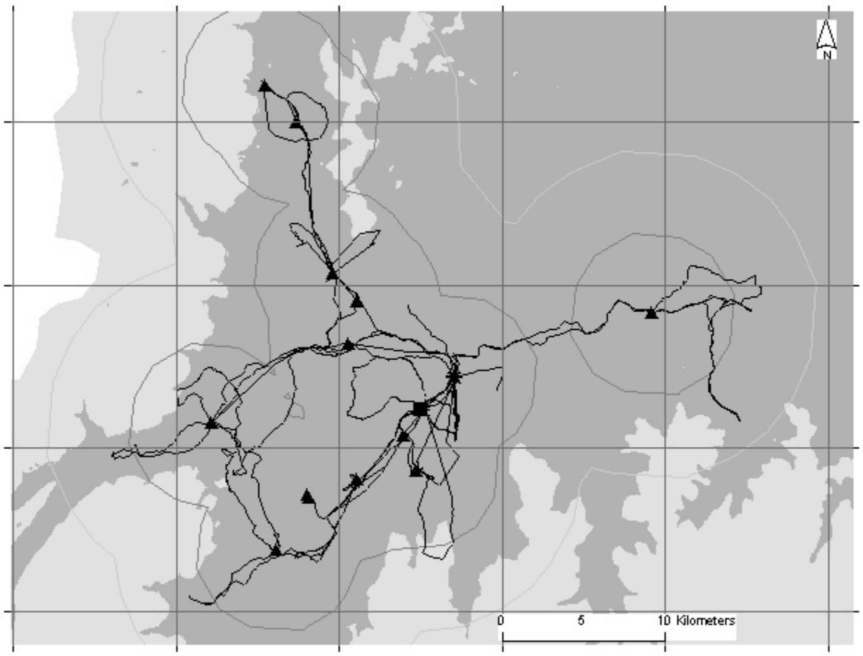


Figure 5.54: Inter-camp movement and travel environment model.
Darkest gray areas are most suitable for travel. Model weighted waterways (suitable) and slope (most favorable = 0-6 degrees incline, middle = 6-16 degrees, and unsuitable >16 degrees). Star = Main Camp.

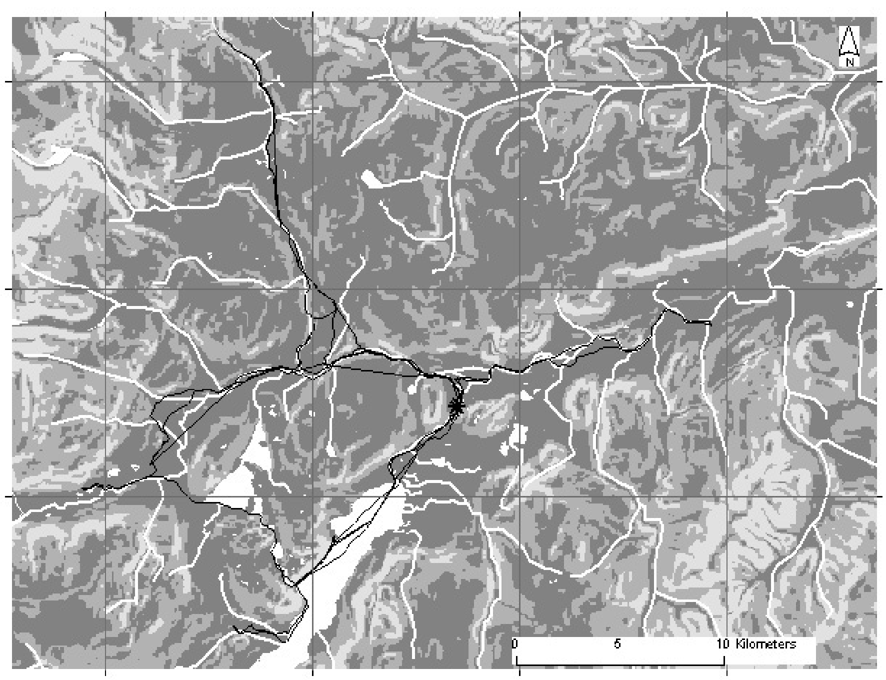


Figure 5.55: Camp placement and terrain model.
Lightest gray areas indicate favorable elevation and travel environment. Model weighed elevation (see Figure 5.53), slope and waterway (see Figure 5.54).
Star = Main Camp, square = Spring camp, triangles = logistical camps.

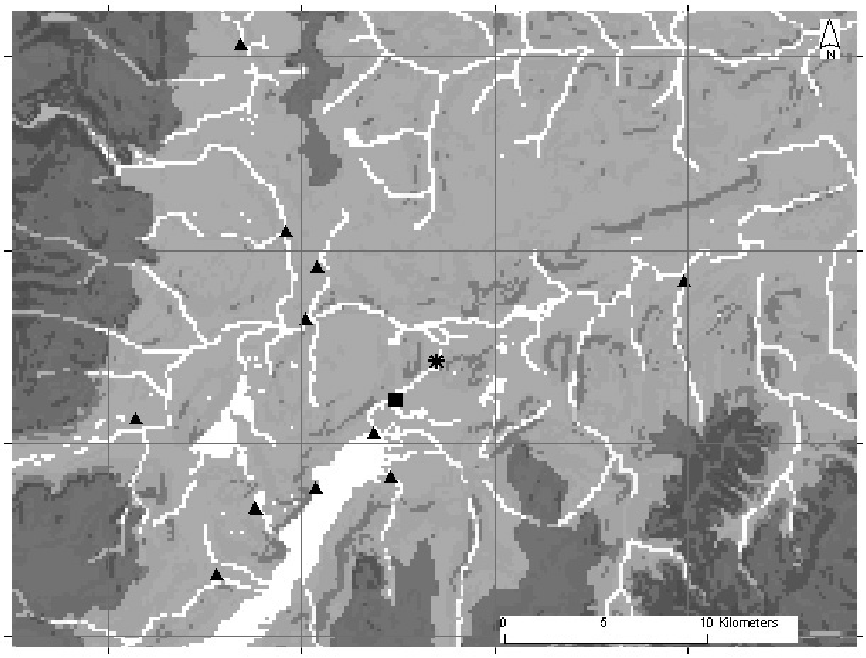


Figure 5.56: Cliffs in territory.
Cliffs (slope >16 degrees) are shown in dark gray. Small black crosses are *kabarga* kill sites, with A, B, and C marking the most common *kabarga* kill areas.
Star = Main Camp, square = Spring camp, triangles = logistical camps.

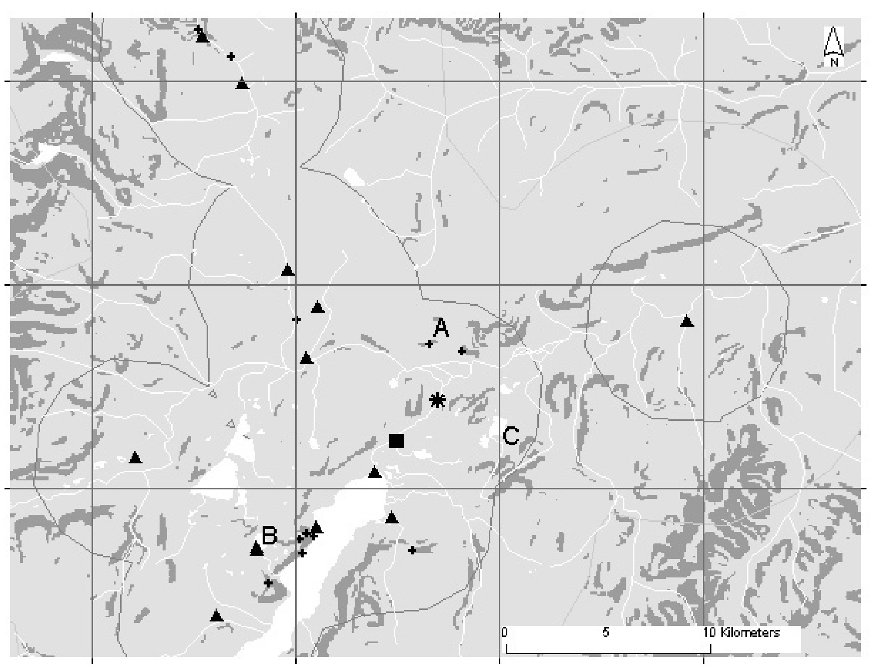


Figure 5.57: Prey types and environment.
Dark gray = denser forest, lighter gray = sparser forest and open areas, classified from combined LANDSAT and CORONA satellite imagery.
K = *kabarga*, R = reindeer, G = gluhar, and S = sable.
Star = Main Camp.

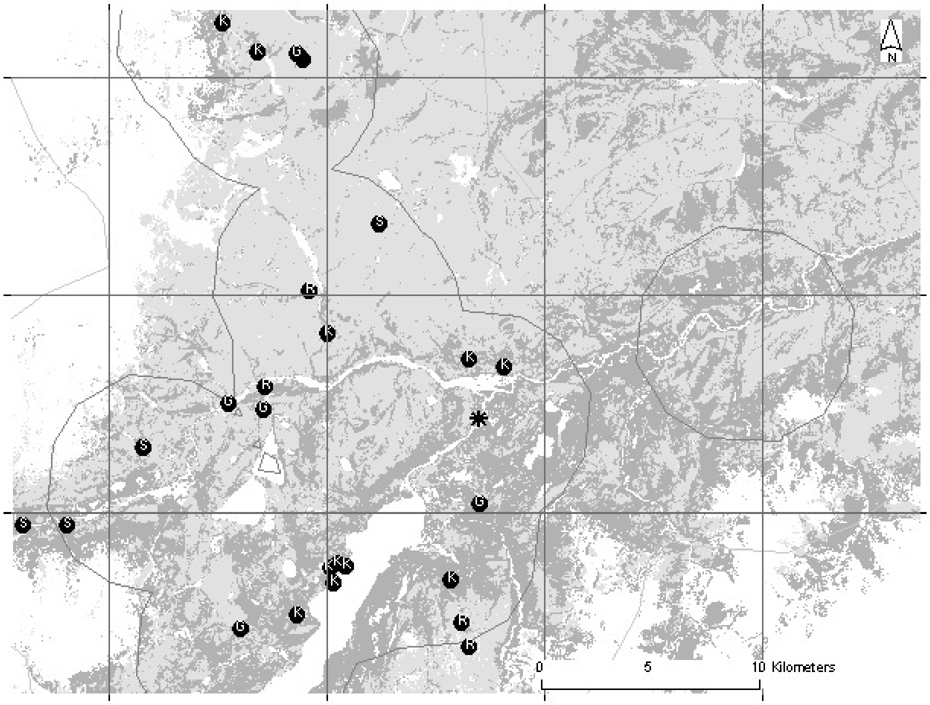


Table 5.58: *Kabarga* kills by hunt type.
Animals in all categories except 'Trapping' were hunted using dogs.
Hunts in the 'Unknown' category were most likely opportunistic hunting, but is separated here to indicate that the precise circumstances are unknown.

	Opportunistic	Planned	Trapping	Unknown
Fall	K01	K03		K04
	K02	K06		
	K05			
	K07			
	K08			
	K09			
	K10			
	K11			
Spring	K01	K11	K04	K09
	K02	K12	K06	K16
	K03	K18	K07	
	K05	K19		
	K08			
	K10			
	K13			
	K14			
	K15			
	K17			
Total	18	6	3	3
	60%	20%	10%	10%

Figure 6.1: *Kabarga* field butchery (evisceration).

SK09 eviscerated before skinning, with innards being given to dogs.

Table 6.2: *Kabarga* butchery sequence and time.

All observed *part butchery* (butchery preceding storage and use) sequences are listed in a)-c), focusing on disarticulation events and generalized into broad categories. The time for each action (given in right column) reflects the time taken for cutting and disarticulation activities; other manipulations of the part could have occurred outside the time indicated. Butchery sequences are arranged first by butchery type and then by individual (see also Table 6.3). A sample full (i.e. non-generalized) sequence is shown in d).

In left column: Total = total time for butchery sequence; Meat = total time *after* fur removal, starting at beginning of meat part removal; Processing = total time of separate but immediately subsequent butchery of some of the parts, as preparation for the first meal.

a) Normal butchery (hanging butchery to produce parts intended for human consumption), of carcasses both whole and without innards (disemboweled at kill site). Order of individuals: Yulia, Vadim, Vasili, then Yakov.

Date	3/16	1:48:33	2:04:18	0:15:45	Slit fur, expose hindlimbs, hang, peel fur.
Animal	K02	2:05:37	2:05:42	0:00:05	MC
Description	Normal, whole	2:05:45	2:05:56	0:00:11	MC
Time (total)	0:33:36	2:06:04	2:10:09	0:04:05	innards out
Time (meat)	0:16:32	2:08:10	2:11:10	0:03:00	ST
Time (processing)	0:10:48	2:11:20	2:12:05	0:00:45	head unit
Butcher	YU	2:12:16	2:12:37	0:00:21	kidneys
		2:13:35	2:13:53	0:00:18	R fore
		2:14:03	2:14:48	0:00:45	CE
		2:14:58	2:16:22	0:01:24	L RI
		2:16:27	2:17:07	0:00:40	R RI
		2:17:15	2:18:10	0:00:55	dramah
		2:18:19	2:19:02	0:00:43	TH
		2:19:13	2:20:38	0:01:25	L hind
		2:21:18	2:22:01	0:00:43	LU and hip
		2:22:01	2:22:09	0:00:08	(R hind)
					END PART BUTCHERY
		2:36:55	2:44:56	0:08:01	LU processed
		2:45:04	2:47:43	0:02:39	hip processed

Date	10/15	4:00:33	4:03:20	0:02:47	Slit fur.
Animal	K01	-	-	-	Expose hindlimb tendons, hang
Description	Normal, whole	4:04:22	4:07:13	0:02:51	Peel fur.
Time (total)	0:12:53	4:07:20	4:07:22	0:00:02	MCR
Time (meat)	0:06:06	4:07:22	4:07:25	0:00:03	MCL
Butcher	VD	4:07:29	4:07:32	0:00:03	L fore
		4:07:36	4:07:42	0:00:06	R fore
		4:07:54	7:08:33	3:00:39	Innards out
		4:08:46	4:09:34	0:00:48	ST
		4:09:43	4:10:04	0:00:21	Liver
		4:10:04	4:10:46	0:00:42	Head unit
		4:10:50	4:11:11	0:00:21	RRI
		4:11:15	4:11:38	0:00:23	LRI
		4:11:42	4:12:03	0:00:21	CE
		4:12:06	4:12:14	0:00:08	Dramah
		4:12:18	4:12:34	0:00:16	TH
		4:12:40	4:12:58	0:00:18	L hind
		4:13:03	4:13:21	0:00:18	LU and hip
		4:13:21	4:13:26	0:00:05	(R hind)

Date	11/21	1:32:59	-	-	Slit fur, expose hindlimb tendons.
Animal	K09	1:34:06	1:35:56	0:01:50	Peel fur.
Description	Normal, whole	1:36:16	1:36:19	0:00:03	L fore
Time (total)	0:09:59	1:36:27	1:36:29	0:00:02	R fore
Time (meat)*	0:06:42	-	-	-	draining
Time (processing)	0:02:58	1:37:15	1:37:45	0:00:30	innards out
* some processing		1:37:59	1:38:07	0:00:08	liver
Butcher	VS	1:38:20	1:38:49	0:00:29	St
		1:39:44	1:40:19	0:00:35	head unit
		1:40:22	1:40:30	0:00:08	L RI
		1:40:33	1:40:41	0:00:08	R RI
		1:40:47	1:40:49	0:00:02	CE
		1:40:52	1:40:54	0:00:02	TH
		1:40:56	1:42:12	0:01:16	LU processed
		1:42:23	1:42:38	0:00:15	L hind
		1:42:46	1:42:49	0:00:03	hip
		1:42:49	1:42:58	0:00:09	(R hind)
					END PART BUTCHERY
		1:43:42	1:43:58	0:00:16	MC (2)
		1:44:05	1:44:09	0:00:04	MT
		1:44:12	1:44:15	0:00:03	MT
		1:44:32	1:45:23	0:00:51	hip processed
		1:45:33	1:45:54	0:00:21	kidneys
		1:46:04	1:46:40	0:00:36	head processed
Date	3/22	5:43:48	5:46:27	0:02:39	Slit fur, expose hindlimb tendons.
Animal	K05	5:46:46	5:49:08	0:02:22	Peel fur.
Description	Normal, whole	5:49:28	5:49:33	0:00:05	R fore
Time (total)	0:21:19	5:49:46	5:49:52	0:00:06	L fore
Time (meat)*	0:15:39	5:50:04	5:51:22	0:01:18	Innards out
Time (processing)	0:00:54	5:52:11	5:52:36	0:00:25	R hind
* some processing		5:52:50	5:53:21	0:00:31	liver
Butcher	VS	5:53:35	5:54:12	0:00:37	ST
		5:54:22	5:55:03	0:00:41	head unit
		5:55:03	5:55:54	0:00:51	head unit processing
		5:55:57	5:56:18	0:00:21	LRI
		5:56:30	5:56:38	0:00:08	RRI
		5:56:43	5:56:51	0:00:08	CE
		5:56:47	5:57:02	0:00:15	dramah
		5:57:02	5:57:09	0:00:07	tail
		5:57:13	5:57:35	0:00:22	kidneys
		5:57:40	5:57:47	0:00:07	TH (1)
		5:57:54	5:58:23	0:00:29	TH (2)
		5:58:29	5:59:59	0:01:30	LU processing
		6:00:03	6:00:09	0:00:06	hip
		6:00:23	6:00:56	0:00:33	hip cleaning (colon)
		6:01:05	6:05:07	0:04:02	(L hind)
					END PART BUTCHERY
		6:14:52	6:14:58	0:00:06	MC
		6:15:04	6:15:09	0:00:05	MC
		6:15:14	6:15:30	0:00:16	TIMT
		6:15:37	6:15:46	0:00:09	TIMT
Date	3/27	11:23:51	11:26:25	0:02:34	Slit fur, expose hindlimb tendons.
Animal	K09	11:26:47	11:28:38	0:01:51	Peel fur.
Description	Normal, whole	11:28:47	11:28:49	0:00:02	L fore
Time (total)	0:09:23	11:29:09	11:29:13	0:00:04	R fore
Time (meat)	0:04:27	11:29:31	11:29:32	0:00:01	drain
Butcher	VS	11:29:49	11:30:23	0:00:34	ST
		11:30:31	11:30:36	0:00:05	liver
		11:30:55	11:31:17	0:00:22	head unit
		11:31:47	11:31:57	0:00:10	LRI
		11:32:02	11:32:09	0:00:07	RRI
		11:32:18	11:32:21	0:00:03	dramah and CE
		11:32:28	11:32:39	0:00:11	TH
		11:32:44	11:32:55	0:00:11	L hind
		11:32:02	11:32:10	0:00:08	LU and hip
		11:32:10	11:33:14	0:01:04	(R hind)
Normal, whole animal butchery by VS					
(n=3) (n=2 for processing)					
Time (total)	**0:13:34**				
Time (meat)	**0:08:56**				
Time (processing)	**0:00:54**				

Date	12/6	4:52:42	4:57:46	0:05:04	Expose hindlimb tendons, hang, peel fur.
Animal	K10	4:57:56	4:58:03	0:00:07	R fore
Description	Normal, innards	4:58:08	4:58:15	0:00:07	L fore
Time (total)	0:16:58	4:58:27	4:58:33	0:00:06	R hind (one-foot hang)
Time (meat)	0:05:55	-	-	-	draining
Time (processing)	0:09:54	5:00:04	5:00:57	0:00:53	ST (*cut earlier)
Butcher	VS	5:01:03	5:01:18	0:00:15	liver
		5:01:50	5:02:33	0:00:43	head unit
		5:02:42	5:02:49	0:00:07	RRI
		5:02:53	5:03:01	0:00:08	LRI
		5:03:07	5:03:09	0:00:02	CE and dramah
		5:03:11	5:03:27	0:00:16	CE
		5:03:38	5:03:44	0:00:06	TH LU and hip
		5:03:44	5:03:51	0:00:07	(L hind)
					END PART BUTCHERY
		5:06:20	5:07:14	0:00:54	TH processed
		5:07:25	5:10:04	0:02:39	LU processed
		5:10:22	5:12:58	0:02:36	hip processed
		5:13:22	5:14:11	0:00:49	dramah processed
		5:14:20	5:16:14	0:01:54	head unit processed
Date	5/8	6:35:38	6:39:11	0:03:33	Slit fur, expose hindlimb tendons.
Animal	K18	6:39:42	6:42:15	0:02:33	Peel fur
Description	Backpack, whole	6:43:56	6:44:54	0:00:58	Innards out.
Time (total)	0:16:23	6:46:33	6:46:37	0:00:04	L MC
Time (meat)	0:08:05	6:46:56	6:46:59	0:00:03	R MC
Butcher	VS	6:47:19	6:47:40	0:00:21	ST
		6:47:48	6:48:32	0:00:44	head unit
		6:49:04	6:49:18	0:00:14	liver
		6:49:46	6:50:10	0:00:24	draining
		6:51:22	6:52:01	0:00:39	front half from back half.
All butchery, VS					
(n=5) (n=3 for processing)					
Time (total)	**0:14:49**				
Time (meat)	**0:08:10**				

Date	10/19	-	-	-	Slit fur
Animal	K02	3:37:45	3:40:25	0:02:40	Expose hindlimb tendons, hang
Description	Normal, innards out	3:40:50	3:44:57	0:04:07	Peel fur.
Time (total)	0:21:49	3:45:03	3:45:22	0:00:19	cleaning (fur)
Time (meat)	0:13:37	3:45:57	3:46:01	0:00:04	L MC
Butcher	YA	3:46:06	3:46:10	0:00:04	R MC
		3:46:50	3:47:05	0:00:15	lateral neck meat
		3:47:08	3:47:17	0:00:09	R fore
		3:47:33	3:47:48	0:00:15	lateral neck meat
		3:47:57	3:48:53	0:00:56	draining
		3:49:05	3:50:17	0:01:12	ST
		3:50:17	3:50:46	0:00:29	L fore, R fore
		3:51:22	3:52:05	0:00:43	liver, head unit
		3:52:15	3:52:37	0:00:22	RRI
		3:52:45	3:53:09	0:00:24	CE
		3:53:16	3:53:33	0:00:17	Dramah
		3:53:40	3:53:54	0:00:14	LRI w/ TH
		3:54:03	3:54:06	0:00:03	kidney
		3:54:08	3:54:16	0:00:08	kidney
		3:54:24	3:56:10	0:01:46	LU
		3:56:22	3:57:31	0:01:09	L hind
		3:57:31	3:58:04	0:00:33	Colon
		3:58:19	3:58:28	0:00:09	Hip
		3:58:10	3:59:34	0:01:24	(R hind)

Date	11/1	1:06:23	1:10:52	0:04:29	Slit fur
Animal	K05	1:11:00	1:13:19	0:02:19	Expose hindlimb tendons, hang.
Description	Normal, innards out	1:15:00	1:20:30	0:05:30	Peel fur.
Time (total)	0:25:15	1:21:17	1:21:23	0:00:06	R MC
Time (meat)	0:10:21	1:21:33	1:21:38	0:00:05	L MC
Time (processing)	0:10:39	1:21:40	1:22:23	0:00:43	cleaning
Butcher	YA	1:22:40	1:22:53	0:00:13	lateral neck meat
		1:23:00	1:23:08	0:00:08	lateral neck meat
		1:23:18	1:23:22	0:00:04	L fore
		1:23:47	1:23:53	0:00:06	R fore
		1:24:04	1:24:27	0:00:23	draining
		1:24:55	1:26:49	0:01:54	ST
		1:26:02	1:26:15	0:00:13	liver
		1:27:22	1:27:37	0:00:15	head unit
		1:27:59	1:28:12	0:00:13	CE
		1:28:25	1:28:41	0:00:16	RRI
		1:28:59	1:29:15	0:00:16	LRI
		1:29:24	1:29:32	0:00:08	Dramah
		1:29:36	1:29:43	0:00:07	TH
		1:30:08	1:30:58	0:00:50	R hind
		1:31:18	1:31:29	0:00:11	LU and hip
		1:31:29	1:31:38	0:00:09	(L hind)
					EMD PART BUTCHERY
		1:37:25	1:38:01	0:00:36	head processed
		1:38:11	1:39:14	0:01:03	R fore processed
		1:39:16	1:40:06	0:00:50	L fore processed
		1:40:15	1:40:52	0:00:37	hind processed
		1:41:00	1:41:17	0:00:17	hind processed
		1:41:30	1:42:33	0:01:03	LU from hip
		1:42:37	1:44:10	0:01:33	hip processed
		1:44:25	1:48:04	0:03:39	LU processed
Normal innards out butchery by YA (n=2) (n=1 for processing)					
Time (total)	**0:23:32**				
Time (meat)	**0:11:59**				
Time (processing)	**0:10:39**				
Date	11/13	5:01:12	5:14:36	0:13:24	Slit fur, expose hindlimb tendons.
Animal	K06	5:07:00	5:07:50	0:00:50	Hang.
Description	Normal, whole	5:08:23	5:15:18	0:06:55	Peel fur.
Time (total)	0:30:28	5:15:40	5:15:52	0:00:12	L MC
Time (meat)	0:16:00	5:15:55	5:16:00	0:00:05	R MC
Time (processing)	0:20:25	5:16:10	5:16:30	0:00:20	lateral neck meat
Butcher	YA	5:16:32	5:16:44	0:00:12	L fore
		5:17:05	5:17:19	0:00:14	lateral neck meat
		5:17:33	5:17:45	0:00:12	R fore
		5:17:59	5:22:02	0:04:03	Innards out
		5:22:14	5:27:24	0:05:10	ST
		5:24:30	5:25:01	0:00:31	liver
		5:25:07	5:25:55	0:00:48	head unit
		5:25:55	5:26:29	0:00:34	cleaning
		5:26:40	5:27:10	0:00:30	kidneys
		5:27:15	5:29:11	0:01:56	CE RRI LRI and TH
		5:29:25	5:30:05	0:00:40	R lower (R leg broken at TI)
		5:30:13	5:30:34	0:00:21	R FE
		5:30:49	5:31:28	0:00:39	LU and hip
		5:31:28	5:31:40	0:00:12	(L hind)
					END PART BUTCHERY
		6:29:17	6:30:21	0:01:04	head processed
		6:31:06	6:31:34	0:00:28	CE
		6:31:41	6:32:36	0:00:55	RRI
		6:32:46	6:34:49	0:02:03	lower TH w/ some RI
		6:34:52	6:35:03	0:00:11	LRI
		-	-	-	(dramah left)
		6:36:23	6:38:18	0:01:55	LU
		6:38:25	6:41:24	0:02:59	hip processed
		6:42:17	6:49:42	0:07:25	LU processed

Date	12/10	4:08:30	4:15:05	0:06:35	Slit fur, expose hindlimbs.
Animal	K11	-	-	-	Hang.
Description	Truncated norm	4:17:49	4:24:04	0:06:15	Peel fur.
Time (total)	0:28:08	-	-	-	cleaning.
Time (meat)	0:11:49	4:24:49	4:25:29	0:00:40	lateral neck meat
Time (processing)	0:29:14	4:25:43	4:25:48	0:00:05	L fore
Butcher	YA	4:25:56	4:26:03	0:00:07	R fore
		-	-	-	draining
		4:27:12	4:28:50	0:01:38	Innards out
		4:29:04	4:31:02	0:01:58	ST
		4:31:24	4:31:39	0:00:15	liver
		4:31:52	4:33:24	0:01:32	head unit
		4:33:35	4:34:02	0:00:27	RRI
		4:34:07	4:34:25	0:00:18	LRI
		4:34:28	4:34:37	0:00:09	CE
		4:34:46	4:35:10	0:00:24	dramah and TH
		4:35:31	4:36:38	0:01:07	LU, hip, and both hindlimb (STOPPED SHORT)
		4:39:02	4:39:15	0:00:13	MC
		4:39:28	4:39:37	0:00:09	MC
		4:39:48	4:40:09	0:00:21	R MT
		4:40:15	4:40:54	0:00:39	R FE meat removal
		4:41:02	4:41:15	0:00:13	L MT
		4:41:20	4:41:57	0:00:37	R hind
		4:42:04	4:42:36	0:00:32	kidneys
		4:42:47	4:43:52	0:01:05	LU and hip (from L hind)
		4:44:58	4:45:42	0:00:44	hip processing (1)
		4:52:03	4:52:18	0:00:15	hip processing (2)
		4:52:49	4:54:25	0:01:36	cleaning
		4:54:31	4:55:23	0:00:52	TH from dramah
		4:55:30	4:55:54	0:00:24	CE processing
		4:56:32	5:03:56	0:07:24	LU processing
		5:04:04	5:05:08	0:01:04	forelimb processing
		5:05:13	5:07:11	0:01:58	2nd SC from HURA
		5:07:18	5:08:16	0:00:58	L hind processing
All normal butchery by YA (n=4) (n=3 for processing)					
Time (total)	**0:25:50**				
Time (meat)	**0:11:54**				
Time (processing)	**0:23:02**				

b) Normal butchery (for human consumption), with carcass lying down on floor, and butchered by two individuals (Vasili and Vadim).

Date	11/15	7:16:30	7:24:07	0:07:37	Peeling (on floor)
Animal	K07	7:24:40	7:24:45	0:00:05	R fore
Description	Floor butchery, innards out	7:24:57	7:26:12	0:01:15	R hind
Time (total)	0:23:40	7:26:30	7:29:03	0:02:33	ST cut open on R
Time (meat)	0:15:30	7:27:25	7:27:36	0:00:11	liver
Butcher	VS VD	7:29:03	7:29:39	0:00:36	RRI
		7:30:00	7:30:50	0:00:50	head unit
		7:31:22	7:31:33	0:00:11	ST
		7:31:39	7:31:47	0:00:08	L fore
		7:32:01	7:33:10	0:01:09	LRI
		7:32:12	7:32:39	0:00:27	L hind
		7:32:56	7:33:23	0:00:27	kidneys
		7:33:23	7:33:50	0:00:27	CE
		7:33:52	7:34:21	0:00:29	dramah and TH
		7:33:45	7:34:23	0:00:38	LU
		7:34:46	7:37:31	0:02:45	hip processing into parts
		7:34:57	7:40:02	0:05:05	LU processing into parts
		7:40:10			done

c) Dog butchery (hanging butchery with parts intended for dog food). Order of individuals: Sasha then Yakov.

Date	3/17	10:15:58	10:18:49	0:02:51	Slit fur, expose hindlimb tendons.
Animal	K03	-	-	-	Hang.
Description	Dog butchery, innards out.	10:20:14	10:27:30	0:07:16	Peel fur.
Time (total)	0:16:06	10:27:59	10:28:40	0:00:41	draining
Time (meat)	0:04:05	10:29:08	10:30:56	0:01:48	head unit
Butcher	SA	10:30:58	10:31:10	0:00:12	liver
		10:31:18	10:32:04	0:00:46	tail and colon
Date	4/13	-	4:33:36	-	Slit fur, expose all limbs, hang.
Animal	K14	4:38:18	4:43:19	0:05:01	Peel fur.
Description	Dog butchery, innards out.	4:43:20	4:45:50	0:02:30	cleaning
Time (total)	?				
Time (meat)	0:02:30				(processing)
Butcher	SA	4:46:13	4:46:44	0:00:31	L hind
		4:46:53	4:47:11	0:00:18	L hind processing
Date	5/2	3:02:10	3:07:13	0:05:03	Slit fur, expose all limbs.
Animal	K17				Hang.
Description	Dog butchery, innards out.	3:07:39	3:11:20	0:03:41	Peel fur.
Time (total)	0:09:10				
Butcher	SA				
Dog butchery by SA (n=2)					
Time (total)	**0:12:38**				
Time (meat)	**0:03:18**				

Date	4/6	1:19:26	1:25:50	0:06:24	Slit fur, expose hindlimbs.
Animal	K10	-	-	-	Hang.
Description	Dog butchery, innards out.	1:26:56	1:34:22	0:07:26	Peel fur.
Time (total)	0:14:56				
Butcher	YA				
Date	4/7	4:46:15	4:51:41	0:05:26	Slit fur, expose hindlimb tendons.
Animal	K11	-	-	-	Hang.
Description	Dog butchery, innards out, ti	4:52:47	5:00:37	0:07:50	Peel fur.
Time (total)	0:19:57	-	-	-	draining (*some cutting of LR forelimb)
Time (meat)	0:04:19	5:04:20	5:04:38	0:00:18	kidneys
Butcher	YA	5:04:54	5:06:12	0:01:18	head unit
Date	4/8	2:50:47	2:57:30	0:06:43	Slit fur, expose hindlimb tendons, struyu out.
Animal	K12	-	-	-	Hang.
Description	Dog butchery, whole.	2:59:13	3:04:15	0:05:02	Peel fur.
Time (total)	0:21:54	3:04:17	3:04:53	0:00:36	cleaning.
Time (meat)	0:06:54	3:05:47	3:07:25	0:01:38	innards out.
Butcher	YA	3:08:34	3:10:15	0:01:41	draining.
		3:10:21	3:11:46	0:01:25	head unit.
		3:12:07	3:12:41	0:00:34	colon
					*kidneys, MCs off after butchery
Dog butchery by YA (n=3) (n=2 for meat)					
Time (total)	**0:18:56**				
Time (meat)	**0:05:37**				

d) Sample detailed butchery procedure. Same as second sequence shown for Yakov in a).

Date		11/1	
Animal		K05	
Butcher		YA	
1:06:23	1:10:52	0:04:29	Slit fur - chin to breast, breast to hole (innards removed), hole to anus. Slit all limbs on posterior side.
1:11:00	1:13:19	0:02:19	Peel fur. Start at L inner thigh, some knife used to start. Peel up to L hoof, cut off with knife. Slice hole in membrane between posterior tendons and MT. Repeat for R hindlimb. Put rope through tendon-holes and hang animal head-down. Fetch dog-bucket for spillage.
1:15:00	1:20:20	0:05:20	Peel fur. Use knife around innards hole, otherwise pull with hands. Pull from caudal to cranial, using weight to pull downwards. Pull fur off neck and to head, pull until ears pop out (still attached to CR) while fur pulls off further. Knife used to cut fur around eyes, then in area front of the eyes (snout). Fur cut off, all in one piece, at the upper lip.
1:20:20	1:20:30	0:00:10	Knife stuck into eyes (ceremonial). Ears cut off at base cartilage and given to dogs.
1:21:17	1:21:23	0:00:06	R MC off. Given to dogs.
1:21:33	1:21:38	0:00:05	L MC off. Saw periosteum from posterior, and also all around. Snap off. Given to dogs.
1:21:40	1:22:23	0:00:43	Lips and fur bits cleaned off snout. Fur bits to dogs.
1:22:40	1:22:53	0:00:13	Stringy meat on R side of neck cut thinly from caudal, to hang at base of head.
1:23:00	1:23:08	0:00:08	Stringy meat on L side of neck cut thinly from caudal, to hang at base of head.
1:23:18	1:23:22	0:00:04	L forelimb off.
1:23:47	1:23:53	0:00:06	R forelimb off.
1:24:04	1:24:27	0:00:23	Abdominal meat cut to hang off ST. Knife point inserted at base of throat to drain breast cavity of fluids. (Fluids caught in bucket for dogs).
1:24:55	1:25:02	0:00:07	R ST-RI joint cut from cranial-caudal, inserting knife in drain-hole and pulling knife upwards.
1:25:28	1:26:49	0:01:21	L ST-RI joint cut caudal-cranial, pulling ST away as knife is forced downwards. ST off.
1:26:02	1:26:15	0:00:13	Liver out, lung and heart hangs out (knife to lightly cut off membrane in cavity).
1:27:22	1:27:37	0:00:15	Cut meat all around AT and snap head off. Esophagus cleaned from windpipe, given to dogs.
1:27:59	1:28:12	0:00:13	CE-TH joint cut, CE off.
1:28:25	1:28:41	0:00:16	R RI off. 1-2 proximal and 1 distal rib left. Cut between ribs, then cut down TH-RI joint from cranial-caudal, forcing knife downwards.
1:28:59	1:29:15	0:00:16	L RI off. Same procedure as R RI.
1:29:24	1:29:32	0:00:08	TH-TH joint cut, dramah (TH-RI) off.
1:29:36	1:29:43	0:00:07	TH-TH/LU joint cut, TH unit off.
1:30:08	1:30:58	0:00:50	R hindlimb off. Tendon cut to remove limb from rope. Leg held ourwards and meat cut from inner thigh to expose FE-IN head. Joint forced open by leverage, and meat cut through.
1:31:18	1:31:29	0:00:11	Hip unit off. Hip unit forced away from L hindlimb, meat cut open, joint pops out, cut meat through.
1:31:29	1:31:38	0:00:09	Cut tendons and take L hindlimb off rope.
1:37:25	1:38:01	0:00:36	CR-MD separation. Meat slit on both sides of head along teeth, towards back of head. Jaw forced open with hands until MD hangs free.
1:38:11	1:38:30	0:00:19	R HU off SC. Cut from anterior, force bone back and open joint. Disarticulated with minimum to no contact with bone.
1:38:34	1:39:14	0:00:40	R RAUL off HU. Cut from anterior, moving joint to find correct position. Snap backwards.
1:39:16	1:39:28	0:00:12	L HU off SC.
1:39:34	1:40:06	0:00:32	L RAUl off HU.
1:40:15	1:40:32	0:00:17	MT off TI, with tarsals attached to TI. Cut membrane all around and snap, then insert knife point from posterior into joint.
1:40:33	1:40:52	0:00:19	TI off FE. Posterior TI meat left with FE meat, joint cut all around.
1:41:00	1:41:17	0:00:17	TI off FE (other MT removed from FETI earlier by VS)
1:41:30	1:42:33	0:01:03	LU-LU joint disarticulation, LU unit off hip unit. Meat cut all around, probe with fingers for joint, insert knife point in joint.
1:42:37	1:43:32	0:00:55	LU-SA disarticulation, LU left on hip unit taken off.
1:43:38	1:44:10	0:00:32	IN-SA and IN-IN disarticulation using axe.
1:44:25	1:45:30	0:01:05	LU-LU joint disarticulation to separate each LU in LU unit.
1:45:35	1:46:33	0:00:58	LU-LU joint disarticulation to separate each LU in LU unit.
1:46:45	1:48:04	0:01:19	LU-LU joint disarticulation to separate each LU in LU unit.

Table 6.3: Summary of total *kabarga* part butchery time.

Elapsed time from Table 6.2 is summarized type of butchery. Times are indicated in both hexadecimal and decimal (seconds).

The average times are shown for major grouping of butchery types. Two anomalous butchery events (SK18 – animal essentially cut in two parts for transportation, and FK07 – processed by two butchers instead of one) are tallied separately.

				Part butchery				**Subsequent cooking butchery**		**Part+cooking butchery**	
				Total time	**seconds**	**w/o fur removal**	**seconds**		**seconds**		**seconds**
1. Normal butchery											
1.a Whole carcass											
1.a-1 hanging-style	VD	F	K01	0:12:53	773	0:06:06	366			0:12:53	773
	VS	F	K09	0:09:59	599	0:06:42	402	0:02:58	178	0:12:57	777
	VS	S	K05	0:21:19	1279	0:15:39	939	0:00:54	54	0:22:13	1333
	VS	S	K09	0:09:23	563	0:04:27	267			0:09:23	563
	YA	F	K06	0:30:28	1828	0:16:00	960	0:20:25	1225	0:50:53	3053
	YA	F	K11	0:28:08	1688	0:11:49	709	0:29:14	1754	0:57:22	3442
	YU	S	K02	0:33:36	2016	0:16:32	992	0:10:48	648	0:44:24	2664
average (1.a-1)				***0:20:49***	***1249***	***0:11:02***	***662***	***0:12:51***	***772***	***0:30:00***	***1801***
1.a-2 backpack	VS	S	K18	0:16:23	983	0:08:05	485			0:16:23	983
Whole average (1.a)				***0:20:16***	***1216***	***0:10:40***	***640***	***0:12:51***	***772***	***0:28:18***	***1699***
1.b Innards out											
1.b-1 hanging-style	VS	F	K10	0:16:58	1018	0:05:55	355	0:09:54	594	0:26:52	1612
	YA	F	K02	0:21:49	1309	0:13:37	817			0:21:49	1309
	YA	F	K05	0:25:15	1515	0:10:21	621	0:10:39	639	0:35:54	2154
average (1.b-1)				***0:21:20***	***1281***	***0:09:57***	***598***	***0:10:16***	***617***	***0:28:11***	***1692***
1.b-2 on-floor butchery	VS VD	F	K07	0:23:40	1420	0:15:30	930			0:23:40	1420
Innards out average (1.b)				***0:21:55***	***1316***	***0:11:20***	***681***	***0:10:16***	***617***	***0:27:03***	***1624***
Normal butchery average (1)				***0:20:49***	***1249***	***0:10:53***	***654***	***0:12:07***	***727***	***0:27:53***	***1674***
2. Dog butchery											
	SA	S	K03	0:16:06	966	0:04:05	245				
	SA	S	K14	?		0:02:30	150				
	SA	S	K17	0:09:10	550						
	YA	S	K10	0:14:56	896						
	YA	S	K11	0:19:57	1197	0:04:19	259				
	YA	S	K12	0:21:54	1314	0:06:54	414				
Dog butchery average (2)				***0:16:24***	***985***	***0:04:27***	***267***				

Figure 6.4: *Kabarga* skinning pattern.

Ventral view.

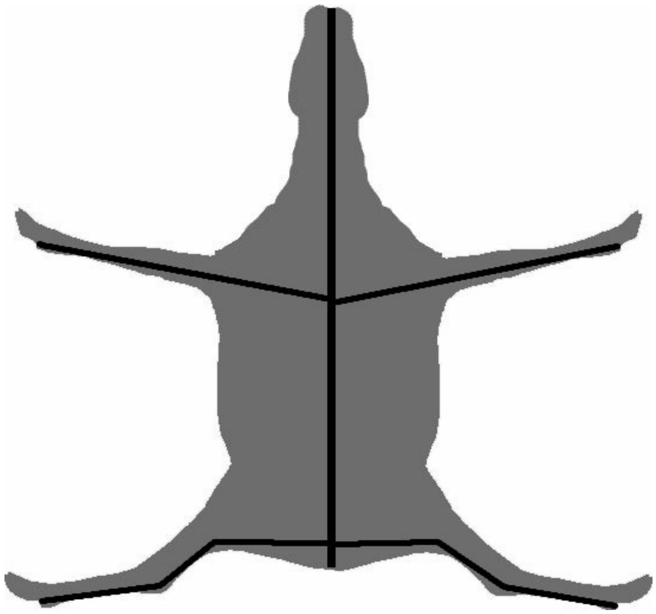


Figure 6.5: *Kabarga* parts butchery position.

Left: hindlimb fur peeled and rope put through tendons prior to hanging (FK05).
Right: hanging carcass upside-down (FK02).

Figure 6.6: *Kabarga* parts butchery: skinning.

Peeling off body fur by force; using a knife to cut off fur at the nose (FK05).

Figure 6.7: *Kabarga* parts butchery: eye-stabbing.

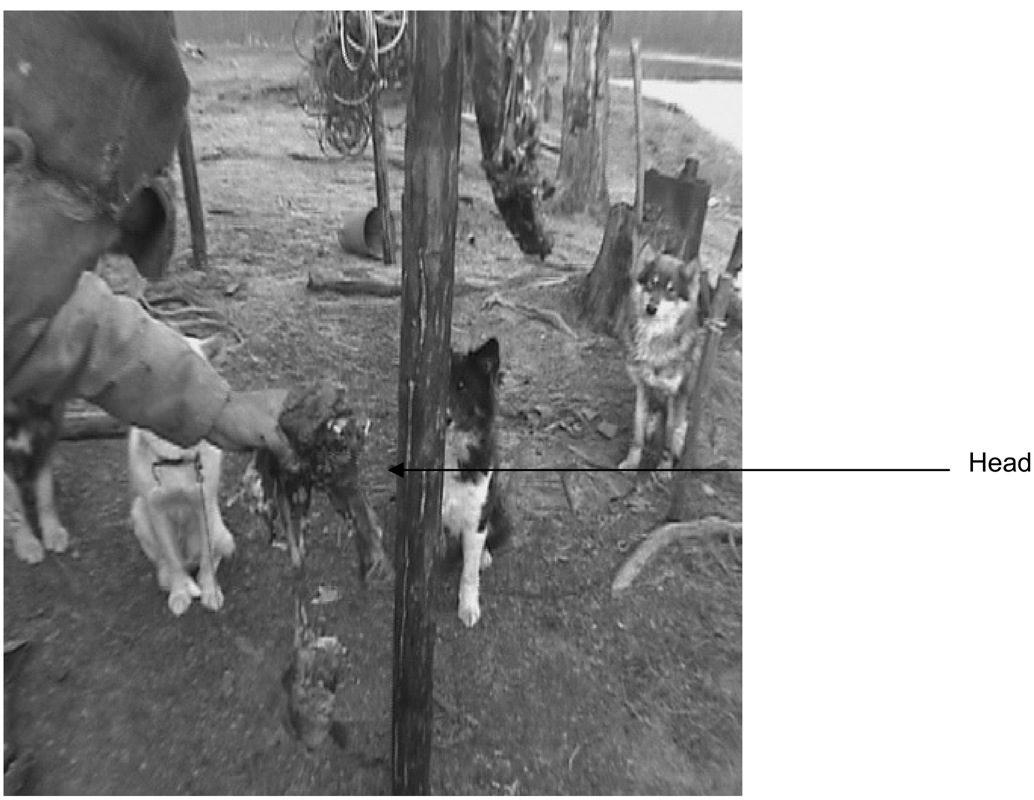
Figure 6.8: *Kabarga* parts butchery details.

a) ST disarticulation (FK05)

b) MC disarticulation (FK02)

c) RI disarticulation (FK05)

d) Head unit (with organs attached via windpipe) (FK 05)



e) Axial part disarticulation (FK05, TH unit from lower body; FK02, LU from lower body)

f) Hindlimb/hip unit disarticulation (FK02, hip unit from hanging R hindlimb).

Table 6.9: Summary of *kabarga* butchery sequences.

a) Rank order of parts, with sided elements represented separately.
Part units that were not separated out for all butcheries (neck meat, MC) and fleshy units (liver, kidneys) are omitted.

	FK01	FK02	FK05	SK05	FK06	FK07	FK09	FK10	FK11	SK02	SK09
forelimb	1	2.5	1	1	1	1	1	1	1	3.5	1
forelimb	2	2.5	2	2	2	6	2	2	2	3.5	2
ST	3	1	3	4	3	3	3	4	3	1	3
head unit	4	4	4	5	4	5	4	5	4	2	4
RI	5	5	6	6	7	4	5	6	5	6	5
RI	6	8	7	7	7	7.5	6	7	6	7	6
CE	7	6	5	8	7	9	7	8.5	7	5	7.5
dramah	8	7	8	9	7	10.5	8.5	8.5	8.5	8	7.5
TH	9	8	9	10	7	10.5	8.5	10.5	8.5	9	9
hindlimb	10	10	10	3	10	2	10	3	11	10	10
LU and hip	11	11	11	11	11	12	11	10.5	11	11	11
hindlimb	12	12	12	12	12	7.5	12	12	11	12	12

b) Spearman’s Rank Order correlation coefficients for a).
N=12, critical values are 0.576 (p< .05) and 0.708 (p< .01)

	FK01	*FK02*	*FK05*	*SK05*	*FK06*	*FK07*	*FK09*	*FK10*	*FK11*	*SK02*	*SK09*
FK01	1.000	--	--	--	--	--	--	--	--	--	--
FK02	0.953	1.000	--	--	--	--	--	--	--	--	--
FK05	0.979	0.960	1.000	--	--	--	--	--	--	--	--
SK05	0.804	0.736	0.783	1.000	--	--	--	--	--	--	--
FK06	0.965	0.953	0.965	0.769	1.000	--	--	--	--	--	--
FK07	0.587	0.533	0.542	0.836	0.510	1.000	--	--	--	--	--
FK09	0.998	0.951	0.977	0.802	0.967	0.589	1.000	--	--	--	--
FK10	0.797	0.726	0.769	0.997	0.759	0.829	0.792	1.000	--	--	--
FK11	0.991	0.944	0.970	0.747	0.960	0.558	0.993	0.736	1.000	--	--
SK02	0.921	0.962	0.942	0.698	0.907	0.512	0.920	0.684	0.913	1.000	--
SK09	0.998	0.951	0.970	0.802	0.967	0.584	0.995	0.799	0.988	0.913	1.000

c) Butchery sequences re-ordered by degree of similarity.

Pairs *without* significant correlation are indicated in bold.
Within significant pairs, shades indicate different degrees of similarity (dark > 0.9, light > 0.8, no shade but numbers not in bold means still over p<.05 threshold).
N=12, critical values are 0.576 (p<.05) and 0.708 (p<.01)

	YA whole *FK06*	YA whole truncated *FK11*	YA innards *FK05*	YA innards *FK02*	VD whole *FK01*	VS whole *SK09*	VS whole *FK09*	VSVD floor *FK07*	VS whole 1 foot *SK05*	VS innards 1 foot *FK10*	YU whole *SK02*
FK06	1.000	--	--	--	--	--	--	--	--	--	--
FK11	0.960	1.000	--	--	--	--	--	--	--	--	--
FK05	0.965	0.970	1.000	--	--	--	--	--	--	--	--
FK02	0.953	0.944	0.960	1.000	--	--	--	--	--	--	--
FK01	0.965	0.991	0.979	0.953	1.000	--	--	--	--	--	--
SK09	0.967	0.988	0.970	0.951	0.998	1.000	--	--	--	--	--
FK09	0.967	0.993	0.977	0.951	0.998	0.995	1.000	--	--	--	--
FK07	**0.510**	**0.558**	**0.542**	**0.533**	0.587	0.584	0.589	1.000	--	--	--
SK05	0.769	0.747	0.783	0.736	0.804	0.802	0.802	0.836	1.000	--	--
FK10	0.759	0.736	0.769	0.726	0.797	0.799	0.792	0.829	0.997	1.000	--
SK02	0.907	0.913	0.942	0.962	0.921	0.913	0.920	**0.512**	0.698	0.684	1.000

	YA				VD	VS		VSVD	VS		YU
	whole FK06	whole truncated FK11	innards FK05	innards FK02	whole FK01	whole SK09	whole FK09	floor FK07	whole 1 foot SK05	innards 1 foot FK10	whole SK02
forelimb	1	1	1	2.5	1	1	1	1	1	1	3.5
forelimb	2	2	2	2.5	2	2	2	6	2	2	3.5
ST	3	3	3	1	3	3	3	3	4	4	1
head unit	4	4	4	4	4	4	4	5	5	5	2
RI	7	5	6	5	5	5	5	4	6	6	6
RI	7	6	7	8	6	6	6	7.5	7	7	7
CE	7	7	5	6	7	7.5	7	9	8	8.5	5
dramah	7	8.5	8	7	8	7.5	8.5	10.5	9	8.5	8
TH	7	8.5	9	8	9	9	8.5	10.5	10	10.5	9
hindlimb	10	11	10	10	10	10	10	2	3	3	10
LU and hip	11	11	11	11	11	11	11	12	11	10.5	11
hindlimb	12	11	12	12	12	12	12	7.5	12	12	12

d) Rank order of parts, with sided elements combined as one category.
Part units that were not separated out for all butcheries (neck meat, MC) and fleshy units (liver, kidneys) are omitted.

	FK01	FK02	FK05	SK05	FK06	FK07	FK09	FK10	FK11	SK02	SK09
forelimb	1	2	1	1	1	2	1	1	1	3	1
ST	2	1	2	2	2	1	2	2	2	1	2
head unit	3	3	3	3	3	4	3	3	3	2	3
RI	4	5	5	4	5.5	5	4	4	4	5	4
CE	5	4	4	6	5.5	6	5	6.5	5	4	5.5
dramah	6	6	6	7	5.5	7.5	6.5	6.5	6.5	6	5.5
TH	7	7	7	8	5.5	7.5	6.5	8	6.5	7	7
hindlimb	8.5	8.5	8.5	5	8.5	3	8.5	5	8.5	8.5	8.5
LU and hip	8.5	8.5	8.5	9	8.5	9	8.5	8	8.5	8.5	8.5

e) Spearman's Rank Order correlation coefficients and D values ($D=\Sigma(R_1-R_2)^2$: Rholf and Sokal 1981) for rank order shown in d)
Critical values for D are applicable to small sample sizes (Sokal and Rohlf 1981:607, values from Bradley 1968:314). Critical values for correlation coefficients for N=<10 are not reliable but are given here as reference. N=9, critical values for correlation coefficients are 0.666 ($p< .05$) and 0.798 ($p< .01$). N=9, critical values for D are 48($p< .05$), 26 ($p< .01$), and 10 ($p< .001$).

Correlation coefficients:

	FK01	*FK02*	*FK05*	*SK05*	*FK06*	*FK07*	*FK09*	*FK10*	*FK11*	*SK02*	*SK09*
FK01	1	--	--	--	--	--	--	--	--	--	--
FK02	0.967	1.000	--	--	--	--	--	--	--	--	--
FK05	0.983	0.983	1.000	--	--	--	--	--	--	--	--
SK05	0.871	0.821	0.838	1.000	--	--	--	--	--	--	--
FK06	0.958	0.942	0.958	0.804	1.000	--	--	--	--	--	--
FK07	0.683	0.683	0.667	0.929	0.650	1.000	--	--	--	--	--
FK09	0.996	0.963	0.979	0.867	0.963	0.688	1.000	--	--	--	--
FK10	0.867	0.808	0.825	0.988	0.808	0.913	0.858	1.000	--	--	--
FK11	0.996	0.963	0.979	0.867	0.963	0.688	1.000	0.858	1.000	--	--
SK02	0.933	0.983	0.950	0.788	0.908	0.650	0.929	0.775	0.929	1.000	--
SK09	0.996	0.954	0.971	0.867	0.963	0.675	0.988	0.871	0.988	0.921	1

Value D:

	FK01	*FK02*	*FK05*	*SK05*	*FK06*	*FK07*	*FK09*	*FK10*	*FK11*	*SK02*	*SK09*
FK01	0	--	--	--	--	--	--	--	--	--	--
FK02	4	0	--	--	--	--	--	--	--	--	--
FK05	2	2	0	--	--	--	--	--	--	--	--
SK05	16	22	20	0	--	--	--	--	--	--	--
FK06	5	7	5	24	0	--	--	--	--	--	--
FK07	38	38	40	9	42	0	--	--	--	--	--
FK09	1	5	3	16	5	38	0	--	--	--	--
FK10	16	23	21	2	23	11	17	0	--	--	--
FK11	1	5	3	16	5	38	0	17	0	--	--
SK02	8	2	6	26	11	42	9	27	9	0	--
SK09	1	6	4	16	5	39	2	16	2	10	0

f) Butchery sequences re-ordered by degree of similarity.

Correlation coefficients: pairs *without* significant correlation are indicated in bold. Within significant pairs, shades indicate different degrees of similarity (dark > 0.9, light > 0.8, no shade but numbers not in bold means still over p<.05 threshold). N=9, critical values for correlation coefficients are 0.666 (p< .05) and 0.798 (p< .01)

	YA whole *FK06*	YA whole truncated *FK11*	YA innards *FK05*	YA innards *FK02*	VD whole *FK01*	VS whole *SK09*	VS whole *FK09*	VSVD floor *FK07*	VS whole 1 foot *SK05*	VS innards 1 foot *FK10*	YU whole *SK02*
FK06	1	--	--	--	--	--	--	--	--	--	--
FK11	0.963	1.000	--	--	--	--	--	--	--	--	--
FK05	0.958	0.979	1.000	--	--	--	--	--	--	--	--
FK02	0.942	0.963	0.983	1.000	--	--	--	--	--	--	--
FK01	0.958	0.996	0.983	0.967	1.000	--	--	--	--	--	--
SK09	0.963	0.988	0.971	0.954	0.996	1.000	--	--	--	--	--
FK09	0.963	1.000	0.979	0.963	0.996	0.988	1.000	--	--	--	--
FK07	**0.650**	0.688	0.667	0.683	0.683	0.675	0.688	1.000	--	--	--
SK05	0.804	0.867	0.838	0.821	0.871	0.867	0.867	0.929	1.000	--	--
FK10	0.808	0.858	0.825	0.808	0.867	0.871	0.858	0.913	0.988	1.000	--
SK02	0.908	0.929	0.950	0.983	0.933	0.921	0.929	**0.650**	0.788	0.775	1

Value D: pairs *without* highly significant correlation are indicated in bold. Within significant pairs, shades indicate different degrees of similarity (gray > .001, no shade but numbers not in bold means over p<.01 threshold). N=9, critical values for D are 48 (p< .05), 26 (p< .01) and 10 (< .001).

	YA whole *FK06*	YA whole truncated *FK11*	YA innards *FK05*	YA innards *FK02*	VD whole *FK01*	VS whole *SK09*	VS whole *FK09*	VSVD floor *FK07*	VS whole 1 foot *SK05*	VS innards 1 foot *FK10*	YU whole *SK02*
FK06	0	--	--	--	--	--	--	--	--	--	--
FK11	5	0	--	--	--	--	--	--	--	--	--
FK05	5	3	0	--	--	--	--	--	--	--	--
FK02	7	5	2	0	--	--	--	--	--	--	--
FK01	5	1	2	4	0	--	--	--	--	--	--
SK09	5	2	4	6	1	0	--	--	--	--	--
FK09	5	0	3	5	1	2	0	--	--	--	--
FK07	**42**	**38**	**40**	**38**	**38**	**39**	**38**	0	--	--	--
SK05	24	16	20	22	16	16	16	9	0	--	--
FK10	23	17	21	23	16	16	17	11	2	0	--
SK02	11	9	6	2	8	10	9	**42**	**26**	**27**	0

	YA				VD	VS		VSVD	VS		YU
	whole	whole truncated	innards	innards	whole	whole	whole	floor	whole 1 foot	innards 1 foot	whole
	FK06	FK11	FK05	FK02	FK01	SK09	FK09	FK07	SK05	FK10	SK02
forelimb	1	1	1	2	1	1	1	2	1	1	3
ST	2	2	2	1	2	2	2	1	2	2	1
head unit	3	3	3	3	3	3	3	4	3	3	2
RI	5.5	4	5	5	4	4	4	5	4	4	5
CE	5.5	5	4	4	5	5.5	5	6	6	6.5	4
dramah	5.5	6.5	6	6	6	5.5	6.5	7.5	7	6.5	6
TH	5.5	6.5	7	7	7	7	6.5	7.5	8	8	7
hindlimb	8.5	8.5	8.5	8.5	8.5	8.5	8.5	3	5	5	8.5
LU and hip	8.5	8.5	8.5	8.5	8.5	8.5	8.5	9	9	8	8.5

Figure 6.10: Individual variation in *kabarga* butchery time.

X-axis is a schematic representation of the part butchery sequence (with parts progressively removed left to right), and Y-axis the mean processing time for the units.

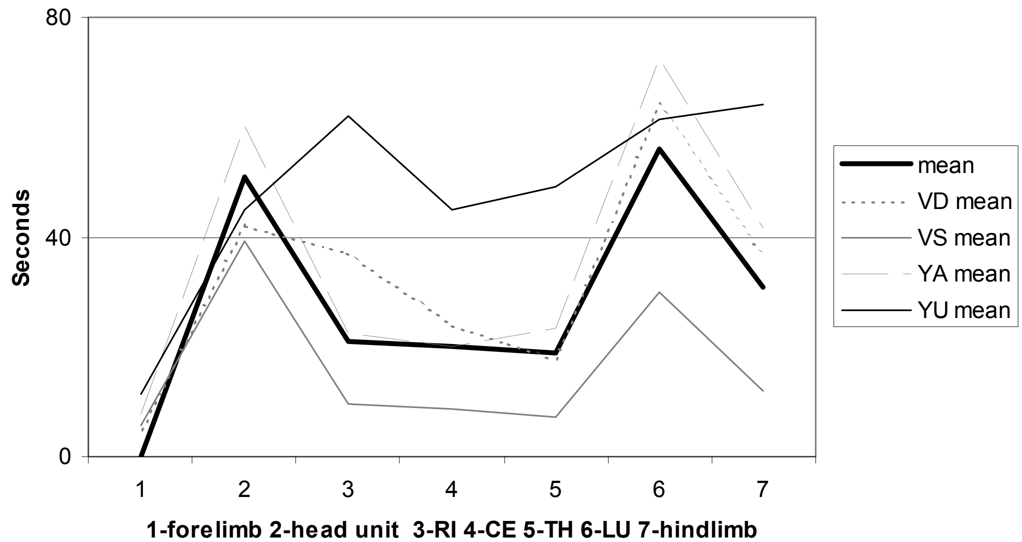


Figure 6.11: Butchery sequence vs. processing time for *kabarga*.

The relationship between the order of parts disarticulated and disarticulation time are shown schematically, with X-axis indicating sequence (see Figure 6.10). There was no linear correlation (correlation coefficient 0.343, critical value 0.754 ($p < .05$) for n=7).

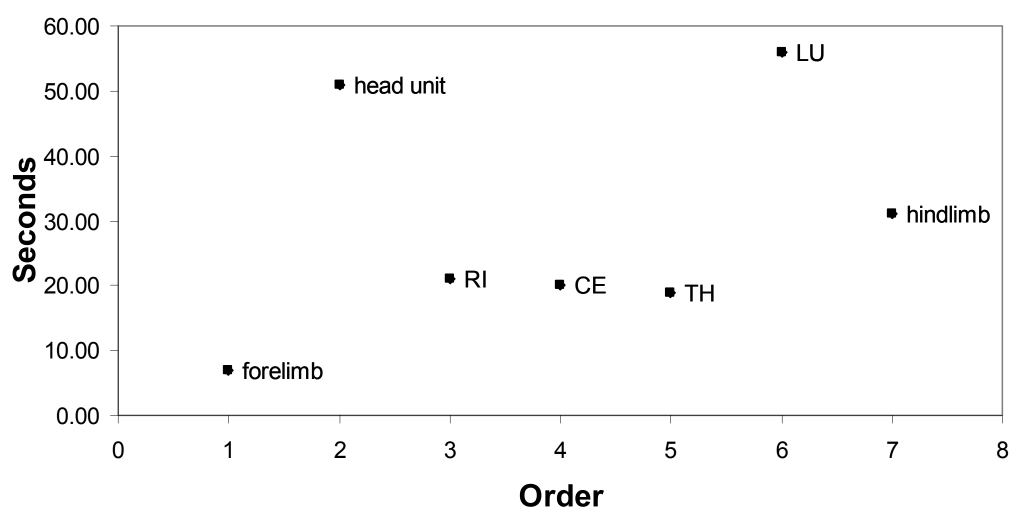


Figure 6.12: Butchery sequence vs. GUI (see Table 6.13) for *kabarga*.

The relationship between the order of parts disarticulated and GUI are shown schematically, with X-axis indicating sequence (see Figure 6.10).
There was no linear correlation (correlation coefficient 0.361, critical value 0.754 ($p < .05$) for n=7).

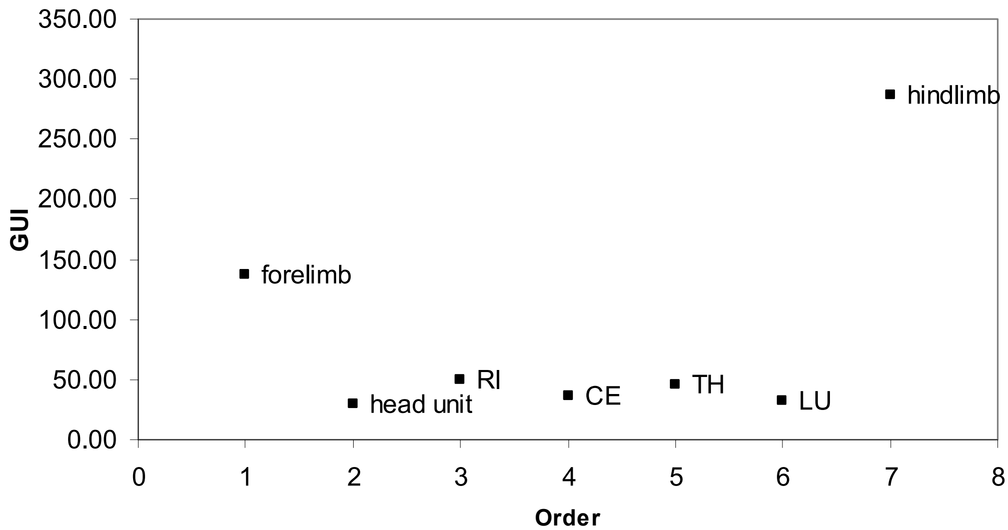


Table 6.13: GUI values for parts.

From Binford 1978:73, Table 2.6. Parts with multiple skeletal elements equal the sum of individual skeletal element GUI. GUIs for proximal and distal were added for each skeletal element.

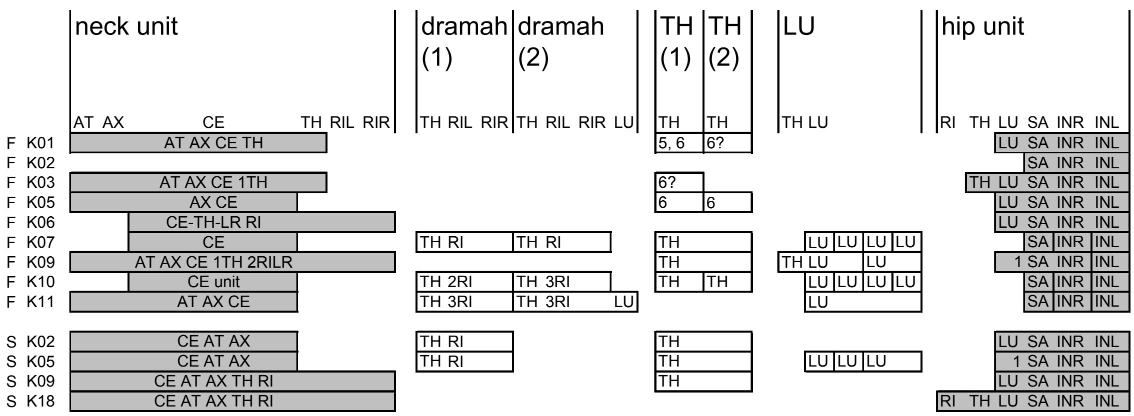
Part	GUI units added	GUI
forelimb	SC HU RAUL (no MC)	137.87
head unit	CR MD	30.26
RI	RI	49.77
CE	CE	35.71
TH	TH	45.53
LU	LU	32.05
hindlimb	FE TI MT	286.62
SC	SC	43.47
HU	HU	59.81
RAUL	RAUL	34.59
MC	MC	17.07
SA-IN	pelvis	47.89
FE	FE	198.32
TI	TI	57.03
MT	MT	31.27
marrow	TI MT	88.30

Figure 6.14: Schematic of element composition of axial parts of *kabarga*.

a) Schematic.
Each box represents a part created in parts butchery (e.g. FK01 was butchered into a neck unit, two TH units, and a hip unit; SK05 had three LU units).

As *kabarga* axial elements (plus head unit) were often consumed in one sitting, the accurate number of vertebrae associated with each unit could not be tallied in every case. The number of elements is indicated if known (e.g. FK09 had one lumbar attached to the hip unit), and element codes indicate presence/absence.

If an element code is present in only one box for an animal, this indicates that the element was completely included in that part (e.g. FK01 lumbar vertebrae were all part of the hip unit). In other cases, the disarticulation was not done exactly at the anatomical boundary (e.g. in F K11, the lumbar was present in the *dramah* unit and the lumbar unit; in SK05, there were three lumbar units as well as a single lumbar vertebra attached to the hip unit).



b) Butcher and part butchery type of animals in schematic.

Animal	Butcher	Type
F K01	VD	Whole normal
F K02	YA	Innards out normal
F K03	(VS VD)	(Backpack)
F K05	YA	Innards out normal
F K06	YA	Whole normal
F K07	VS VD	Whole floor
F K09	VS	Whole normal
F K10	VS	Innards out normal
F K11	YA	Whole normal (truncated)
S K02	YU	Whole normal
S K05	VS	Whole normal
S K09	VS	Whole normal
S K18	VS	Innards out, backpack

Table 6.15: Processing time for parts (in seconds) for *kabarga*.

a) Evisceration time, removal of organs, and skinning.

Innards removal time is for both kill site disembowelment (‘field’) and disembowelment during parts butchery (no notation).

Organs consumed include kidney, liver, heart, windpipe and lung. Heart, windpipe and lung were taken off with the head, which is shown in e).

Fur removal occurred in two segments, with a pause for hanging the animal upside-down in between. ‘Fur’ is total time, including the break in between; the two parts (‘on floor’ and ‘hanging’) are also indicated.

	SA	Time	VD	Time	VS	Time	YA	Time	YU	Time	All
innards			S K15 field	210	S K09 field	61	F K06	243	S K02	245	
					S K14 field	89	F K11	98			
					F K09	30	S K12	98			
					S K05	78					
					S K18	58					
			VD mean	**210**	**VS mean**	**63**	**YA mean**	**146**	**YU mean**	**245**	**121**
kidneys					F K07	27	F K02	13	F K01	25	
					F K09	21	F K06	30	S K02	21	
					S K05	22	F K11	32			
							S K11	18			
							S K12	18			
					VS mean	**23**	**YA mean**	**22**	**YU mean**	**23**	**23**
liver	S K03	12	F K01	21	F K09	8	F K05	13			
			F K07	11	F K10	15	F K06	31			
					S K05	31	F K11	15			
					S K09	5					
					S K18	14					
	SA mean	**12**	**VD mean**	**16**	**VS mean**	**15**	**YA mean**	**20**			**16**
Fur	S K03	692	F K01	379	F K07	457	F K05	416	S K02	924	
	S K17	550			F K10	609	F K05	837			
					S K05	262	F K06	804			
					S K09	266	F K11	905			
					S K18	364	S K10	874			
							S K11	828			
							S K12	808			
	SA mean	**621**	**VD mean**	**379**	**VS mean**	**392**	**YA mean**	**782**	**YU mean**	**924**	**623**
fur part	S K03	171	F K01	167	F K10	280	F K06	804			
(on floor)	S K17	303			S K05	159	F K11	395			
					S K09	154	S K10	384			
					S K18	213	S K11	326			
							S K12	403			
	SA mean	**237**	**VD mean**	**167**	**VS mean**	**161**	**YA mean**	**330**			**313**
fur part	S K03	436	F K01	150	F K07	43	F K02	200			
(hanging)	S K17	221			F K09	84	F K05	320			
					F K10	260	F K06	373			
					S K05	84	F K11	346			
					S K09	90	S K10	424			
					S K18	120	S K11	436			
							S K12	302			
	SA mean	**329**	**VD mean**	**150**	**VS mean**	**114**	**YA mean**	**343**			**243**

b) Rib and sternum.

RI disarticulation times are for the removal of 5-10 ribs as a single part from the rest of the body, and includes the cutting in meat at caudal and cranial, as well as the cutting at the RI-TH joint for however many ribs were in the unit. It does not include the cutting of a RI part into individual ribs.

ST disarticulation time could not be accurately recorded, given that the cutting around the ST unit (ST and abdominal meat) started at the initial evisceration and continued after the soft parts were removed. The times are given here as a reference only, and the variation could well be a result of recording discrepancy as well as individual difference.

	SA	**Time**	**VD**	**Time**	**VS**	**Time**	**YA**	**Time**	**YU**	**Time**	**All**
RI			F K01	21	F K09	8	F K02	22	S K02	84	
			F K01	23	F K09	8	F K02	14	S K02	40	
			F K07	36	F K10	7	F K05	16			
			F K07	69	F K10	8	F K05	16			
					S K05	21	F K06	55			
					S K05	8	F K06	11			
					S K09	10	F K11	27			
					S K09	7	F K11	18			
			VD mean	**37**	**VS mean**	**10**	**YA mean**	**22**	**YU mean**	**62**	**21**
ST	S K03	53	F K01	43	F K07	164	F K02	101	S K02	87	
			F K01	64	F K10	53	F K05	111			
					S K05	37	F K06	310			
					S K09	34	F K11	118			
					S K18	21					

c) Forelimb.

The forelimb (SC-HU-RAUL-MC-hoof or SC-HU-RAUL) was removed from the body during parts butchery.

The disarticulation of at the SC-HU joint occurred during the processing of the forelimb into units for cooking and use. HU-RAUL joint disarticulation occurred most frequently in the context of the separation of HU at cooking, and very rarely to separate RAUL for marrow extraction.

The MC (and hoof) was disarticulated from RAUL and given to dogs, with the carpals usually still attached to the MC.

	VD	**Time**	**VS**	**Time**	**YA**	**Time**	**YU**	**Time**	**All**
forelimb	F K01 SC-body	3	F K07 SC-body	8	F K02 SC-body	9	S K02 SC-body	18	
	F K01 SC-body	6	F K09 SC-body	3	F K05 SC-body	4	S K13 SC-body	11	
	F K07 SC-body	5	F K09 SC-body	2	F K05 SC-body	6	S K13 SC-body	5	
			F K10 SC-body	7	F K06 SC-body	12			
			F K10 SC-body	7	F K06 SC-body	12			
			S K05 SC-body	5	F K11 SC-body	5			
			S K05 SC-body	6	F K11 SC-body	7			
			S K09 SC-body	2					
			S K09 SC-body	4					
			S K18 SC-body	13					
			S K18 SC-body	6					
	VD mean	**5**	**VS mean**	**6**	**YA mean**	**8**	**YU mean**	**11**	**7**
SC-HU			S K18 SC-HU	6	F K03 SC-HU	13			
joint			S K18 SC-HU	8	F K03 SC-HU	12			
					F K05 SC-HU	19			
					F K05 SC-HU	12			
					F K11 SC-HU	12			
					F K11 SC-HU	33			
			VS mean	**7**	**YA mean**	**17**			**14**
HU-RAUL					F K03 HU-RA	45	S K13 SCHU-RA	19	
joint					F K03 HU-RA	49	S K13 SCHU-RA*	43	
					F K05 HU-RA	40	(*distal HU)		
					F K05 HU-RA	32			
					F K11 HU-RA	48			
					F K11 HU-RA	80			
					YA mean	**49**	**YU mean**	**31**	**44**
RAUL-MC	F K01 RA-MC	2	F K09 RA-MC	16	F K02 RA-MC	4	S K02 RA-MC	5	
joint	F K01 RA-MC	3	S K05 RA-MC	6	F K02 RA-MC	4	S K02 RA-MC	11	
			S K05 RA-MC	5	F K05 RA-MC	6			
			S K18 RA-MC	4	F K05 RA-MC	5			
			S K18 RA-MC	3	F K06 RA-MC	12			
					F K06 RA-MC	5			
					F K11 RA-MC	13			
					F K11 RA-MC	9			
	VD mean	**3**	**VS mean**	**7**	**YA mean**	**5**	**YU mean**	**8**	**5**

d) Vertebrae.

Disarticulation times are for disarticulation between two vertebral units, including butchery for large units (i.e. part butchery) and further processing for cooking.

CE: Disarticulation between two CE indicated by 'CE', disarticulation of CE unit during part butchery indicated by 'CE-TH'.
TH: Disarticulation between two TH indicated by 'TH', disarticulation of the *dramah* unit (TH with proximal L and R RI) from TH is also a TH-TH disarticulation. The disarticulation of TH from the LU-hip unit is indicated as 'TH-LU?' as often a TH vertebra remained with the LU unit.
LU: Disarticulation of the LU unit from at the proximal extreme indicated as 'LU-TH' and the distal extreme as 'LU-SA', and disarticulation between two LU (from further processing) indicated by 'LU-LU'.

	VD	Time	VS	Time	YA	Time	YU	Time	All
CE	F K01 CE-TH joint	21	F K09 CE-TH joint	2	F K02 CE	24	S K02 CE	45	
	F K07 CE-TH joint	27	F K10 CE-TH joint	16	F K03 CE-TH joint	23			
			S K05 CE-TH joint	8	F K11 CE	24			
					(with neck meat off)				
					F K05 CE	13			
					F K06 CE-TH joint	28			
					F K11 CE-TH joint	9			
	VD mean	**24**	**VS mean**	**9**	**YA mean**	**20**	**YU mean**	**45**	**20**
TH	F K01 TH-TH	8	F K10 dramah	2	F K02 dramah	17	S K02 TH-TH	55	
	F K01 TH-LU?	16	S K05 dramah	15	F K05 dramah	8	S K02 TH-LU?	43	
	F K07 TH-TH	29	S K09 dramah	3	F K05 TH-TH	7			
			F K09 TH-TH	2	F K11 TH-LU?	24			
			F K10 TH-TH	10	F K11 TH-TH	52			
			S K05 TH-TH	7	F K03 TH-TH	33			
			S K09 TH-LU?	11					
	VD mean	**18**	**VS mean**	**7**	**YA mean**	**24**	**YU mean**	**49**	**19**
LU	F K07 TH-LU	77	F K07 LU-SA	38	F K02 LU-LU	102	F K01 LU-LU	83	
	F K07 LU-LU	44	F K09 LU-LU	19	F K03 LU-SA	83	F K01 LU-LU*	65	
	F K07 LU-LU	69	F K09 LU-LU	14	F K05 LU-SA	63	F K01 LU-LU	75	
	F K07 LU-LU	66	F K09 LU-LU	32	F K06 LU-SA	115	F K01 LU-LU*	35	
			F K10 TH-LU	44	F K03 LU-LU	98	S K02 TH-LU	44	
			F K10 LU-LU	24	F K03 LU-LU	56	S K02 LU-LU	53	
			F K10 LU-LU	32	F K03 LU-LU	45	S K02 LU-LU	53	
			F K10 LU-LU	31	F K03 LU-LU	84	S K02 LU-LU	86	
			F K10 LU-SA	42	F K05 LU-LU	65	S K02 LU-LU	59	
			S K05 TH-LU	29	F K05 LU-LU	58	(*axe as		
			S K05 LU-LU	26	F K05 LU-LU	79			
			S K05 LU-LU	29	F K11 TH-LU	63			
			S K05 LU-LU	29	F K11 LU-LU	67			
					F K11 LU-LU	39			
					F K11 LU-LU	72			
	VD mean	**64**	**VS mean**	**30**	**YA mean**	**73**	**YU mean**	**61**	**56**
Vert	**VD mean**	**40**	**VS mean**	**20**	**YA mean**	**50**	**YU mean**	**58**	

e) Head.

Head unit processing time includes the extraction of the heart and lung from chest cavity (usually with some cutting at proximal ribs), extraction of the windpipe (cutting of neck meat), removal of the esophagus, and the disarticulation of the head at or near the CR-AT joint. The resulting unit is the head (CR and MD), heart, and lungs connected by the windpipe.

'MD from CR' is the disarticulation time of the MD (with two sides connected) from CR.

	SA	Time	VD	Time	VS	Time	YA	Time	YU	Time	All
head unit	S K03	91	F K01	42	F K07	50	F K02	43	S K02	45	
	F K01	42			F K09	35	F K05	15			
					F K10	43	F K06	48			
					S K05	41	F K11	92			
					S K09	22	S K11	78			
					S K18	44	S K12	85			
	SA mean	**67**	**VD mean**	**42**	**VS mean**	**39**	**YA mean**	**60**	**YU mean**	**45**	**51**
MD from CR							F K05	36			
							F K06	64			
							YA mean	**50**			**50**
MD from CR with cleaning and/or heart slice					F K09	36	F K03	87	F K01	71	
					F K10	114	F K11	96			
					S K05	51	F K06	34			
					VS mean	**67**	**YA mean**	**72**	**YU mean**	**71**	**70**

f) Hindlimb.

The ‘hindlimb’ (FE-TI-MT-hoof: indicated as FE-IN) and the ‘hip’ unit (SA, L IN, R IN: indicated as IN-FE) were disarticulated from each other during part butchery, with the separation at the femur-innominate joint.

The disarticulation of at the FE-TI joint occurred during the processing stage, to eat marrow (TI-MT-hoof) or to create a FE unit for cooking.

The TI-MT joint disarticulation occurred in the context of marrow extraction, with the tarsals remaining attached to either bone. The tarsals and hooves were removed, but their removal was interspersed with other activities (tendon eating, periosteum cleaning) and could not be accurately timed. Cracking was also accompanied by eating and could not be accurately timed. They are listed in the ‘marrow’ section as a reference.

	SA	Time	VD	Time	VS	Time	YA	Time	YU	Time	All
hindlimb	S K14 FE-IN*	31	F K01 FE-IN	18	F K07 FE-IN	27	F K02 FE-IN	69	S K02 FE-IN	85	
	(*floor)		F K07 FE-IN*	75	F K09 FE-IN	15	F K05 FE-IN	50	S K02 IN-FE	43	
			F K01 IN-FE	18	F K10 FE-IN	6	F K06 FE-IN	40			
			(*floor)		S K05 FE-IN*	25	F K06 FE-IN	21			
					S K09 FE-IN	11	F K02 IN-FE	9			
					F K09 IN-FE	3	F K05 IN-FE	11			
					F K10 IN-FE	6	F K06 IN-FE	39			
					S K05 IN-FE	6	F K11 IN-FE	65			
					S K09 IN-FE	8	F K02 FE-IN, FE-TI	70			
					(*w/ cleaning)						
	SA mean	**31**	**VD mean**	**37**	**VS mean**	**12**	**YA mean**	**42**	**YU mean**	**64**	**31**
FE-TI joint	S K14 TIMT-FE	18			S K05 TIMT-FE	16	F K03 TIMT-FE	40	F K01 TIMT-FE	7	
					S K05 TIMT-FE	9	F K03 TIMT-FE	56	F K01 TIMT-FE	29	
							F K05 TIMT-FE	19	F K06 TIMT-FE	60	
							F K05 TI-FE	17	S K13 TIMT-FE	17	
							F K11 TIMT-FE	37			
							F K11 TIMT-FE	25			
							F K11 TIMT-FE	14			
	SA mean	**18**			**VS mean**	**13**	**YA mean**	**30**	**YU mean**	**28**	**26**
TI-MT joint					F K05 MT-TI	14	F K05 MT-TI	17			
					F K05 MT-TI	4	F K11 MT-TI	21			
					F K09 MT-TI	4	F K11 MT-TI	13			
					F K09 MT-TI	3					
					VS mean	**6**	**YA mean**	**17**			**11**
marrow							S K11 TI-tarsals	87	F K01 MT-tarsals, MT cracking.	18	
							S K11 MT-hoof	85	F K01 MT-hoof	20	
							S K11 TI cracking	79	F K01 TI cracking	7	
							S K11 TI cracking	85	F K05 MT cracking	28	
							YA mean	**84**	**YU mean**	**18**	**51**

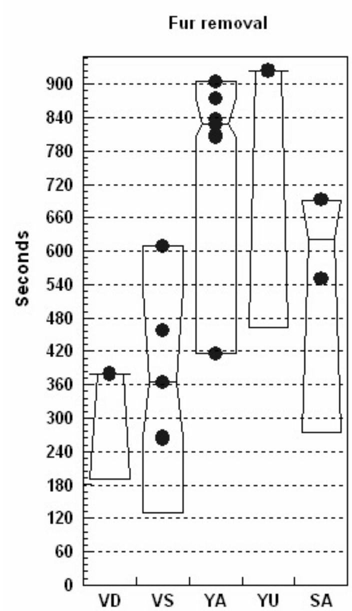
g) Sacrum and innominate.

Disarticulation occurred during processing of the hip unit for use.

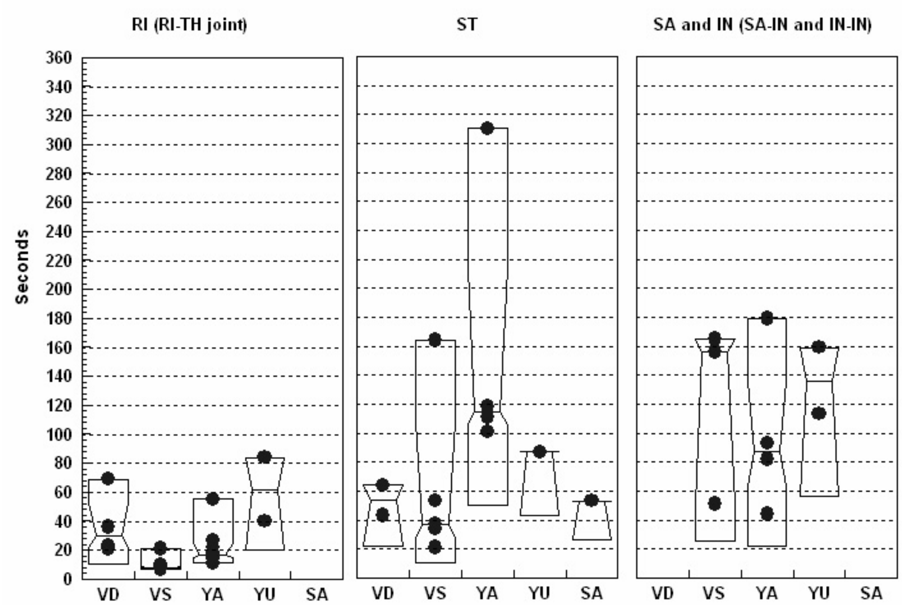
	VS	Time	YA	Time	YU	Time	All
SA, IN	F K07 SA axe, IN-IN axe, tail off, colon removal	165	F K05 SA knife, IN-IN	93	F K01 SA axe, colon removal	113	
	F K09 SA snapped, IN-IN snapped, tail off, colon removal	51	F K06 SA axe, IN-IN axe, tail off	179	S K02 SA knife and axe, IN-IN axe	159	
	F K10 SA knife, tail off, colon removal	156	F K11 SA axe, IN-IN axe, tail off, colon removal	44			
			F K03 SA axe	82			
	VS mean	124	**YA mean**	100	**YU mean**	136	**116**

Figure 6.16: Spread of processing time by part and individual.

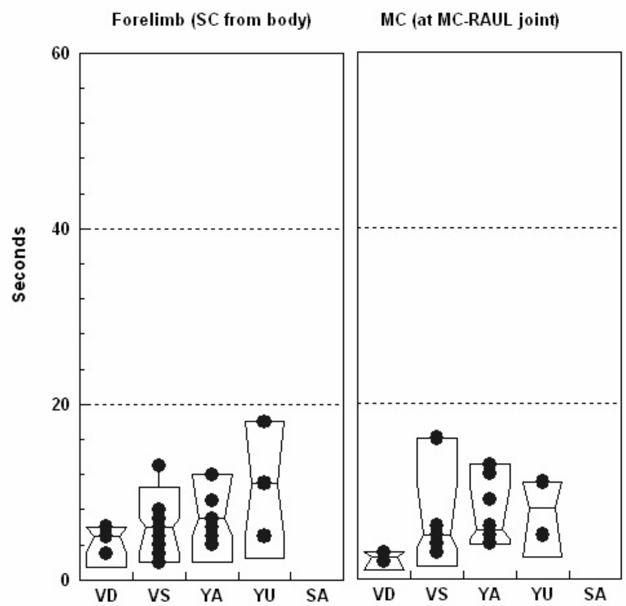
a) Fur removal.



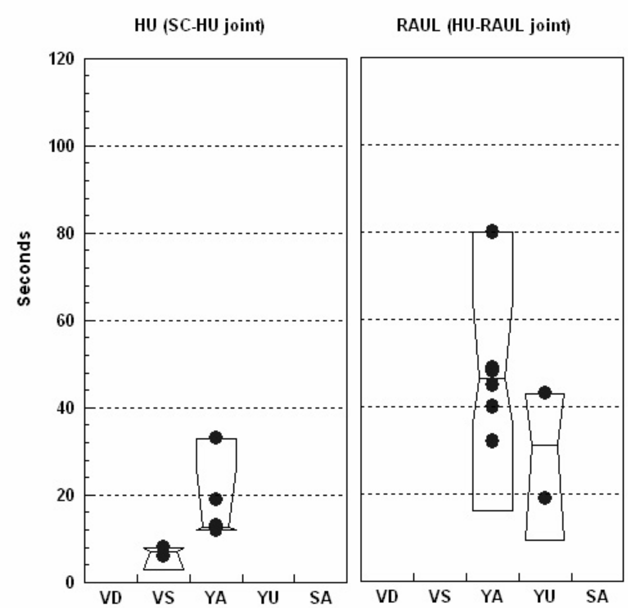
b) Ribs, sternum, and hip parts.



c) Forelimb.

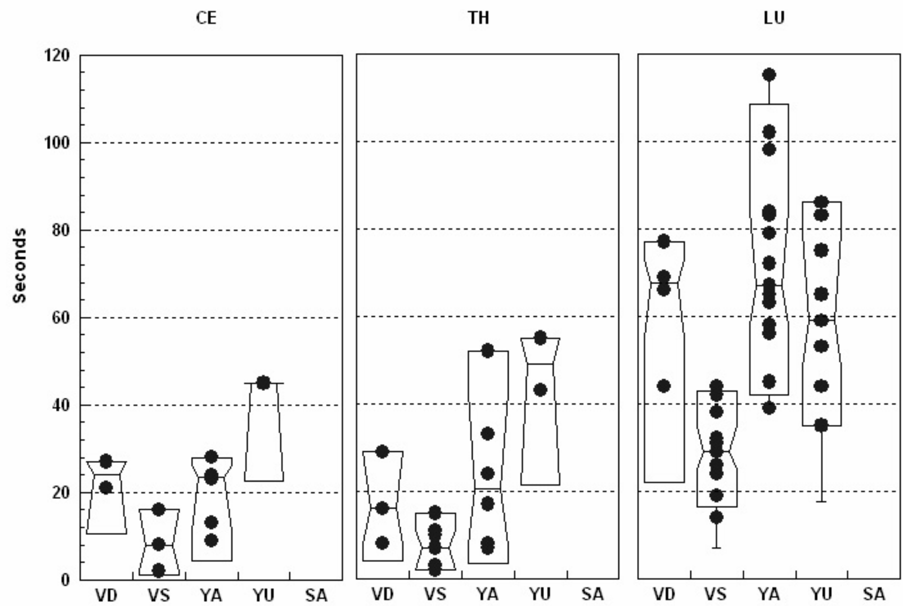


Forelimb (SC from body)
MC (at MC-RAUL joint)
Seconds
60
40
20
0
VD
VS
YA
YU
SA

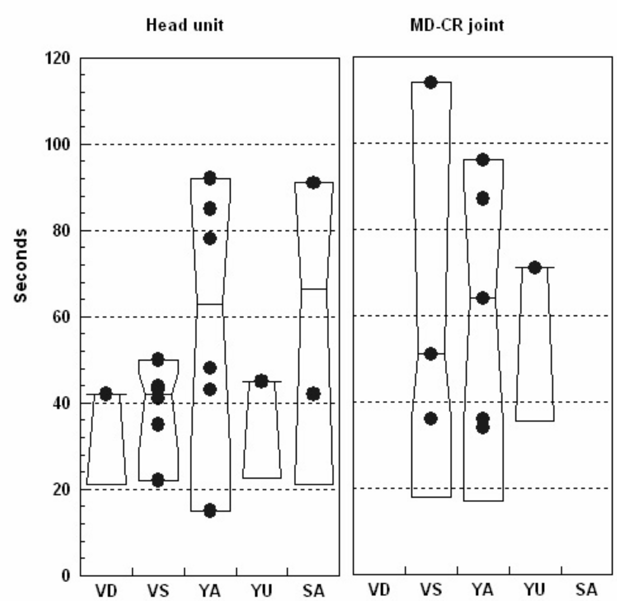


HU (SC-HU joint)
RAUL (HU-RAUL joint)
Seconds
120
100
80
60
40
20
0
VD
VS
YA
YU
SA

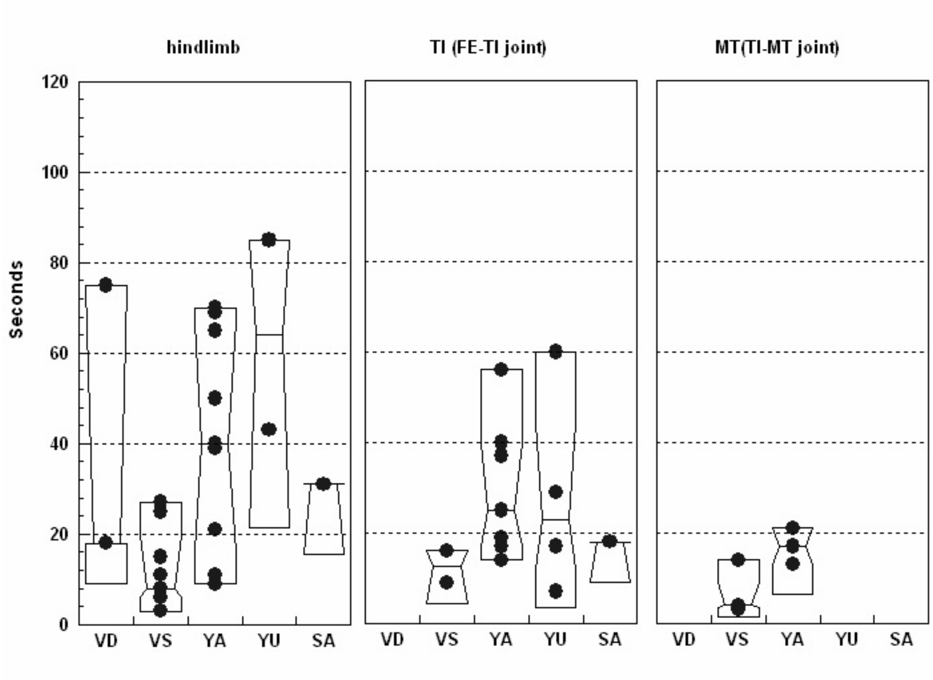
d) Vertebrae.



e) Head.



f) Hindlimb.



g) Marrow processing, evisceration.

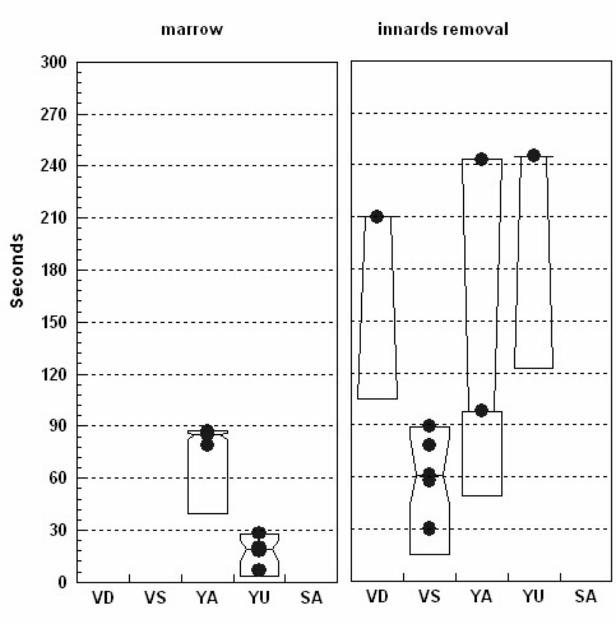


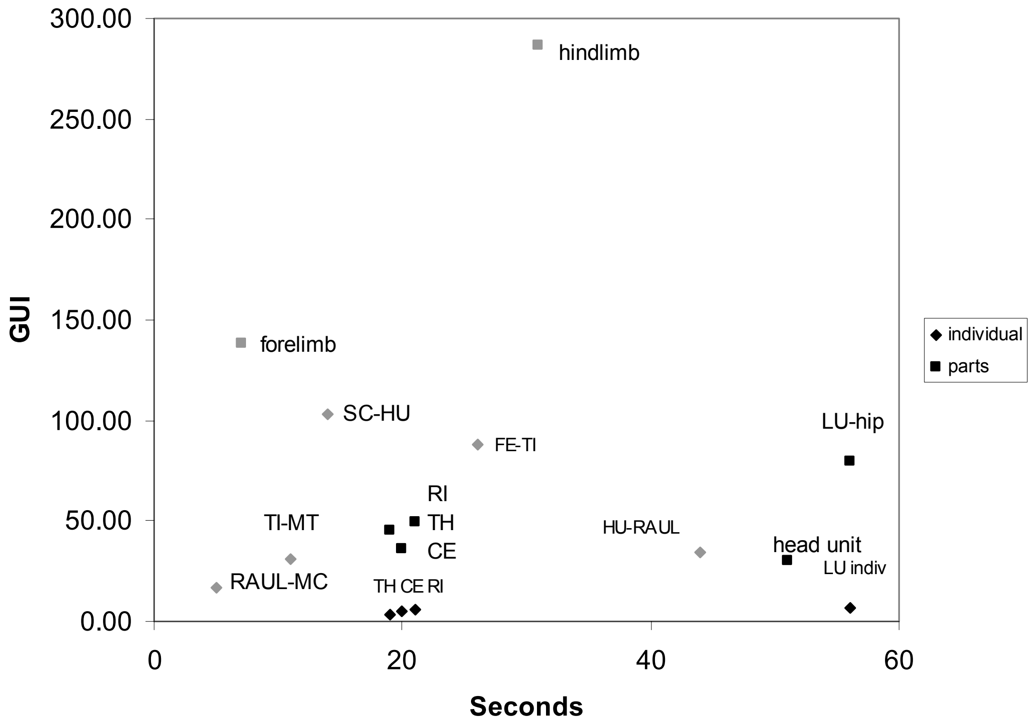
Figure 6.17: Mean processing time vs. GUI.

a) Summary of processing times from Table 6.15.

		Time Mean	SA mean	VD mean	VS mean	YA mean	YU mean
ORDER BUTCHERY	Fur	623	621	379	392	782	924
	forelimb	7		5	6	8	11
	head unit	51	67	42	39	60	45
	RI	21		37	10	22	62
	CE	20		24	9	20	45
	TH	19		18	7	24	49
	LU	56		64	30	73	61
	(vertebrae)	37		40	20	50	58
	hindlimb	31	31	37	12	42	64
PROCESSING	SC-HU	14			7	17	
	HU-RAUL	44				49	31
	RAUL-MC	5		3	7	5	8
	SA-IN	116			124	100	136
	FE-TI	26	18		13	30	28
	TI-MT	11			6	17	
	marrow extraction	51				84	18
	MD from CR	70			67	72	71
SOFT PARTS	innards	121		210	63	146	245
	kidneys	23			23	22	23
	liver	16	12	16	15	20	

b) Processing time vs. GUI, with GUI calculated for parts units and smaller units.

This chart shows time vs. GUI for parts butchery (square), and the disarticulation of parts units into further units (diamond). Gray = limbs, black = axial elements.



Series 'individual'

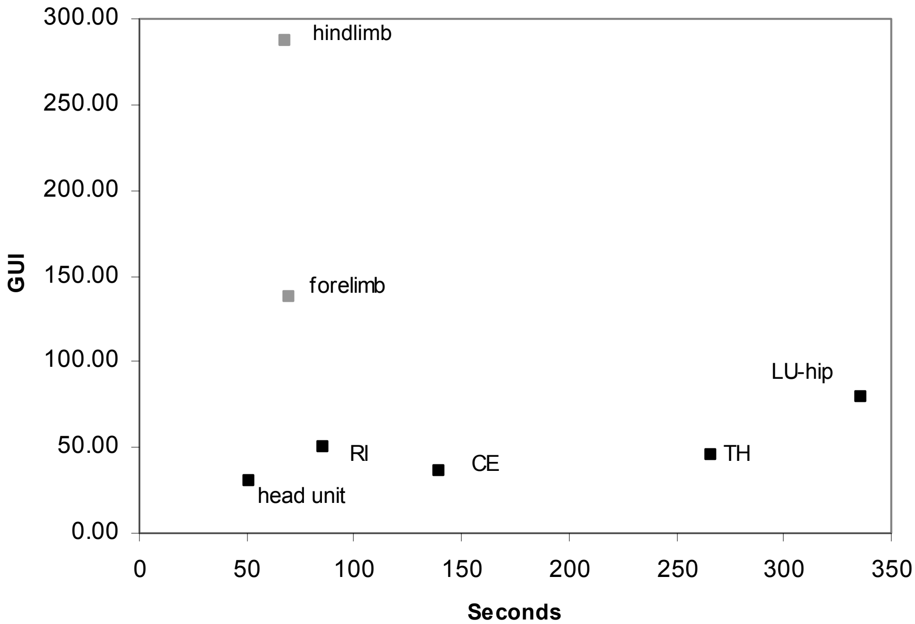
Disarticulation	Time	Utility	(elements)
SC-HU	14	103.28	HU + RAUL
HU-RAUL	44	34.59	RAUL
RAUL-MC	5	17.07	MC
RI indiv	21	6.22	1 RI
CE indiv	20	5.10	1 CE
TH indiv	19	3.25	1 TH
LU indiv	56	6.41	1 LU
FE-TI	26	88.30	TI-MT
TI-MT	11	31.27	MT

Series 'parts'

Disarticulation	Time	Utility	(elements)
forelimb	7	137.87	all fore
head unit	51	30.26	CR + MD
RI	21	49.77	all RI
CE	20	35.71	all CE
TH	19	45.53	all TH
LU-hip	56	79.94	all LU
hindlimb	31	286.62	all hind

c) Total processing time spent on each part vs. part GUI.

This chart depicts total time vs. GUI. Total processing time (shown in table below), is the sum time spent in parts butchery plus additional (cooking) butcheries for elements in each part. Times for additional butcheries are shown in b). Gray = limbs, black = axial elements.



Disarticulation	Utility	Time (parts)	Additional time	Total time
forelimb	137.87	7	SC-HU, HU-RAUL, RAUL-MC	70
head unit	30.26	51	-	51
RI	49.77	21	RI x 13	86
CE	35.71	20	CE x 6	140
TH	45.53	19	TH x 13	266
LU-hip	79.94	56	LU x 5 + hip	336
hindlimb	286.62	31	FE-TI, TI-MT	68

Note: RI, CE and TH parts were actually not disarticulated into individual elements, as the table assumes here.

Table 6.18: Raw rank order of *kabarga* use.

All animals were observed from initial kill and/or parts butchery. Animals not observed from the beginning of use were omitted from this table.

The numbers indicate the order of consumption (eating) of *kabarga*, with 1 being eaten first, and larger numbers later. The parts marked ‘D’ were observed being given to dogs and thus were not part of the human meal. These parts were given the lowest rank (highest number). Ranks were left blank for units that were not observed in a meal (e.g. cooked for dog food). It is important to note that rank is assigned at *first use*, and does not necessarily indicate *complete* use of a part unit. The animals to the left of the dotted line in each box (for explanation of box divisions, see Table 6.20) were used relatively completely.

The rank order is the ‘all parts’ version (Table 6.19). The asterisks (key in Table 6.19) indicate rows that would change (i.e. be combined) in different rank orders.

Unit	A*	B*	**Rank order with all units**																		
			SK02	FK01	SK05	FK03	FK05	FK09	FK11	FK06	SK03	SK06	SK09	FK10	FK07	FK02	SK18	SK08	SK14	SK15	SK11
Head unit			4	2	1	2	2	2	2	3	2	1	1		3	2					
Neck unit			4		1	2	3	2	4						3	D					
TH or dramah			4	2	1	2	3	2	2	3				2	3	D					
RI L	*		4	2	1	2	2	2	4					2	3	D					
RI R	*		4	3	1	2		2	4					2	3	D					
ST			4	2	1	2	2	2	2					2	3	D					
LU			2	2	1	2	2	2	2	3				2							
Hip			2	2			2	2	2	3				3		2					
Forelimb L (SC HU)	*		6	4	1	4	2	4		4	4			3	2	2	1			1	
Forelimb R (SC HU)	*			4		4	3	4	4	4					2	2	1				
RAUL L	*	*	1				3	4						1							
RAUL R	*	*	1				3	4			1			1							
FE L	*		5	3	3	3	4	3	3	2				3	1	2	2	1	1		
FE R	*		3	3	4		4	3	3	2	3			3	1	3	1	1			
TI MT L	*	*	1	1	2	1	1	1	1	1	1				1	1					1
TI MT R	*	*	1	1	2	1	1	1	1	1	1				1	1	1				1
MC L	*	*	D	D	D		D	1	1	1	1			1		D					
MC R	*	*	D	D	D		D	1	1	1	1			1		D					

Table 6.19: Generalized part units used in *kabarga* use analysis.

Part units were generalized (e.g. combining TH and *dramah*) to allow for comparison between a maximum number of animals.

a) Four different sets of generalized parts were made to test the use order of *kabarga*. These are: all units vs. meaty units only ('without marrow'); and for each, with sided elements kept separate vs. sided elements combined (in which case, the rank of L and R elements were averaged).

Rank order type	**All units**	**All units, sided elements combined**	**Without marrow**	**W/o marrow, sided elements combined**
Part unit	Head unit	Head unit	Head unit	Head unit
	Neck unit	Neck unit	Neck unit	Neck unit
	TH or dramah	TH or dramah	TH or dramah	TH or dramah
	RI L	RI	RI L	RI
	RI R	ST	RI R	ST
	ST	LU	ST	LU
	LU	Hip	LU	Hip
	Hip	Forelimb (SC HU)	Hip	Forelimb (SC HU)
	Forelimb L (SC HU)	RAUL	Forelimb L (SC HU)	FE
	Forelimb R (SC HU)	FE	Forelimb R (SC HU)	
	RAUL L	TI MT	FE L	
	RAUL R	MC	FE R	
	FE L			
	FE R			
	TI MT L			
	TI MT R			(A* rank averaged)
	MC L	(A* rank averaged)	(B* rank removed)	(B* rank removed)
	MC R			
	n=18	n=12	n=12	n=9

b) Actual rank order.

All units

	SK02	FK01	SK05	FK03	FK05	FK09	FK11	FK06	SK03	SK06	SK09	FK10	FK07	FK02	SK18	SK08	SK14	SK15	SK11
head unit	10.5	5.5	4.5	6	5.5	8.5	7	8.5	6	1	1	16	9.5	5	12	10.5	10	10	10.5
neck unit	10.5	15	4.5	6	11	8.5	13.5	15.5	13.5	10	10	16	9.5	15	12	10.5	10	10	10.5
TH and/or dramah	10.5	5.5	4.5	6	11	8.5	7	8.5	13.5	10	10	7	9.5	15	12	10.5	10	10	10.5
L RI	10.5	5.5	4.5	6	5.5	8.5	13.5	15.5	13.5	10	10	7	9.5	15	12	10.5	10	10	10.5
R RI	10.5	10	4.5	6	16	8.5	13.5	15.5	13.5	10	10	7	9.5	15	12	10.5	10	10	10.5
ST	10.5	5.5	4.5	6	5.5	8.5	7	15.5	13.5	10	10	7	9.5	15	12	10.5	10	10	10.5
LU	5.5	5.5	4.5	6	5.5	8.5	7	8.5	13.5	10	10	7	15.5	10	12	10.5	10	10	10.5
SA-IN-IN	5.5	5.5	14.5	15.5	5.5	8.5	7	8.5	13.5	10	10	11.5	15.5	5	12	10.5	10	10	10.5
L SC and/or HU	15	12.5	4.5	11.5	5.5	16.5	17	11.5	8	10	10	11.5	5.5	5	2.5	10.5	10	1	10.5
R SC and/or HU	16	12.5	14.5	11.5	11	16.5	13.5	11.5	13.5	10	10	16	5.5	5	2.5	10.5	10	10	10.5
L RAUL	2.5	15	14.5	15.5	11	16.5	17	15.5	13.5	10	10	2.5	15.5	10	12	10.5	10	10	10.5
R RAUL	2.5	15	14.5	15.5	11	16.5	17	15.5	3	10	10	2.5	15.5	10	12	10.5	10	10	10.5
L FE	14	10	11	10	14.5	13.5	10.5	5.5	13.5	10	10	11.5	2.5	5	5	1.5	1	10	10.5
R FE	7	10	12	15.5	14.5	13.5	10.5	5.5	7	10	10	11.5	2.5	8	2.5	1.5	10	10	10.5
L TI and/or MT	2.5	1.5	9.5	1.5	1.5	2.5	2.5	2.5	3	10	10	16	2.5	1.5	12	10.5	10	10	1.5
R TI and/or MT	2.5	1.5	9.5	1.5	1.5	2.5	2.5	2.5	3	10	10	16	2.5	1.5	2.5	10.5	10	10	1.5
L MC	17.5	17.5	17.5	15.5	17.5	2.5	2.5	2.5	3	10	10	2.5	15.5	15	12	10.5	10	10	10.5
R MC	17.5	17.5	17.5	15.5	17.5	2.5	2.5	2.5	3	10	10	2.5	15.5	15	12	10.5	10	10	10.5

All units, sided elements combined

	SK02	FK01	SK05	FK03	FK05	FK09	FK11	FK06	SK03	SK06	SK09	FK10	FK07	FK02	SK18	SK08	SK14	SK15	SK11
head unit	7	4	3.5	4.5	3.5	6	5	5.5	4	1	1	11	6	3	8	8	7	7	8
neck unit	7	10.5	3.5	4.5	8	6	9.5	10.5	9.5	7	7	11	6	9.5	8	8	7	7	8
TH and/or dramah	7	4	3.5	4.5	8	6	5	5.5	9.5	7	7	4.5	6	9.5	8	8	7	7	8
RI	7	7	3.5	4.5	10	6	9.5	10.5	9.5	7	7	4.5	6	9.5	8	8	7	7	8
ST	7	4	3.5	4.5	3.5	6	5	10.5	9.5	7	7	4.5	6	9.5	8	8	7	7	8
LU	3.5	4	3.5	4.5	3.5	6	5	5.5	9.5	7	7	4.5	10.5	6.5	8	8	7	7	8
SA-IN-IN	3.5	4	10.5	11	3.5	6	5	5.5	9.5	7	7	7.5	10.5	3	8	8	7	7	8
SC and/or HU	11	9	7	8	6	11.5	11	8	6	7	7	9	3	3	1	8	7	1	8
RAUL	1.5	10.5	10.5	11	8	11.5	12	10.5	3	7	7	1.5	10.5	6.5	8	8	7	7	8
FE	10	8	9	9	11	10	8	3	5	7	7	7.5	1.5	5	2	1	1	7	8
TI and/or MT	1.5	1	8	1	1	1.5	1.5	1.5	1.5	7	7	11	1.5	1	3	8	7	7	1
MC	12	12	12	11	12	1.5	1.5	1.5	1.5	7	7	1.5	10.5	7	8	8	7	7	8

Without marrow

	SK02	FK01	SK05	FK03	FK05	FK09	FK11	FK06	SK03	SK06	SK09	FK10	FK07	FK02	SK18	SK08	SK14	SK15
head unit	6.5	3.5	4.5	4	3.5	4.5	3	4.5	1	1	1	11	7.5	3	9.5	7.5	7	7
neck unit	6.5	12	4.5	4	8	4.5	9.5	10.5	8	7	7	11	7.5	10	9.5	7.5	7	7
TH and/or dramah	6.5	3.5	4.5	4	8	4.5	3	4.5	8	7	7	3	7.5	10	9.5	7.5	7	7
L RI	6.5	3.5	4.5	4	3.5	4.5	9.5	10.5	8	7	7	3	7.5	10	9.5	7.5	7	7
R RI	6.5	8	4.5	4	12	4.5	9.5	10.5	8	7	7	3	7.5	10	9.5	7.5	7	7
ST	6.5	3.5	4.5	4	3.5	4.5	3	10.5	8	7	7	3	7.5	10	9.5	7.5	7	7
LU	1.5	3.5	4.5	4	3.5	4.5	3	4.5	8	7	7	3	11.5	7	9.5	7.5	7	7
SA-IN-IN	1.5	3.5	11.5	11.5	3.5	4.5	3	4.5	8	7	7	7.5	11.5	3	9.5	7.5	7	7
L SC and/or HU	11	10.5	4.5	9.5	3.5	11.5	12	7.5	3	7	7	7.5	3.5	3	2	7.5	7	1
R SC and/or HU	12	10.5	11.5	9.5	8	11.5	9.5	7.5	8	7	7	11	3.5	3	2	7.5	7	7
L FE	10	8	9	8	10.5	9.5	6.5	1.5	8	7	7	7.5	1.5	3	5	1.5	1	7
R FE	3	8	10	11.5	10.5	9.5	6.5	1.5	2	7	7	7.5	1.5	6	2	1.5	7	7

Without marrow, sided elements combined

	SK02	FK01	SK05	FK03	FK05	FK09	FK11	FK06	SK03	SK06	SK09	FK10	FK07	FK02	SK18	SK08	SK14	SK15
head unit	5	3	3.5	3.5	2.5	4	3	3.5	1	1	1	8.5	5	2	7	6.5	5.5	5.5
neck unit	5	9	3.5	3.5	7.5	4	7.5	8	6.5	5.5	5.5	8.5	5	7.5	7	6.5	5.5	5.5
TH and/or dramah	5	3	3.5	3.5	7.5	4	3	3.5	6.5	5.5	5.5	2.5	5	7.5	7	6.5	5.5	5.5
RI	5	6	3.5	3.5	6	4	7.5	8	6.5	5.5	5.5	2.5	5	7.5	7	6.5	5.5	5.5
ST	5	3	3.5	3.5	2.5	4	3	8	6.5	5.5	5.5	2.5	5	7.5	7	6.5	5.5	5.5
LU	1.5	3	3.5	3.5	2.5	4	3	3.5	6.5	5.5	5.5	2.5	8.5	5	7	6.5	5.5	5.5
SA-IN-IN	1.5	3	9	9	2.5	4	3	3.5	6.5	5.5	5.5	5.5	8.5	2	7	6.5	5.5	5.5
SC and/or HU	9	8	7	7	5	9	9	6	3	5.5	5.5	7	2	2	1	6.5	5.5	1
FE	8	7	8	8	9	8	6	1	2	5.5	5.5	5.5	1	4	2	1	1	5.5

Table 6.20: Categorization of use strategies indicated by the use order of kabarga parts.

a) Groupings, schematic rank order, and correlation coefficients for Spearman's rank order correlation using the 'All units' rank order. See text for discussion.

	Groups of significantly correlated rank orders (P>5%) Head eaten, axial elements eaten before limbs								Incomplete*			Head not eaten	Limbs and marrow eaten before axial elements		Incomplete*				
All units	a1	a1	a1	a1	a1	a2	a3	a3	(a)	(a)	(a)	b	c	c	(c)	(c)	(c)	(c)	(c)
Combine sided elements (A*)	a1	a1	a1	a1	a1	a2	a2	a/c	(a)			b	c	a/c	(c)	(c)	(c)	(c)	(c)
Schematic rank order	SK02	FK01	SK05	FK03	FK05	FK09	FK11	FK06	SK03	SK06	SK09	FK10	FK07	FK02	SK18	SK08	SK14	SK15	SK11
1	m	m	axial	m	m	m	m	m	m	head	head	m	m/l	m	a/l	limb	limb	limb	m
2	axial	axial	m	axial	axial	axial	axial	limb	head			axial	limb	a/l	limb				
3	limb	axial	limb	limb	limb	limb	limb	axial	limb			a/l	axial	limb					
4	axial	limb	limb	limb	limb	limb	axial	limb	limb										
5	limb																		

All coefficients for pairs using 'All units' rank order, illustrating how above groupings were determined. The incompletely used animals (see Table 6.18) correlated to almost all animals (due to their incompleteness) and are shown here provisionally allied with one group or other. Gray boxes indicate a significant correlation (N=18, critical value 0.468 for p< .05).

	SK02	FK01	SK05	FK03	FK05	FK09	FK11	FK06	SK03	SK06	SK09	FK10	FK07	FK02	SK18	SK08	SK14	SK15	SK11
SK02	1.000				a1	a2					a								
FK01	0.506	1.000																	
SK05	0.143	0.558	1.000																
FK03	0.287	0.753	0.767	1.000															
FK05	0.562	0.787	0.498	0.632	1.000														
FK09	0.041	0.369	0.112	0.483	0.196	1.000		a3											
FK11	-0.005	0.410	-0.078	0.330	0.179	0.882	1.000												
FK06	-0.054	0.214	-0.288	0.083	0.025	0.612	0.812	1.000											
SK03	0.184	0.021	-0.209	0.051	0.133	0.487	0.503	0.648	1.000										
SK06	0.427	0.519	0.563	0.534	0.525	0.494	0.491	0.469	0.582	1.000									
SK09	0.427	0.519	0.563	0.534	0.525	0.494	0.491	0.469	0.582	1.000	1.000								
FK10	-0.033	-0.410	-0.217	-0.399	-0.413	0.048	-0.048	-0.116	0.150	0.331	0.331	1.000							
FK07	0.066	0.468	0.356	0.522	0.315	0.042	0.094	0.307	0.190	0.463	0.463	-0.596	1.000	c					c
FK02	0.399	0.463	-0.027	0.217	0.569	-0.036	0.157	0.447	0.376	0.546	0.546	-0.540	0.575	1.000					
SK18	0.103	0.239	0.172	0.195	0.259	-0.026	0.094	0.417	0.358	0.568	0.568	-0.138	0.767	0.663	1.000				
SK08	0.338	0.357	0.327	0.279	0.196	0.257	0.337	0.529	0.419	0.754	0.754	0.308	0.653	0.505	0.758	1.000 --			
SK14	0.362	0.436	0.443	0.460	0.358	0.401	0.426	0.525	0.442	0.833	0.833	0.415	0.593	0.546	0.698	0.921	1.000		
SK15	0.343	0.389	0.563	0.432	0.525	0.345	0.305	0.413	0.544	0.833	0.833	0.415	0.537	0.546	0.744	0.754	0.833	1.000	
SK11	0.636	0.672	0.401	0.697	0.679	0.666	0.635	0.641	0.688	0.754	0.754	0.141	0.653	0.690	0.628	0.666	0.754	0.754	1.000

Coefficients for 'All units, sided elements combined' rank order. Gray boxes indicate a significant correlation (N=12, critical value 0.576 for p< .05).

	SK02	FK01	SK05	FK03	FK05	FK09	FK11	FK06	SK03	SK06	SK09	FK10	FK07	FK02	SK18	SK08	SK14	SK15	SK11
SK02	1.000				a1														
FK01	0.549	1.000																	
SK05	0.124	0.446	1.000																
FK03	0.336	0.666	0.799	1.000															
FK05	0.636	0.802	0.329	0.538	1.000														
FK09	0.203	0.430	0.187	0.502	0.29	1.000		a2											
FK11	0.114	0.549	0.010	0.341	0.367	0.881	1.000												
FK06	-0.044	0.301	-0.306	0.063	0.096	0.566	0.757	1.000											
SK03	0.061	-0.094	-0.423	-0.056	0.005	0.283	0.311	0.589	1.000										
SK06	0.402	0.526	0.573	0.537	0.535	0.507	0.486	0.463	0.552	1.000									
SK09	0.402	0.526	0.573	0.537	0.535	0.507	0.486	0.463	0.552	1.000	1.000								
FK10	0.026	-0.259	-0.161	-0.330	-0.397	0.077	0.038	-0.052	0.08	0.224	0.224	1.000							
FK07	-0.128	0.306	0.311	0.547	0.152	0.066	0.030	0.233	0.254	0.46	0.460	-0.490	1.000						
FK02	0.337	0.434	-0.159	0.135	0.572	0.231	0.355	0.622	0.636	0.645	0.645	-0.269	0.402	1.000					
SK18	0.056	0.254	0.091	0.292	0.262	0.094	0.140	0.495	0.535	0.531	0.531	-0.084	0.820	0.715	1.000				
SK08	0.175	0.271	0.248	0.254	0.112	0.238	0.273	0.516	0.444	0.668	0.668	0.287	0.607	0.460	0.738	1.000			
SK14	0.276	0.358	0.343	0.348	0.220	0.339	0.360	0.568	0.51	0.748	0.748	0.371	0.649	0.561	0.783	0.962	1.000		
SK15	0.234	0.316	0.427	0.390	0.430	0.276	0.234	0.358	0.469	0.748	0.748	0.308	0.586	0.645	0.825	0.668	0.748	1.000	
SK11	0.591	0.614	0.297	0.645	0.601	0.654	0.591	0.589	0.615	0.668	0.668	0.115	0.607	0.656	0.689	0.657	0.668	0.668	1.000

b) Groupings, schematic rank order, and correlation coefficients for rank order analysis using the 'Without marrow' rank order. See text for discussion.

	Groups of significantly correlated rank orders (P>5%) Head eaten, axial elements eaten before limbs								Incomplete*			Head not eaten	Limbs and marrow eaten before axial elements		Incomplete*				
Without marrow (B*)	a1	a	a	a	a	a	a	c				b	c	c					
Combine sidees and w/o marrow (A* B*)	a	a	a	a	a	a	a												
Schematic rank order	SK02	FK01	SK05	FK03	FK05	FK09	FK11	FK06	SK03	SK06	SK09	FK10	FK07	FK02	SK18	SK08	SK14	SK15	SK11
1	axial	axial	axial	axial	axial	axial	axial	limb	head	head	head	axial	limb	a/l	limb	limb	limb	limb	
2	limb	axial	limb	limb	limb	limb	limb	axial	limb			a/l	limb	limb	limb				
3	axial	limb	limb	limb	limb	limb	axial	limb	limb				axial						
4	limb																		

Coefficients for 'Without marrow' rank order. Gray boxes indicate a significant correlation (N=12, critical value 0.576 for p< .05).

	SK02	FK01	SK05	FK03	FK05	FK09	FK11	FK06	SK03	SK06	SK09	FK10	FK07	FK02	SK18	SK08	SK14	SK15
SK02	1.000						a											
FK01	0.622	1.000																
SK05	0.212	0.372	1.000															
FK03	0.201	0.442	0.881	1.000														
FK05	0.306	0.580	0.425	0.278	1.000													
FK09	0.703	0.717	0.656	0.773	0.427	1.000												
FK11	0.650	0.813	0.178	0.299	0.381	0.621	1.000											
FK06	0.311	0.255	-0.212	-0.290	-0.049	-0.063	0.502	1.000										
SK03	0.262	0.224	0.379	0.119	0.364	0.157	0.243	0.521	1.000									
SK06	0.448	0.580	0.617	0.591	0.580	0.619	0.586	0.507	0.825	1.000								
SK09	0.448	0.580	0.617	0.591	0.580	0.619	0.586	0.507	0.825	1.000	1.000							
FK10	0.414	0.619	0.547	0.505	0.192	0.549	0.316	-0.080	-0.028	0.255	0.255	1.000						
FK07	-0.430	-0.381	-0.037	-0.203	-0.325	-0.427	-0.313	0.357	0.542	0.409	0.409	-0.182	1.000					
FK02	-0.080	-0.010	-0.254	-0.406	0.262	-0.262	0.124	0.633	0.594	0.601	0.601	-0.413	0.416	1.000				
SK18	-0.360	-0.448	-0.243	-0.495	-0.159	-0.598	-0.364	0.381	0.531	0.318	0.318	-0.285	0.829	0.601	1.000			
SK08	0.353	0.234	0.187	0.119	0.024	0.189	0.344	0.748	0.626	0.633	0.633	0.266	0.776	0.528	0.633	1.000		
SK14	0.301	0.392	0.428	0.423	0.287	0.409	0.439	0.633	0.531	0.748	0.748	0.402	0.661	0.601	0.507	0.885	1.000	
SK15	0.259	0.287	0.617	0.360	0.580	0.325	0.208	0.381	0.741	0.748	0.748	0.402	0.577	0.601	0.633	0.633	0.748	1.000

Coefficients for 'Without marrow, sided elements combined' rank order. Gray boxes indicate significant correlation using D values (N=12, critical value 48 for p< .05).

	SK02	FK01	SK05	FK03	FK05	FK09	FK11	FK06	SK03	SK06	SK09	FK10	FK07	FK02	SK18	SK08	SK14	SK15
SK02	0						a											
FK01	36	0																
SK05	76	76	0															
FK03	76	76	0	0														
FK05	45	37	89	89	0													
FK09	18	36	31	31	55	0												
FK11	33	7	77	77	49	34	0											
FK06	98	71	141	141	119	107	61	0										
SK03	147	110	110	110	106	119	107	50	0									
SK06	68	50	47	47	50	41	50	58	25	0								
SK09	68	50	47	47	50	41	50	58	25	0	0							
FK10	71	53	73	73	100	62	68	113	154	104	104	0						
FK07	196	162	111	111	171	144	159	98	35	68	68	134	0					
FK02	112	96	159	159	68	123	100	49	33	44	44	164	98	0				
SK18	181	159	150	150	148	163	161	78	42	82	82	136	27	60	0			
SK08	117	106	110	110	133	99	95	43	44	58	58	94	40	76	33	0		
SK14	95	86	88	88	109	77	77	35	34	41	41	77	32	62	37	8	0	
SK15	104	95	79	79	73	86	104	80	43	41	41	90	41	44	28	58	41	0

Table 6.21: Relationship of use strategies to GUI and meat weight.

Schematic from ‘All parts’ rank order in Table 6.20a. Marrow indicated in gray.

%total GUI is the sum GUI of all parts that had the same rank (see Table 6.18), divided by total GUI. This value could *over*estimate utility, as rank was assigned by first use, and not complete use. This value also roughly represents the relative amount of meat (and marrow) consumed in one sitting.

Rank average GUI is the sum GUI of all parts that had the same rank, divided by the count of parts that had the same rank, and indicates if the meal generally consisted of high- or low-ranked utility parts.

The weight (part weight including meat and bone) is given here to show its general agreement with %total GUI. Most parts were only weighed at parts butchery, and the values below include estimates (e.g. 2CE equals a fourth of a neck unit) as well as actual measurements. Again, the values tend to overestimate.

a) The ‘soup’ use pattern.

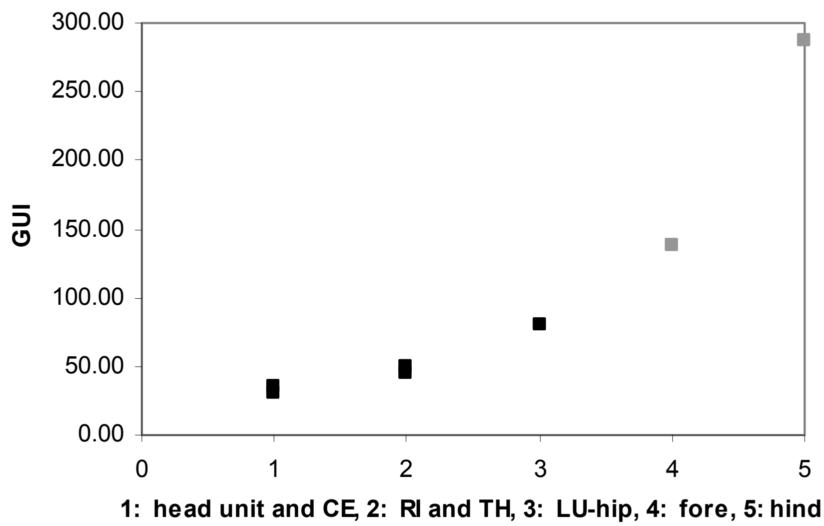
		Head eaten, axial elements eaten before limbs								Incomplete*		
Schematic rank		**SK02**	**FK01**	**SK05**	**FK03**	**FK05**	**FK09**	**FK11**	**FK06**	**SK03**	**SK06**	**SK09**
	1	m	m	axial	m	m	m	m	m	m	head	head
	2	axial	axial	m	axial	axial	axial	axial	limb	head		
	3	limb	axial	limb	limb	limb	limb	limb	axial	limb		
	4	axial	limb	limb	limb	limb	limb	axial	limb	limb		
	5	limb										
%total GUI												
		SK02	**FK01**	**SK05**	**FK03**	**FK05**	**FK09**	**FK11**	**FK06**	**SK03**	**SK06**	**SK09**
	1	20%	14%	33%	14%	14%	17%	17%	17%	20%	2%	2%
	2	6%	22%	14%	25%	26%	29%	18%	32%	2%		
	3	16%	36%	16%	16%	20%	32%	32%	13%	16%		
	4	22%	17%	16%	17%	32%	22%	19%	17%	8%		
	5	24%										
Rank average GUI												
		SK02	**FK01**	**SK05**	**FK03**	**FK05**	**FK09**	**FK11**	**FK06**	**SK03**	**SK06**	**SK09**
	1	3	3	3	3	2	3	3	3	3	1	1
	2	5	4	2	4	3	4	4	1	4		
	3	2	1	1	1	4	1	1	4	1		
	4	4	2	1	2	1	2	2	2	2		
	5	1										
Weight (kg)												
		SK02	**FK01**	**SK05**	**FK03**	**FK05**	**FK09**	**FK11**	**FK06**	**SK03**	**SK06**	**SK09**
	1			3.44				0.35	0.49	0.75		
	2	2.15	2.60		5.01	2.45	3.75	2.36	2.60			
	3	3.20	3.60	1.50	1.80	1.75	2.00	2.20	3.50			
	4	3.04	1.70	1.60	1.46	2.08	1.11	2.22	1.58			
	5	0.77										

b) The ‘snack’ use pattern.

		Head not eaten	Limbs and marrow eaten before axial elements						
					Incomplete*				
Schematic rank		**FK10**	**FK07**	**FK02**	**SK18**	**SK08**	**SK14**	**SK15**	**SK11**
	1	m	m/l	m	a/l	limb	limb	limb	m
	2	axial	limb	a/l	limb				
	3	a/l	axial	limb					
	4								
	5								
%total GUI		**FK10**	**FK07**	**FK02**	**SK18**	**SK08**	**SK14**	**SK15**	**SK11**
	1	8%	46%	14%	40%	32%	16%	8%	14%
	2	19%	17%	39%	16%				
	3	44%	22%	16%					
	4								
	5								
Rank average GUI		**FK10**	**FK07**	**FK02**	**SK18**	**SK08**	**SK14**	**SK15**	**SK11**
	1	3	1	3	2	1	1	1	1
	2	2	2	2	1				
	3	1	3	1					
	4								
	5								
Weight (kg)		**FK10**	**FK07**	**FK02**	**SK18**	**SK08**	**SK14**	**SK15**	**SK11**
	1		3.10				1.00		
	2	2.62	1.63	1.80					
	3	3.75	4.21	0.67					
	4								
	5								

Figure 6.22: Use order.
Kabarga use order of ‘complete and ‘soup’ type, averaged, combined.
Black = axial parts, gray = limb parts.

a) Use order vs. GUI.



b) Use order vs. total time.
See Figure 6.12c for total time.

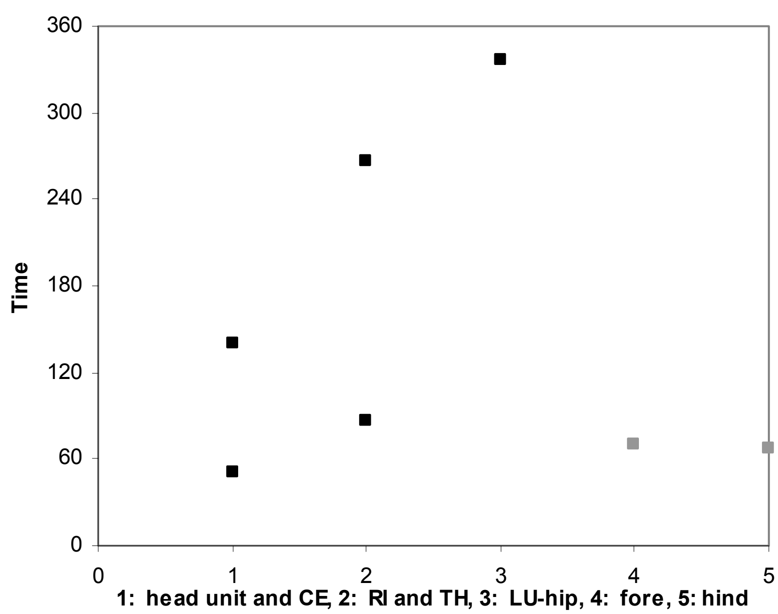


Table 6.23: Observed major reindeer butchery events.

Kill butchery: evisceration, skinning, and some disarticulation at kill site.
Field butchery: further disarticulation, soft part and fluid collection. If transport method is pack reindeer, the animal is completely cut up into parts at this stage.
Parts butchery: disarticulation of headless, lower limbless body into parts.
Kamus butchery and marrow cracking: processing of lower limbs
Head butchery: skinning and disarticulation of head.

	FR01	**SR01**	**SR02**	**SR03**	**SR04**	**SR05**
Hunt observed?	N	N	N	N	N	N
Kill butchery recorded?	N	**Y**	N	N	N	N
Field butchery recorded?	N	**Y**	N	**Y**	N	N
Field butchery result	*Parts*	*Whole*	*Whole*	*Whole*	*Parts*	*Parts*
Transport type	*Pack*	*Sled*	*Sled*	*Sled*	*Pack*	*Pack*
Parts butchery recorded?	n/a	**Y**	**Y**	**Y**	n/a	n/a
Kamus butchery recorded?	Y	Y	Y	Y	Y	Y
Marrow cracking recorded?	Y	Y	Y	Y	Y	Y
Head butchery recorded?	Y	Y	Y	Y	Y	Y

Figure 6.24: Reindeer after kill site butchery.
SR02, immediately prior to field butchery.

Table 6.25: Observed kill butchery.

Date	3/24		
Animal	R01		
Butcher	VS VD		
-	-	-	R01 brought back whole by sled, rolled off sled and over on side.
6:35:26	6:36:05	0:00:39	Slit fur on body at chest (VS). Separate kamus from body fur, front kamus (VD), hind kamus (VS). Front kamus extends to proximal RAUL, hind kamus extend halfway up TI.
6:36:10	6:36:49	0:00:39	Slit fur on body, chest to chin, cutting through lower lips (VD)
6:36:49	6:37:39	0:00:50	Slit fur on body, abdomen to anus (VS). Slit fur on upper limb, forelimb (VD), hindlimb (VS).
6:37:48	6:49:09	0:11:21	Peel fur. Start at inner thigh hindlimb (VS) and from underarm forelimb (VD). Use knife on limb and neck area (VD), and fisting on body. Peel all R side to spine, 6:40:16 flip animal, do L side. Fur off, tail cut off with fur.
6:43:34	6:43:35	0:00:01	FE meat cut a bit (VS)
6:44:09	6:46:47	0:02:38	Cut chest surface lightly with knife, at L joint ST-RI, and down to abdomen, also off to the left side of center line. Open abdominal cavity with a series of shallow cuts tracing original cut. Innards out. Cut caudal L ST-RI joint to get stomach out. Stomach broke from bullet hit; contents scooped out with hands. Stomachs carried short distance from butchery area, abdominal fat kept near body (VS).
6:47:04	6:47:12	0:00:08	Intestines and colon out. Buried in snow, surface washed in snow (VS).
6:47:47	6:48:20	0:00:33	Abdominal meat cut further towards anus, uterus removed with knife (with foetus). Put uterus/foetus under tree and cover with snow (VS).
6:48:35	6:49:05	0:00:30	Liver out (VS).
6:49:10	6:49:40	0:00:30	L ST-RI joint cut further towards cranial. Blood pooled in body cavity. Some mixing with knife-point (VS).
6:49:23	6:49:45	0:00:22	Lower L forelimb cut off at RAUL. Cut from anterior, then snapped towards posterior (VD).
6:49:50	6:49:55	0:00:05	Lower L hindlimb cut off at TI (VS).
6:50:00	6:50:29	0:00:29	Lower R forelimb cut off at RAUL (VD).
6:50:06	6:50:11	0:00:05	Lower R hindlimb cut off at TI (VS).
6:50:35	6:51:02	0:00:27	Meat cut on ventral neck to expose windpipe. Deep cut by knife on dorsal AT-AX joint, then cut meat all around AT-AX joint. Head twisted 360 degrees, off (VS).
6:51:15	6:51:40	0:00:25	L ST-RI joint separated completely (VS).
6:51:48	6:52:30	0:00:42	Windpipe taken out, lateral surface meat on neck is sliced off but not completely. Lungs, heart, and windpipe pulled out (VS). Heart cut off lungs and windpipe (VD).
6:54:10	6:56:45	0:02:35	VS cleans stomach - turn inside out, wring out, all stomachs.
-	7:09:40		Cover meat with fur (fur side out), then with snow (VS VD). Cover stomach, lungs and windpipe, heart, liver with snow.
Time (total)	**0:34:14**		
Time (meat)	**0:26:06**		

Figure 6.26: Reindeer skinning pattern.
Ventral view.

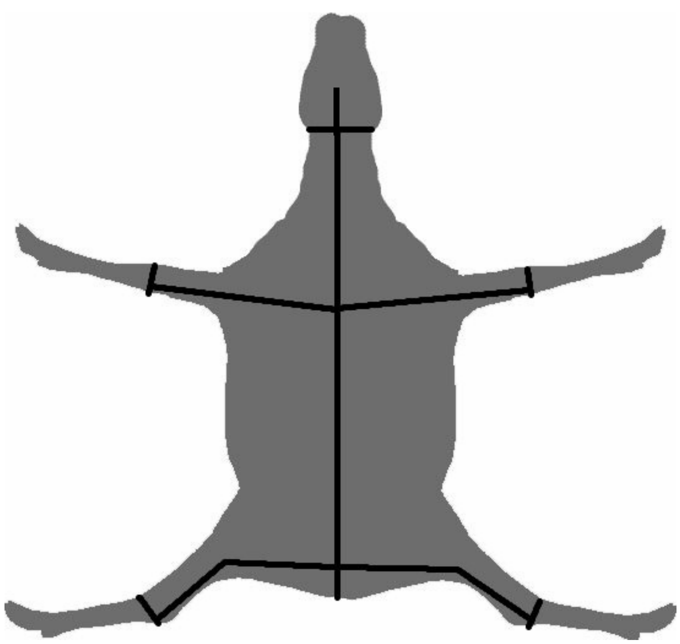


Figure 6.27: Reindeer kill butchery: evisceration.

SR01 eviscerated at kill butchery, from right side.

Table 6.28: Observed reindeer field butchery (for sled transportation).

Date		3/25	
Animal		R02	
Butcher		VS VD	
-	-	-	R02 left covered in snow and fur overnight at kill site. Body fur removed, with furry head and lower limbs still attached to body. Blood pooling in cavity, organs stored outside body.
9:00:05	9:00:27	0:00:22	Fur removed from meat. Fur covered meat, fur side out (VS VD).
-	-	-	Sled prepared for loading. Ropes untied, tarp spread (VS VD).
9:01:05	9:01:35	0:00:30	Stomach and intestines put in canvas bag. Stomachs already emptied (VS).
9:01:45	9:02:07	0:00:22	Omasum prepared into bag, with opening twisted around sharpened stick (VS).
9:02:25	9:04:22	0:01:57	Blood for human consumption skimmed carefully and poured in omasum (VS).
-	-	-	Omasum bag closed with stick, then tied with string (VS).
9:04:59	9:05:13	0:00:14	Rumen (caudroventral blind sac, or ventral sac of rumen) prepared as bag with stick (VS).
9:05:15	9:06:44	0:01:29	Blood for dogs scooped into rumen (VS).
9:06:46	9:07:26	0:00:40	Rumen bag closed with stick, then tied with string (VS).
9:07:39	9:08:50	0:01:11	Deep cut by knife on dorsal and ventral AT-AX joint, then cut meat all around AT-AX joint. Head forced back towards spine, off (VD).
9:08:02	9:08:15	0:00:13	Lower L hindlimb cut off at TI. Posterior TI meat sliced from distal-posterior to proximal-anterior direction to expose FE-TI joint while meat remain attached to FE meat. Meat cut towards FE-TI joint, then limb snapped off (VS).
9:08:20	9:08:35	0:00:15	Lower R hindlimb cut off at TI (VS).
9:08:38	9:08:52	0:00:14	Lower L forelimb cut off at RAUL. Cut from anterior, then snapped towards posterior (VS).
9:08:52	9:08:57	0:00:05	Examine ear of R02 (VS VD).
9:09:20	9:09:32	0:00:12	Lower R forelimb cut off at RAUL (VS? VD?).
9:09:46	9:10:05	0:00:19	Lower limbs put in canvas bag (VS VD).
-	-	-	Tarp rearranged on sled (VS VD).
9:10:26	9:10:33	0:00:07	Body, with lower limbs and head off, moved onto tarp (VS VD).
9:10:35	9:11:50	0:01:15	Organs, blood bags, bowl, canvas bags of stomach placed into body cavity. Canvas bag of intestines and head placed separately. Canvas bag of lower limbs on top, then fur over everything. All of R02 on one sled.
9:11:50	9:14:12	0:02:22	Close tarp, tie down sled with rope.
Time (total)		**0:14:07**	

Date		4/28	
Animal		R03	
Butcher		VS SA	
-	-	-	R03 left covered in fur overnight at kill site, on bed of thin branches. Body fur removed, furry head removed, with furry lower limbs still attached to body (R fore and hindlimb removed). Cavity opened with L ST-RI joint cut open. Blood pooling in cavity, organs stored outside body.
10:33:24	10:37:37	0:04:13	Blood for human consumption skimmed carefully and placed in plastic 2L bottle (VS).
10:33:24	10:39:30	0:06:06	Stomach (stored with contents inside) opened, emptied, and cleaned with snow (SA).
10:39:30	10:41:31	0:02:01	Caudroventral blind sac, or ventral sac of rumen selected for bag (VS). Stomach opened from different location (SA) and some time taken to figure out which part to use. Cut bag off (SA).
10:42:30	10:45:07	0:02:37	Put stomach into canvas bag. Cut colon/lower intestines off other intestines and squeeze out contents (VS). Some intestine parts given to dog.
-	-	-	Rumen sac made into bag with sharp stick (VS).
10:47:45	10:49:40	0:01:55	Blood for dogs scooped into rumen (SA VS).
-	-	-	Leftover blood scooped onto ground.
10:53:26	10:53:56	0:00:30	Lower L forelimb cut off at RAUL, cut from medial and anterior, then all around, then snapped towards posterior (VS).
10:54:10	10:54:26	0:00:16	Lower L hindlimb cut off at TI. Posterior TI meat sliced from distal-posterior to proximal-anterior direction to expose FE-TI joint while meat remain attached to FE meat. Meat cut towards FE-TI joint, then limb snapped off (VS).
10:54:39	10:55:20	0:00:41	Vagina and colon out, deposited on tree branch away from dog (VS).
10:56:05	10:59:40	0:03:35	Pack R03 on one sled (SA VS).
Time (total)		**0:26:16**	

Figure 6.29: Reindeer field butchery.

a) Bag of blood (SR02).

b) Disarticulated head, with AT attached (SR01).

c) Disarticulation of lower limbs (SR01, VS disarticulating FE-TI joint from posterior, Vadim twisting lower forelimb at HU-RAUL joint after cutting).

Table 6.30: Cached moose parts retrieved in Fall field season.

Part	Weight
stomach (for dogs - w/ blood)	6.20
1 L RI 4 RRI TH CE (dramah)	>20kg
CE	9.00
L RI and TH	14.90
lung and windpipe	4.00
heart	1.75
SA INLR LU	19.80
8R RI	3.40
L FE	14.00
L SCHU	12.40
liver	4.20
R FE	13.80
R SCHU	11.90
head jaw antlers	14.60

Table 6.31: Observed reindeer parts butchery.

Date		3/25	
Animal		R01	
Butcher		VD	
-	-	-	R01 body without lower limbs and head.
-	12:25:49	-	R FE off.
12:25:56	12:26:07	0:00:11	R SCHU off, with knife sliced from underarm towards dorsal. Flip body over.
12:26:32	12:27:07	0:00:35	L SCHU off.
12:27:15	12:27:22	0:00:07	L abdominal meat cut to hang from ST.
12:27:30	12:27:50	0:00:20	L ST-RI joint cut from interior of body cavity, from cranial direction. (R ST-RI joint and abdominal meat already cut)
12:28:00	12:28:10	0:00:10	ST off?
12:28:25	12:28:42	0:00:17	L FE off.
12:29:01	12:31:11	0:02:10	L RI cut from interior. Count RI, cut b/w RI to separate, then trace RI-TH joint with knife on both ventral and dorsal sides. Trace several times, then RI forced outwards. Knife forced into some individual TH-RI joints but not all. Final cut caudal to cranial, L RI off.
-	-	-	VD steps on dog, gives dog a bit of meat.
12:31:30	12:33:00	0:01:30	R RI cut - count RI, cut b/w RI to separate, then insert knife point into each cranial/caudal TH-RI articulation. RI unit forced outwards, cut through meat from cranial to caudal. R RI off.
12:33:21	12:33:54	0:00:33	TH-TH joint separated from ventral, take off upper dramah (TH-RI) unit.
12:34:09	12:34:16	0:00:07	TH-TH joint separated from ventral, take off TH unit.
12:34:22	12:34:54	0:00:32	Slit open fat sac of kidneys, remove kidneys.
12:34:58	12:35:59	0:01:01	TH-LU joint cut, lower dramah (TH-RI) unit off. Cut meat from both sides then ventral to expose joint, insert knife point into joint, force unit towards dorsal.
12:36:19	12:37:17	0:00:58	CE-TH joint cut, neck unit off. Cut all around with knife. Go get axe (12:37:07 back with axe). Chop with axe from dorsal, finish cut with knife.
11:37:20	12:38:06	1:00:46	Meat on SA-IN joints cut by knife on dorsal (not filmed). Chop out SA with axe, finish cut with knife.
12:38:09	12:38:15	0:00:06	IN-IN joint chopped with axe, finish cut with knife.
Time (total)		**0:12:26**	(start time?)

Date		3/25	
Animal		R02	
Butcher		VS	
-	-	-	R02 body without lower limbs and head.
12:29:07	12:29:17	0:00:10	L SCHU off, with knife sliced from underarm towards dorsal.
12:29:25	12:29:43	0:00:18	L FE off. Meat cut at FE-IN joint to expose joint, some knife use at acetabulum.
12:30:37	12:31:23	0:00:46	L ST-RI joint cut from exterior of body cavity, to extend the cut (from field butchery) to cranial end. R ST-RI joint cut from exterior. ST off.
12:31:00	12:33:40	0:02:40	Neck meat cut back (thinly) to expose windpipe. Switch to L RI while YU ladles out pooled blood. YU finished around 12:33:40.
12:32:20	12:33:34	0:01:14	Abdominal meat cut off from last L RI. RI counted, then cut L RI from interior. Cut b/w RI to separate, then insert knife point into TH-RI articulation while snapping RI outwards, cutting through at TH-RI joint but in continuous motion. L RI off.
12:33:40	12:33:58	0:00:18	Neck meat cutting continued, cut windpipe out and pull out with lungs and heart.
12:33:58	12:34:30	0:00:32	Clean esophagus off windpipe, deposit away from dogs. (Heart cut from windpipe and slit in half).
12:35:04	12:35:28	0:00:24	Kidneys out. (Body flipped over).
12:36:01	12:36:35	0:00:34	R FE off - same as L FE, but with slit cut in meat for finger-hold. Some talking and delay.
12:37:15	12:37:38	0:00:23	R SCHU off.
12:37:49	12:38:56	0:01:07	R RI off. Cut b/w RI to separate (from proximal to distal), then trace RI-TH joint with knife, knife forced into some individual TH-RI joints, force outwards.
12:39:03	12:39:18	0:00:15	Upper dramah (TH-RI) off. TH-TH joint cut from ventral all the way through to dorsal.
12:39:29	12:40:07	0:00:38	TH-TH joint cut, TH unit off. Cut meat from both sides then ventral to expose joint, insert knife point into joint.
12:40:17	12:40:58	0:00:41	Abdominal meat cut off to hang from ST (L and R meat). Tail removed, colon removed, both deposited away from dogs.
12:41:05	12:41:23	0:00:18	Meat on SA-IN joints cut by knife on dorsal.
12:41:25	12:41:42	0:00:17	CE-TH joint cut, neck unit off. Cut meat mainly from ventral and dorsal with knife. Chop with axe.
12:41:50	12:42:00	0:00:10	Chop SA-IN joints from cranial, and wedge out SA.
12:42:05	12:42:12	0:00:07	IN-IN joint chopped with axe, two blows.
Time (total)		**0:13:05**	

Date		4/28	
Animal		R03	
Butcher		YA SA	
-	-	-	R03 body without lower limbs and head.
4:37:35	4:37:46	0:00:11	Stringy surface meat on L side of neck off (YA).
4:37:57	4:38:25	0:00:28	L SCHU off (YA)
4:37:57	4:38:33	0:00:36	L FEL off (SA).
4:38:42	4:41:16	0:02:34	L RI off. Cut between 2nd/3rd RI. Cut back fillet from dorsal surface, back fillet left attached to body at caudal end. Finger hole cut between RI. Count off 8 RI and make a shallow cut in meat, then force RI outwards (forcing by SA). Cut along TH-RI joint from interior, from caudal to cranial. Insert knife point at joint where RI did not pop out (2 RI at cranial end). Cut unit off with knife, from interior, moving cranial to caudal (YA).
4:39:00	4:39:29	0:00:29	Cut abdominal meat to hang at ST (SA). Clean interior of body cavity with knife scrapes (SA).
4:39:29	4:40:11	0:00:42	R ST-RI joint cut (L ST-RI cut in field). ST off (SA).
4:41:40	4:42:06	0:00:26	Free windpipe by cutting meat along neck. Pull out windpipe, heart, and lungs (YA SA).
-	-	-	Heart cut off lungs and windpipe (SA). Flip animal.
4:43:52	4:45:14	0:01:22	L FE off (SA).
4:43:52	4:44:22	0:00:30	Stringy surface meat on R side of neck off (YA).
4:44:36	4:45:03	0:00:27	R SCHU off (YA).
	4:45:22	4:45:22	Tail off (SA, YA instructs). Deposited on tree.
4:45:36	4:45:41	0:00:05	R RI counted from interior, cut proximal-distal between ribs. Cut along TH on dorsal (YA).
4:45:41	4:46:02	0:00:21	L back fillet off and hanging at caudal (YA).
4:46:17	4:47:13	0:00:56	R RI off. Count off 8 RI, cut from exterior along TH, then insert knife point into TH-RI articulation while snapping RI outwards, cutting through at TH-RI joint but in continuous motion from caudal to cranial (YA).
4:47:19	4:48:03	0:00:44	TH-TH joint cut, upper dramah off (SA, YA instructs).
4:48:10	4:49:44	0:01:34	LU-SA joint cut to take off lower dramah (SA tries while YA instructs, then YA takes over). Find joint from ventral (SA, YA). Cut meat following sides of IN (YA). Separate LU-SA joint by inserting knife into joint from ventral, then forcing unit towards dorsal (SA).
4:49:50	4:50:45	0:00:55	Meat on SA-IN joints cut by knife on dorsal (YA). Chop with axe from cranial (SA). Wedge out, SA off.
4:50:49	4:51:14	0:00:25	IN-IN joint chopped with axe, one blow. Finished cut with knife (YA).
4:51:39	4:53:05	0:01:26	CE-TH joint cut, neck unit off. Cut meat from dorsal, neck bent forwards towards ventral and broken. Finish cut with knife (YA).
Time (total)		**0:15:30**	

Table 6.32: Reindeer parts butchery sequences.

The sequences have been generalized and only disarticulation events listed.

Date		3/25	
Animal		R01	
Butcher		VD	
-	12:25:49	-	R FE
12:25:56	12:26:07	0:00:11	R SCHU
12:26:32	12:27:07	0:00:35	L SCHU
12:27:15	12:27:22	0:00:07	ST
12:27:30	12:27:50	0:00:20	ST
12:28:00	12:28:10	0:00:10	ST
12:28:25	12:28:42	0:00:17	L FE
12:29:01	12:31:11	0:02:10	L RI
12:31:30	12:33:00	0:01:30	R RI
12:33:21	12:33:54	0:00:33	upper dramah
12:34:09	12:34:16	0:00:07	TH
12:34:22	12:34:54	0:00:32	kidneys
12:34:58	12:35:59	0:01:01	lower dramah
12:36:19	12:37:17	0:00:58	neck
11:37:20	12:38:06	1:00:46	SA
12:38:09	12:38:15	0:00:06	IN-IN
Time (total)		**0:12:26**	

Date		3/25	
Animal		R02	
Butcher		VS	
12:29:07	12:29:17	0:00:10	L SCHU
12:29:25	12:29:43	0:00:18	L FE
12:30:37	12:31:23	0:00:46	ST (w/o abdominal)
12:31:00	12:33:40	0:02:40	windpipe lungs heart
12:32:20	12:33:34	0:01:14	L RI
12:33:40	12:33:58	0:00:18	windpipe lungs heart
12:33:58	12:34:30	0:00:32	windpipe lungs heart
12:35:04	12:35:28	0:00:24	kidneys
12:36:01	12:36:35	0:00:34	R FE
12:37:15	12:37:38	0:00:23	R SCHU
12:37:49	12:38:56	0:01:07	R RI
12:39:03	12:39:18	0:00:15	upper dramah
12:39:29	12:40:07	0:00:38	TH
12:40:17	12:40:58	0:00:41	meat parts
12:41:05	12:41:23	0:00:18	SA
12:41:25	12:41:42	0:00:17	neck
12:41:50	12:42:00	0:00:10	SA
12:42:05	12:42:12	0:00:07	IN-IN
Time (total)		**0:13:05**	

Date		4/28	
Animal		R03	
Butcher		YA SA	
4:37:35	4:37:46	0:00:11	neck meat
4:37:57	4:38:25	0:00:28	L SCHU
4:37:57	4:38:33	0:00:36	L FE
4:38:42	4:41:16	0:02:34	L RI
4:39:00	4:39:29	0:00:29	ST
4:39:29	4:40:11	0:00:42	ST
4:41:40	4:42:06	0:00:26	windpipe heart lungs heart
4:43:52	4:45:14	0:01:22	L FE
4:43:52	4:44:22	0:00:30	neck meat
4:44:36	4:45:03	0:00:27	R SCHU
	4:45:22	4:45:22	tail
4:45:36	4:45:41	0:00:05	R RI
4:45:41	4:46:02	0:00:21	R RI
4:46:17	4:47:13	0:00:56	R RI
4:47:19	4:48:03	0:00:44	upper dramah
4:48:10	4:49:44	0:01:34	lower dramah/LU
4:49:50	4:50:45	0:00:55	SA
4:50:49	4:51:14	0:00:25	IN-IN
4:51:39	4:53:05	0:01:26	neck
Time (total)		**0:15:30**	

Figure 6.33: Reindeer parts butchery.

a) Forelimb part (SC and HU) removal (SR01).

b) FE disarticulation (SR01).

c) ST disarticulation (SR01).

d) RI disarticulation (SR03).

e) Disarticulation of axial parts (upper half from lower half, SR01).

f) Disarticulation of LU from hip unit (SR01).

g) Disarticulation of neck (CE) unit by axe (SR01).

h) Disarticulation of SA and IN by axe (sacrum from innominates SR03; separation of two innominates SR01).

Table 6.34: Comparison of reindeer parts created in field and parts butchery.

a) With sled transport. See Table 6.35 for estimated weight calculation.

Animal	**SR01**		
Butchery	**Field**	**Parts**	
Butcher	**VS VD**	**VD**	**(kg)**
lungs and windpipe	lungs and windpipe		2.80
heart	heart		1.40
liver	liver		2.00
intestines, stomach	intestines, stomach		7.50
kidneys		kidneys w/ fat	0.40
blood food	blood w/ stomach		1.40
blood dogs	blood w/ stomach		5.00
soft other			
body fur	fur		4.00
head	head, fur, antlers, AT		5.30
kamus	R fore (RAUL and below)		2.10
kamus	L fore (RAUL and below)		2.10
kamus	R hind (TI and below)		2.60
kamus	L hind (TI and below)		2.60
body	body		
ST		ST	4.30
L RI		8 RI L	2.20
R RI		8 RI R	2.25
neck		neck (AX 4CE 1CEfrag)	3.90
neck meat			
dramah		dramah (1CE 6TH 4RILR)	6.40
TH		TH (1LU w/ 5TH)	1.30
lower dramah			
LU		LU (4LU)	4.40
SA		SA (w/ 1 caudal)	0.60
L IN		L IN	2.25
R IN		R IN	3.20
L SCHU		L SCHU	5.60
R SCHU		R SCHU	6.00
L FE		L FE	7.40
R FE		R FE	5.80
fluid discard	stomach content (est)		8.00
blood discard	blood (est)		5.00
soft discard	uterus, foetus		8.00
soft discard	Vagina/colon		0.18
soft discard			
tail discard			
Total	*w/ stomach content, blood		115.98
Body part weight			55.60
Est. living weight	*same as total weight		115.98

Animal	**SR02**		
Butchery	**Field**	**Parts**	
Butcher	**VS VD**	**VS**	**(kg)**
lungs and windpipe	lungs and windpipe		1.90
heart	heart		1.40
liver	liver		2.25
intestines, stomach	intestines, stomach, fat		7.50
kidneys		kidneys w/ fat	0.40
blood food	blood w/ stomach		1.30
blood dogs	blood w/ stomach		8.50
soft other			
body fur	fur		4.35
head	head, fur, antlers, AT		6.40
kamus	R fore (RAUL and below)		2.25
kamus	L fore (RAUL and below)		2.30
kamus	R hind (TI and below)		2.75
kamus	L hind (TI and below)		2.80
body	body		
ST		ST	4.10
L RI		8RI R	2.75
R RI		8RI L	3.10
neck		neck unit (AX 3CE)	0.90
neck meat			
dramah		dramah (6 CE/TH, 4RI)	6.10
TH			
lower dramah		TH-LU (8TH 4 LU 1 RI)	6.60
LU			
SA		SA (w/ 1 caudal, 1 LU)	1.50
L IN		L IN	3.10
R IN		R IN	3.20
L SCHU		L SCHU	6.30
R SCHU		R SCHU	6.40
L FE		L FE	8.50
R FE		R FE	8.90
fluid discard			
blood discard	blood (est)		10.00
soft discard	uterus, foetus		8.80
soft discard	vagina/colon		0.40
soft discard	esophagus		0.20
tail discard			
Total	*w/ blood		124.95
Body part weight			61.45
Est. living weight			127.78

Animal	**SR03**		
Butchery	**Field**	**Parts**	
Butcher	**SA VS**	**YA SA**	**(kg)**
lungs and windpipe		lungs w/ windpipe	2.30
heart		heart	1.10
liver	liver w/ fat		2.30
intestines, stomach	stomach?		0.52
kidneys	kidneys		0.24
blood food	blood bottle		2.00
blood dogs	blood w/ stomach, intestines		5.75
soft other			
body fur	fur		4.90
head	head, fur, antlers		5.90
kamus	R fore (RAUL and below)		2.40
kamus	L fore (RAUL and below)		2.30
kamus	R hind (TI and below)		3.40
kamus	L hind (TI and below)		3.20
body	body		
ST		ST w/ abdominal meat	4.20
L RI		RI R	1.75
R RI		RI L	2.10
neck		neck unit (AT AX CE)	5.25
neck meat		neck meat	0.51
dramah			
TH		dramah (1CE 9TH 5RI)	7.30
lower dramah		TH-LU (9TH 5LU 2RI)	7.50
LU			
SA		SA	0.82
L IN		L IN	2.25
R IN		R IN	3.10
L SCHU		L SCHU	7.00
R SCHU		R SCHU	6.60
L FE		L FE	9.00
R FE		R FE	8.10
fluid discard			
blood discard			
soft discard	penis		
soft discard	testicles		
soft discard	esophagus		
tail discard		tail	0.01
Total	*w/o blood		101.80
Body part weight			65.48
Est. living weight			136.16

b) With pack reindeer transport.

Animal Butchery Butcher	SR04 Field VD	(kg)	SR05 Field VD SA	(kg)
lungs and windpipe	Lung, windpipe, some meat	2.50	Lung, windpipe, some meat	1.00
heart	heart	1.80	heart	0.80
liver	liver	1.80	liver	1.00
kidneys	(w/ lower dramah)		kidneys	
soft other			fat and teats	0.50
head	head, fur, antlers, AT	9.40	head skinned (broken CR, MD), AT	3.10
kamus	R fore (RAUL and below)	3.20	R fore (RAUL and below)	
kamus	L fore (RAUL and below)	2.70	L fore (RAUL and below)	
kamus	R hind (TI and below)	3.00	R hind (TI and below)	
kamus	L hind (TI and below)	3.80	L hind (TI and below)	
ST	ST w/ abdominal meat	6.15	ST w/ abd meat w/ 2RI	2.25
L RI	8L RI	2.80	8L RI	1.20
R RI	8R RI 8TH	5.40	9R RI	1.40
neck	neck (AX CE)	7.20	neck (AX CE TH 2RI)	1.20
neck meat				
dramah	5L RI 6TH	6.40		
TH	(TH w/ R RI)			
lower dramah	LU (w/ TH RI kidneys)	5.80		
LU				
SA	SA	0.70	LR IN, SA, all LU, 2-3TH, 2RI	7.20
L IN	L IN	3.60		
R IN	R IN	3.10		
L SCHU	L SCHU (w/ prox RAUL)	7.40	L SCHU	3.75
R SCHU	R SCHU	8.00	R SCHU	3.75
L FE	L FE	9.00	L FE	5.40
R FE	R FE	9.20	R FE	5.30
discarded parts	body fur		body fur	
discarded parts	intestines, stomach		intestines, stomach	
discarded parts	blood		blood	
discarded parts	usually discarded parts		usually discarded parts	
Total	*only parts brought back	102.95	*only parts brought back	37.85
Body part weight		74.75		31.45
Est. living weight		155.44		65.40

Table 6.35: Estimated weight values for reindeer.
Svalbard reindeer values from Ringberg et al. (1979).

Wild svalbard reindeer

	A16/76	A17/76	A18/76
total body weight	41.7	57.1	50.0
carcass weight	18.6	29.2	24.5
muscle/tendons/nerve	14.3	19.1	19.0
fat	1.1	7.6	4.9
bone	6.4	7.9	6.6

Ratio to carcass weight *Mean of Svalbard reindeer

	A16/76	A17/76	A18/76	SR01	Mean*
total body weight	2.24	1.96	2.04	2.09	2.08
muscle/tendons/nerve	0.77	0.33	0.38		0.49
fat	0.03	0.13	0.10		0.09
bone	0.15	0.14	0.13		0.14

Known weight from field study

	SR01	SR02	SR03	SR04	SR05
total body weight	115.98				
carcass weight	55.6	61.45	65.48	74.75	31.45

Estimate values from carcass weight

	SR01	SR02	SR03	SR04	SR05
total body weight	115.62	127.78	136.16	155.44	65.40
muscle/tendons/nerve	27.49	30.38	32.38	36.96	15.55
fat	4.77	5.27	5.62	6.42	2.70
bone	7.86	8.68	9.25	10.56	4.44

Table 6.36: Schematic comparison of reindeer parts created in field and parts butchery.

'Y' for parts created. Bold 'Y' indicates part was created in parts butchery. Italicized part names are parts that are created in parts butchery for sled-transported reindeer.

	Sled **SR01** **VS VD**	 **SR02** **VS VD**	 **SR03** **SA VS**	**Pack** **SR04** **VD**	 **SR05** **VD SA**
lungs and windpipe	Y	Y	**Y**	Y	Y
heart	Y	Y	**Y**	Y	Y
liver	Y	Y	Y	Y	Y
intestines, stomach	Y	Y	Y		
kidneys	**Y**	**Y**	Y		
blood food	Y	Y	Y		
blood dogs	Y	Y	Y		
soft other					Y
body fur	Y	Y	Y		
head	Y	Y	Y	Y	Y
kamus	Y	Y	Y	Y	Y
kamus	Y	Y	Y	Y	Y
kamus	Y	Y	Y	Y	Y
kamus	Y	Y	Y	Y	Y
body	Y	Y	Y		
ST	**Y**	**Y**	**Y**	Y	Y
L RI	**Y**	**Y**	**Y**	Y	Y
R RI	**Y**	**Y**	**Y**	Y	Y
neck	**Y**	**Y**	**Y**	Y	Y
neck meat			**Y**		
dramah	**Y**	**Y**		Y	
TH	**Y**		**Y**	Y	
lower dramah		**Y**	**Y**	Y	
LU	**Y**				
SA	**Y**	**Y**	**Y**	Y	Y
L IN	**Y**	**Y**	**Y**	Y	
R IN	**Y**	**Y**	**Y**	Y	
L SCHU	**Y**	**Y**	**Y**	Y	Y
R SCHU	**Y**	**Y**	**Y**	Y	Y
L FE	**Y**	**Y**	**Y**	Y	Y
R FE	**Y**	**Y**	**Y**	Y	Y

Table 6.37: Observed reindeer *kamus* butchery.

Date	11/3													
Animal	R01													
VD					**VS**					**YA**				
Time		**(seconds)**			**Time**		**(seconds)**			**Time**		**(seconds)**		
7:07:00	7:13:21	381	fore	fur						7:02:00	7:13:21	681	hind	fur
					7:08:16	7:10:18	122	fore	tendons/ hoof					
					7:10:20	7:10:46	26	fore	mc-raul					
					7:10:46	7:11:05	19	fore	c					
7:13:40	7:15:50	130	fore	hoof	7:12:17	7:14:43	146	fore	perio	7:13:58	7:21:21	443	hind	fur
7:14:50	7:15:59	69	MC	perio										
7:16:09	7:16:46	37	fore	mc-raul	7:16:24	7:17:45	81	hind	tendons/ hoof					
7:17:50	7:18:32	42	fore	mc-raul										
7:18:43	7:19:09	26	fore	meat	7:18:11	7:19:28	77	hind	mt-ti					
7:19:10	7:20:26	76	RAUL	perio	7:19:30	7:21:30	120	MT	perio					
7:20:00	7:22:11	131	MC	perio						7:21:47	7:23:35	108	hind	hoof
7:25:00	7:27:30	150	MT	perio	7:25:00	7:27:26	146	TI	perio	7:24:09	7:24:40	31	hind	mt-ti
										7:24:40	7:25:59	79	hind	meat
7:27:40	7:28:34	54	hind	t						7:26:18	7:28:45	147	TI	perio
Total	**0:21:34**				**Total**	**0:19:10**				**Total**	**0:26:45**			
Total elapsed				**0:57:33**	**Total man-hours**				**1:07:29**					

Date	3/24													
Animal	R01													
SA					**VD**					**VS**				
Time		**(seconds)**			**Time**		**(seconds)**			**Time**		**(seconds)**		
8:29:48	8:33:42	234	fore	fur	8:30:07	8:34:15	248	hind	fur					
8:33:56	8:37:14	198	fore	tendons										
8:37:14	8:37:50	36	hind	hoof/mt-ti										
8:37:50	8:40:43	173	hind	meat	8:38:08	8:38:32	24	hind	hoof/mt-ti					
					8:38:32	8:39:44	72	hind	meat					
								TI	perio					
8:40:54	8:41:50	56	hind	t	8:41:18	8:42:29	71	fore	tendons					
					8:42:29	8:42:47	18	fore	hoof					
					8:43:50	8:44:22	32	fore	mc-raul					
					8:44:22	8:45:34	72	fore	meat					
8:45:50	8:46:59	69	hind	t										
8:47:17	8:48:53	96	fore	fur	8:47:25	8:47:42	17	fore	c					
										8:50:17	8:50:48	31	hind	t
8:53:15	8:58:32	317	fore					all	perio				all	perio
8:55:18	8:55:41	23	fore	hoof										
8:55:49	8:56:20	31	fore	c										
8:58:44	8:59:50	66	fore	c										
9:09:29	9:16:52	443	all	perio										
Total	**0:47:04**				**Total***	**0:17:35**				**Total***	**0:00:31**			
Total elapsed				**0:47:04**	**Total man-hours***				**1:05:10**					

* does not include periosteum cleaning by VS VD

Date	3/25								
Animal	R02								
VD					**YA**				
Time		**(seconds)**			**Time**		**(seconds)**		
					4:45:42	5:02:07	985	hind	fur
4:54:38	4:59:13	275	fore	fur	5:02:21	5:04:40	139	hind	tendons/ hoof
4:59:29	5:04:14	285	fore	fur	5:04:40	5:04:47	7	hind	mt-ti
5:04:24	5:05:55	91	fore	tendons	5:04:47	5:07:34	167	hind	meat
5:05:55	5:06:42	47	fore	mc-raul					
5:06:42	5:07:07	25	fore	c					
5:07:07	5:08:18	71	fore	meat					
5:08:32	5:11:08	156	fore	tendons	5:08:11	5:19:28	677	hind	fur
5:13:21	5:13:52	31	fore	hoof					
5:13:52	5:14:22	30	fore	mc-raul					
5:14:52	5:15:20	28	fore	meat					
5:15:49	5:17:13	84	RAUL	perio					
5:17:20	5:18:30	70	MC	perio					
5:18:36	5:19:56	80	RAUL	perio					
5:19:56	5:21:14	78	MC	perio	5:19:52	5:21:00	68	hind	tendons
5:21:18	-	-	TI	perio	5:21:00	5:25:34	274	hind	mt-ti
					5:25:34	5:27:12	98	hind	meat
Total*	**0:26:40**				**Total***	**0:41:30**			
Total elapsed				**0:26:40**	**Total man-hours***				**1:08:10**

*VD's total incomplete

Date	4/28								
Animal	R03								
SA					**YA**				
Time		**(seconds)**			**Time**		**(seconds)**		
5:03:02	5:07:23	261	fore	fur	5:03:03	5:07:36	273	fore	fur
5:07:30	5:08:20	50	fore	tendons	5:07:49	5:08:26	37	fore	
5:08:24	5:13:54	330	hind	fur	5:08:26	5:13:50	324	hind	fur
5:14:29	5:17:13	164	hind	tendons					
5:17:13	5:17:48	35	hind	hoof	5:17:05	5:19:39	154	hind	tendons/ hoof
5:17:48	5:19:51	123	hind	mt-ti	5:19:39	5:21:09	90	hind	mt-ti
5:19:51	5:23:17	206	hind	t	5:21:09	5:22:53	104	hind	meat
					5:21:34	5:21:55	21	hind	t (VS)
5:23:17	5:23:55	38	hind	meat	5:23:04	5:25:20	136	fore	tendons/ hoof
5:24:00	5:26:33	153	fore	hoof	5:25:20	5:27:17	117	fore	mc-raul
5:26:33	5:27:09	36	fore	mc-raul					
5:27:09	5:28:17	68	fore	meat	5:27:17	5:28:00	43	fore	meat
5:28:28	5:37:32	544	all	perio	5:28:28	5:37:32	544	all	perio
Total	**0:34:30**				**Total**	**0:34:29**			
Total elapsed				**0:57:33**	**Total man-hours**				**1:08:59**

Date	5/18								
Animal	R04 R05								
SA					**YA**				
Time		**(seconds)**			**Time**		**(seconds)**		
					9:52:47	9:59:10	383	hind	fur
					10:29:57	10:32:50	173	fore	tendons/ hoof
					10:32:50	10:33:52	62	fore	mc-raul
					10:33:52	10:34:30	38	fore	perio
					10:35:07	10:38:09	182	fore	tendons/ hoof
					10:38:09	10:39:46	97	fore	mc-raul
					10:39:46	10:41:07	81	fore	meat
					10:41:26	10:44:30	184	hind	tendons/ hoof
					10:44:30	10:45:56	86	hind	mt-ti
10:45:40	10:47:10	90	MC	perio	10:45:56	10:48:20	144	hind	meat
10:47:26	10:51:14	228	RAUL	perio	10:49:35	10:53:45	250	hind	tendons/ hoof
10:51:32	10:52:10	38	fore	c	10:53:45	10:54:49	64	hind	mt-ti
10:52:21	10:53:15	54	hind	t	10:54:49	10:56:19	90	hind	meat
10:53:17	10:54:41	84	MT	perio					
10:55:50	10:56:27	37	hind	t	10:57:14	10:59:48	154	hind	tendons/ hoof
10:56:31	10:58:04	93	MT	perio					
10:58:30	10:58:57	27	RAUL	perio					
10:59:00	10:59:30	30	RAUL	perio	10:59:48	11:00:45	57	hind	mt-ti
11:00:54	11:01:27	33	fore	c	11:00:45	11:02:11	86	hind	meat
11:01:34	11:03:02	88	MC	perio	11:02:37	11:05:43	186	fore	tendons/ hoof
11:03:16	11:03:54	-	hind	t					
11:03:58	11:06:26	-	MT	perio	11:05:43	11:06:31	48	fore	mc-raul
11:06:33	11:08:07	-	all	perio	11:06:31	11:07:21	50	fore	meat
					11:07:49	11:10:20	151	fore	tendons/ hoof
					11:10:20	11:11:07	47	fore	mc-raul
					11:11:07	11:11:53	46	fore	meat
Total*	**0:22:27**				**Total***	**0:41:56**			
Total elapsed				**1:19:06**	**Total man-hours***				**1:04:23**
	(Two animals)								

*SA's total incomplete
*YA one hindlimb processing, all but one fur processing missing

Abbreviations: fur = skinning, tendons = removal of tendons, hoof = removal of hooves as a pack from MC/MT, meat = removal of proximal TI/RAUL muscle mass, perio = periosteum removal.

Total = total for individual butcher. Total elapsed = for whole kamus butchery sequence. Total man-hours = sum of individual totals.

Figure 6.38: Reindeer *kamus* butchery.

a) *Kamus* removal (SR03).

b) Tendon removal (left). *Chachaki* (muscle mass), tendons, and hooves taken off as one unit (SR03) (right).

c) Cleaning of long bones in preparation of marrow-cracking (SR03).

d) Marrow cracking by axe, and by hammer-and-anvil (SR01).

Table 6.39: Lower limb processing time for reindeer (from *kamus* butchery). This table lists observed forelimb and hindlimb processing time (seconds) for skinning and disarticulation activities.

Kamus butchery was done by multiple butchers (see Table 6.36) and while eating bits of tendon. It was difficult to separate the eating activity (which could arguably be part of the butchery process, as the teeth were used to hold tendons and other parts) from disarticulation activity, and it was also difficult to record all activities simultaneously. The times vary by these conditions, rather than by individual or by skeletal element. Thus the range of time is shown, not the mean.

The major steps of *kamus* butchery were skinning (step 1), disarticulation of long bones and the formation of a meat (*chachaki*)-tendon-hoof part (steps 2-4), and the removal of the pack of carpals/tarsals from the long bones (step 5). The butcher in some cases switched between the major steps (1, 2-4, and 5), and step 5 in some cases occurred together with marrow-cracking. Thus the total processing time do not include step 5.

a) Forelimb.

	FR01		SR01			SR02		SR03		SR04 and SR05						Range
	VD	VS	SA	SA	VD	VD	VD	SA	YA	SA	SA	YA	YA	YA	YA	
1. Take off fur																
Fur	381		234	96		275	285	261	273							1'36" - 6'21"
2. Tendon/hoof off																
tendons			198			156		50								
hoof	69		23		18	31		153								
tendons/hoof	***69***	**122**	***221***		**71**	**91**		***203***				**173**	**182**	**186**	**151**	**1'09" - 3'41"**
3. Disarticulation																
MC-RAUL	42	26			32	47		36	117			62	97	48	47	0'26" - 1'57"
carpals?	MC	MC	RA		MC	MC							MC	MC	MC	
4. Chachaki off																
meat	26				72	71		68	43				81	50		0'26" - 1'21"
5. Disarticulation																
C-MC		19			17	25				38	33					0'17" - 0'38"
C-RAUL			97													1'37"
Total (2,3,4)	**137**		**221**		**175**	**209**		**307**					**360**	**284**		**2'17" - 6'00"**
Total (1,2,3,4)	**518**		**455**			**484**		**568**								**7'35" - 9'28"**

b) Hindlimb.

	FR01			SR-1			SR02		SR03				SR04 and SR05				Range
	VS	YA	YA	SA	SA	VD	YA	YA	SA	SA	VS	YA	YA	YA	YA	YA	
1. Take off fur																	
Fur		681	443				985	677		330	324		383				5'24" - 16'25"
2. Tendon/hoof off																	
tendons									164								
hoof			108		36	24											
tendons/hoof	**81**			**36**			**139**	**68**				**154**		**184**	**250**	**154**	**0'36" - 3'04"**
3. Disarticulation																	
MT-TI	77		31				7	274	123			90		86	64	57	0'07" - 2'03"
carpals?																	
4. Chachaki off																	
meat			79	173		71	167	98	38			104		144	90	86	0'38" - 2'47"
5. Disarticulation																	
T-MT						31				21		54					
T-TI			125					206									
Total (2,3,4)			**110**				**313**	**440**	**161**			**348**		**414**	**404**	**297**	**1'50" - 7'20"**
Total (1,2,3,4)			**553**				**1298**	**1117**									**9'13" - 21'38"**

c) Periosteum cleaning.

	FR01			SR02		SR04 and SR05			Range
	VD	VS	YA	VD	VD	SA	SA	SA	
MC	131			70	78	90	88		1'10" - 2'11"
RAUL	76			84		228	27	30	0'27' - 3'48"
MT	150	120				84			1'24" - 2'30"
TI		146	147						2'26" - 2'27"

Table 6.40: Marrow cracking in reindeer.

Lower limb bones were cracked for marrow while raw, while upper limb bones (FE HU) were cracked after cooking. Only lower limb marrow cracking were recorded.

Time by element is the time from first break to the complete removal of marrow. The variation comes from the shape and fragmentary nature of the break, and the time spent removing splinters and extracting marrow.

'Time/#' is the total time of recorded marrow butchery divided by the number of recorded bones processed.

			Time	Seconds										
				MC	MC	RAUL	RAUL	MT	MT	TI	TI	#Bones	Time/#	Notes
F	**R01**	**VS?**	0:18:58	-	-	-	-	-	-	-	-	8	142	
S	**R01**	**VS**	0:08:15	-		-				-		3	165	
S	**R01**	**VS**	0:20:55	-		-		-		-		4	313	
S	**R03**	**-**	0:45:08	-	-	-		-	-	-	-	7	386	Drinking
S	**R04 R05**	**VS**	0:14:54	63	52	33?	87?	134	71?	-	111	7	128	
S	**R04 R05**	**VS**	0:11:12	65	106	87		66	84	74	136	7	96	

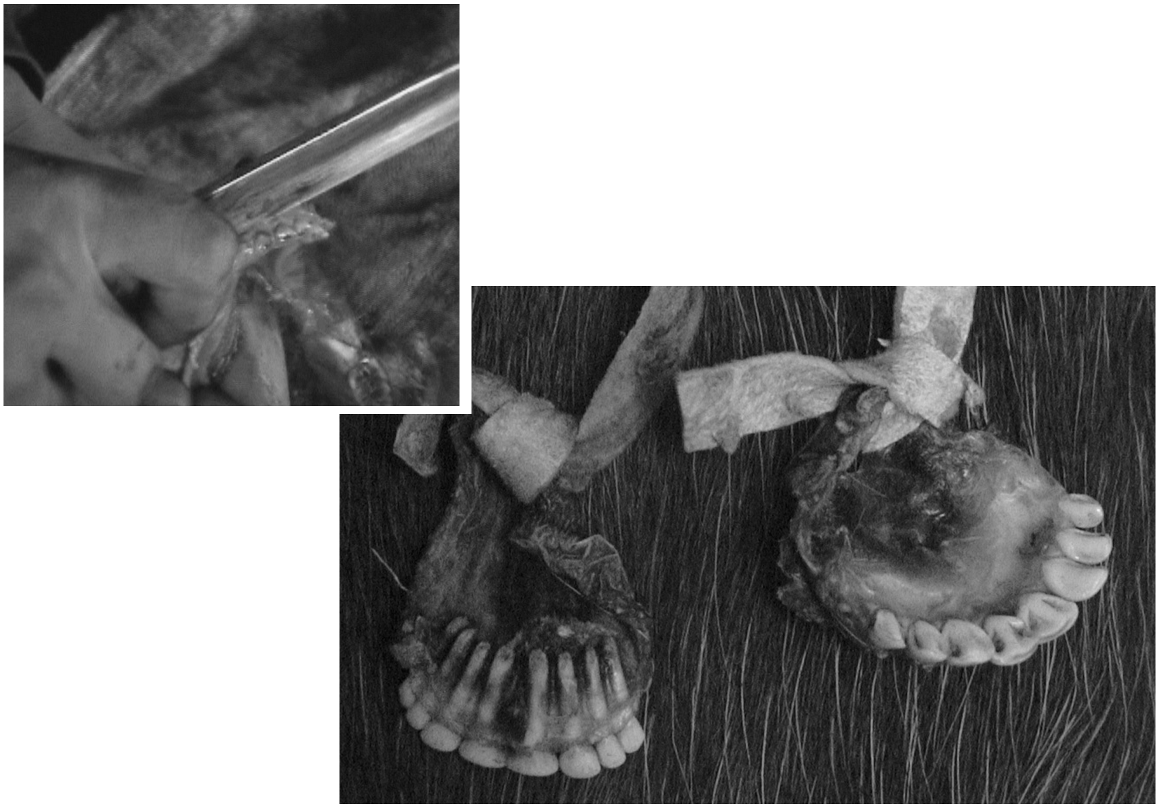
Figure 6.41: Reindeer head butchery.

a) Eyeball removal and slitting (SR01).

b) Skinning of head fur (SR01 and SR02); final removal of fur at nose (OR).

c) Opening of jaw by force, and ceremonial tapping by knife (SR01).

d) Removal of incisors (SR01); use of incisors as rattle on '*ryukaryuk'* (salt-bag).



e) Chopping the cranium by axe (SR01).

Table 6.42: Observed reindeer head butchery.

a) Sample sequence.

Date	11/4		
Animal	R01		
Butcher	VS		
8:35:49	8:45:30	0:09:41	Skinning. Skin from under chin, antler removed with hammer. Eye back-stabbed, eyeball ceremony. Hammer off other antler. Eye back-stabbed, eyeball ceremony. Fur off.
8:40:20	8:41:00	0:00:40	Eyeball slit from side in white of eye, water and aqueous humor squeezed out in ladle, thrown into fire. Eat rest of eye.
8:44:16	8:45:08	0:00:52	Eyeball slit from side in white of eye, water and aqueous humor squeezed out in ladle, thrown into fire. Eat rest of eye.
8:46:03	8:46:42	0:00:39	Unidentified part under mastoid bone removed for barbecueing.
8:46:42	8:47:07	0:00:25	AT-CR joint disarticulation.
8:47:22	8:47:49	0:00:27	Meat at sides of mouth slit towards occipital, jaw forced open by hands.
8:47:50	8:48:00	0:00:10	Tap roof of mouth with knife-point, chant.
8:48:00	8:48:32	0:00:32	Tongue and MD taken off from CR.
8:48:32	8:48:45	0:00:13	Tongue taken off MD.
8:49:00	8:49:32	0:00:32	Cut below incisors from buccal, use hammer to knock out incisors as group (connected with gum/membrane), cut off membrane.
8:49:32	8:49:39	0:00:07	MD split into L and R by hand.
8:49:57	8:53:06	0:03:09	Score CR with knife in preparation of axe-chopping. Cut off nose from head just frontal to eye-sockets. Cut head in half. Take brains out. Cut nose in half.
Total		**0:17:17**	

b) Comparison of observed head butchery events.

Date	11/4		
Animal	R01		
Butcher	VS		
8:35:49	8:45:30	0:09:41	Fur off. Eyeball ceremony x2.
8:46:03	8:46:42	0:00:39	Mastoid meat.
8:46:42	8:47:07	0:00:25	AT off CR.
8:47:22	8:47:49	0:00:27	Open jaw.
8:47:50	8:48:00	0:00:10	Roof of mouth tap and chant.
8:48:00	8:48:32	0:00:32	Tongue and MD off CR.
8:48:32	8:48:45	0:00:13	MD off tongue.
-	-	-	Clean tongue.
8:49:00	8:49:32	0:00:32	Incisors removal.
8:49:32	8:49:39	0:00:07	L MD off R MD.
8:49:57	8:53:06	0:03:09	CR in four pieces, brains out.
Total		**0:17:17**	

Date	3/31		
Animal	R01		
Butcher	VS		
3:17:07	3:17:23	0:00:16	Antler off.
3:17:37	3:17:49	0:00:12	Antler off.
3:18:24	3:24:38	0:06:14	Fur off. Eyeball ceremony x2.
3:25:35	3:26:13	0:00:38	AT off CR.
3:26:20	3:26:40	0:00:20	Open jaw.
3:26:45	3:26:55	0:00:10	Roof of mouth tap and chant.
3:27:02	3:27:30	0:00:28	Tongue and MD off CR.
3:27:37	3:27:52	0:00:15	MD off tongue.
-	-	-	Clean tongue.
3:28:10	3:28:27	0:00:17	Incisors removal.
3:28:32	3:28:37	0:00:05	L MD off R MD.
3:28:41	3:31:32	0:02:51	CR in four pieces, brains out.
Total		**0:14:25**	

Date	3/31		
Animal	R02		
Butcher	VD (VS)		
3:18:09	3:18:48	0:00:39	Antler off.
3:18:59	3:19:51	0:00:52	Antler off.
3:20:02	3:31:41	0:11:39	Fur off. Eyeball ceremony x2.
3:32:30	3:33:14	0:00:44	AT off CR.
3:33:32	3:34:12	0:00:40	Open jaw.
-	-	-	Roof of mouth tap and chant.
3:34:25	3:34:46	0:00:21	Tongue and MD off CR.
3:35:11	3:37:40	0:02:29	(VS) chant, CR in four pieces, brains out.
3:35:11	3:36:23	0:01:12	MD off tongue.
3:36:30	3:37:17	0:00:47	Incisors removal.
3:37:17	3:37:29	0:00:12	L MD off R MD.
Total		**0:19:20**	

Date	5/5		
Animal	R03		
Butcher	VS		
5:05:19	5:05:32	0:00:13	Antler off.
5:05:40	5:05:58	0:00:18	Antler off.
5:06:32	5:16:07	0:09:35	Fur off. Eyeball ceremony x2.
5:16:18	5:18:09	0:01:51	Open jaw, tongue and MD off CR.
5:18:13	5:18:28	0:00:15	MD off tongue.
-	-	-	Clean tongue.
5:18:56	5:19:22	0:00:26	Incisors removal.
5:19:22	5:19:30	0:00:08	L MD off R MD.
5:20:35	5:21:16	0:00:41	CR into head and nose. Parasites off nose.
5:21:53	5:22:31	0:00:38	Head into two pieces, brains out.
5:23:41	5:24:05	0:00:24	Nose into two pieces.
Total		**0:18:46**	

Date	5/18		
Animal	R04		
Butcher	VS		
2:20:25	2:20:50	0:00:25	Antler off (x2).
2:22:34	2:29:49	0:07:15	Fur off. Eyeball ceremony x2.
2:30:29	2:31:02	0:00:33	AT off CR.
2:31:22	2:31:42	0:00:20	Open jaw.
-	-	-	Clean tongue.
2:32:10	2:32:14	0:00:04	Roof of mouth tap and chant.
2:31:17	2:32:37	0:01:20	Tongue and MD off CR.
2:32:40	2:32:49	0:00:09	MD off tongue.
-	-	-	Clean tongue.
2:33:29	2:33:43	0:00:14	Incisors removal.
2:33:46	2:33:48	0:00:02	L MD off R MD.
2:33:59	2:34:30	0:00:31	Parasites off CR.
2:34:34	2:37:12	0:02:38	CR in four pieces, brains out.
Total		**0:16:47**	

Date	5/18		
Animal	R05		
Butcher	VS (VD)		
-	-	-	Fur already off.
2:16:50	2:17:06	0:00:16	Slit side of LR MD.
2:17:07	2:17:22	0:00:15	AT off CR.
2:17:25	2:17:29	0:00:04	Open jaw.
2:17:30	2:17:34	0:00:04	Roof of mouth tap and chant.
2:17:36	2:17:41	0:00:05	Tongue and MD off CR.
2:17:43	2:17:58	0:00:15	MD off tongue.
-	-	-	Clean tongue.
2:18:16	-	-	(VD) Incisors removal and MD LR split.
2:18:28	2:19:33	0:01:05	CR in four pieces, brains out.
Total		**(not complete)**	

Table 6.43: Processing time of head butchery in reindeer.

Processing time is given for both reindeer killed during the field season and reindeer killed between field seasons but butchered during the field season (OR). The 1st OR head was butchered by YU in her first attempt at head butchery, and subsequently took the longest time. The 2nd and 3rd OR heads had their tongue removed by MI, by breaking the mandible – thus the posterior half of the mandible were missing from these heads. As they were over five months old, these crania were cursorily opened to check the freshness of the brain.

	FR01 VS	**SR01 VS**	**SR02 VD**	**SR02 VS**	**SR03 VS**	**SR04 VS**	**SR05 VS**	**OR YU**	**OR* YU**	**OR* YU**	**Mean (all)**	**Mean (VS VD)**
Antler off x2.		28	91		31	25			31		41	44
Fur off. Eyeball ceremony x2.		374	699		575	435			476		640	521
Fur and antler.	581	*402*	*790*		*606*	*460*		830	*507*	746	615	568
AT off CR.	25	38	44			33	15				31	31
Open jaw.	27	20	40			20					27	27
Roof of mouth tap and chant.												
Tongue and MD off CR.	32	28	21			80	20		58	24	38	36
Opening jaw to tongue and MD off.					111		5				111	58
MD off tongue.	13	15	149		15	9	15				36	36
Clean tongue.												
Incisors removal.	32	17	47		26	14			28		27	27
L MD off R MD.	7	5	12		8	2					7	7
CR in four pieces, brains out.	189	171		149	103	158	65	252	61	145	144	139
Total	**1037**	**865**	**1160**		**1126**	**1007**		**1178**	**736**	**990**	**1012**	**1039**

Table 6.24: Summary of butchery times for main butchery events of reindeer.

	FR01	SR01	SR02	SR03	SR04	SR05
Kill butchery (total)		0:34:14				
Kill butchery (meat)		0:26:06				
Field butchery			0:14:07	0:26:16		
Parts butchery		0:12:26	0:13:05	0:15:30		
Kamus butchery (man-hours)	1:07:29	1:05:10	1:08:10	1:08:59	incomplete	incomplete
Marrow-cracking	0:18:58	0:08:15	0:20:55	party	0:14:54	0:11:12
Head butchery	0:17:17	0:14:25	0:19:20	0:18:46	0:16:47	incomplete

Table 6.45: Summary of reindeer part butchery sequences.

a) Rank order of parts, with sided elements represented separately.

	R01 VD	R02 VS	R03 YA SA
FE1	1	1	2
SCHU1	2	2	1
SCHU2	3	6	6
ST	4	3	4
FE2	5	5	5
RI1	6	4	3
RI2	7	7	7
upper dramah	8	8	8
TH/lower dramah	9	9	9
neck	10	11	12
SA	11	10	10
IN-IN	12	12	11

b) Spearman's rank order coefficients for butchery sequences with sided elements represented separately. N=12, critical values are 0.532 ($p< .05$) and 0.661 ($p< .01$). All relationships were highly significant.

	VD	*VS*	*YA SA*
VD	1		
VS	0.944	1	
YA SA	0.909	0.979	1

c) Rank order of parts, with sided elements combined as one category.

	R01 VD	R02 VS	R03 YA SA
FE	2	2	1
SCHU	1	3	2
ST	3	1	3
RI	4	4	4
upper dramah	5	5	5
TH/lower dramah	6	6	6
neck	7	8	9
SA	8	7	7
IN-IN	9	9	8

d) Spearman's rank order coefficients and D values for butchery sequences with sided elements combined as one category. N=9, critical values are 0.602 (p< .05) and 0.735 (p< .01) for correlation coefficient, and 26 (p< .01) for D. All relationships were highly significant.

Correlation coefficient:

	VD	*VS*	*YA SA*
VD	1		
VS	0.917	1	
YA SA	0.933	0.933	1

D values:

	VD	*VS*	*YA SA*
VD	1		
VS	10	1	
YA SA	8	8	1

Figure 6.46: Individual variation in butchery time, for parts butchery.

a) Generalized parts butchery sequence and processing time (seconds). Asterisks denote parts processed with axe.

	VD			**VS**			**YA SA**			**Mean**
			mean			mean			mean	
FE	17		17	18	34	26	36	82	59	37
SCHU	11	35	23	10	23	17	28	27	28	22
ST	37		37	46		46	71		71	51
RI	130	90	110	74	67	71	154	82	118	100
upper dramah	33		33	15		15	44		44	31
TH/lower dramah	68		68	38		38	94		94	67
neck*	58		58	28		28	86		86	57
SA*	46		46	18		18	55		55	40
IN-IN*	6		6	7		7	25		25	13

b) Individual variation.
X-axis is a schematic representation of the part butchery sequence, and Y-axis the mean processing time for each unit.

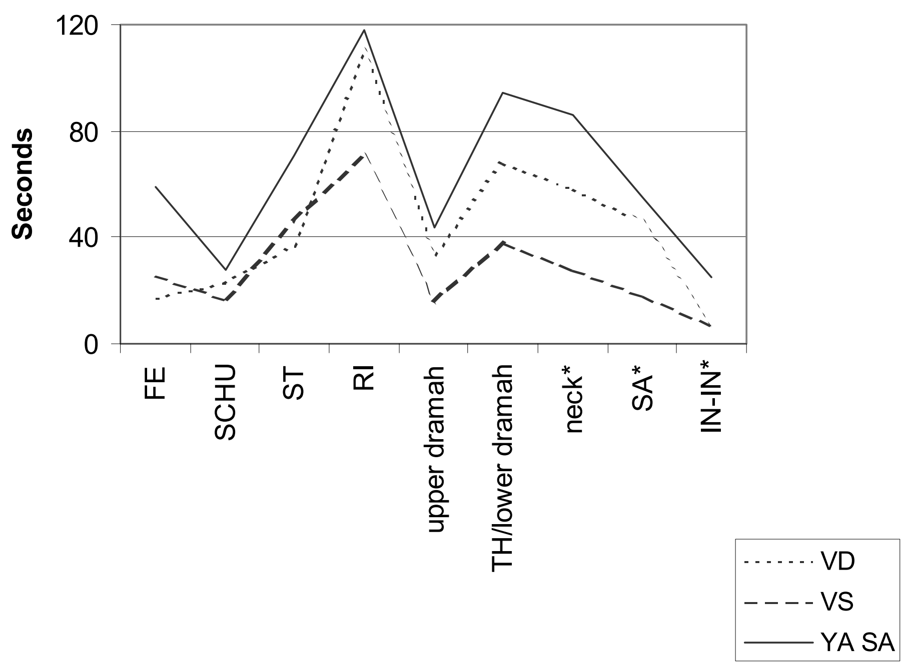


Figure 6.47: Part butchery sequence vs. processing time for reindeer.

a) Average rank order and mean processing time.
As the rank order of reindeer parts butchery did not significantly differ from each other, they were averaged. Asterisks denote parts processed with axe.

	Average order	Mean time
FE	1	37
SCHU	1	22
ST	3	51
RI	4	100
upper dramah	5	31
TH/lower dramah	6	67
neck*	8	57
SA*	7	40
IN-IN*	9	13

b) Butchery sequence vs. processing time.
There is no significant linear correlation (-0.430 for raw time, with critical value 0.666 for p< .05, N=9).

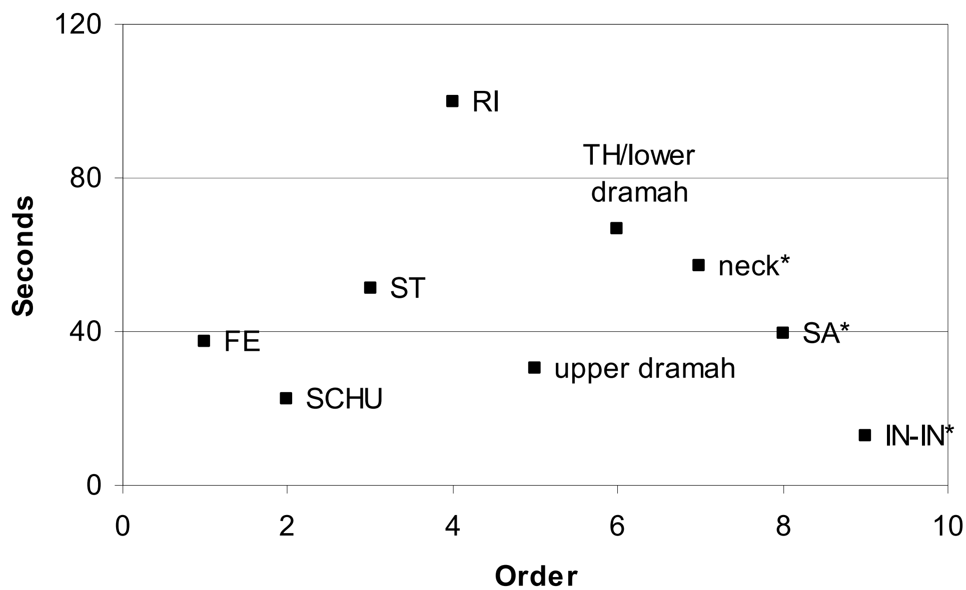


Figure 6.48: Butchery sequence vs. GUI for reindeer.

a) Calculation of GUI for generalized parts, from Binford (1978:73 Table 2.6).

Part	Units added	x portion	GUI
FE	FE	1	198.32
SCHU	SC HU	1	103.28
ST	ST	1	64.13
RI	RI	0.7	34.84
upper dramah	TH RI	0.3	28.59
TH/lower dramah	TH RI	1	95.30
neck*	CE	1	35.71
SA*	pelvis	0.25	11.97
hip*	pelvis	0.75	35.92

b) Butchery sequence vs. GUI.

The linear correlation is significant, -0.695 (critical value 0.666 for p< .05, n=9) when FE and SCHU are included. However, the relationship is not significant, 0.368 (critical value 0.950 for p< .05, n=4) for knife-butchered axial parts, and -0.280 (critical value 0.754 for p< .05, n=7) for all axial parts.

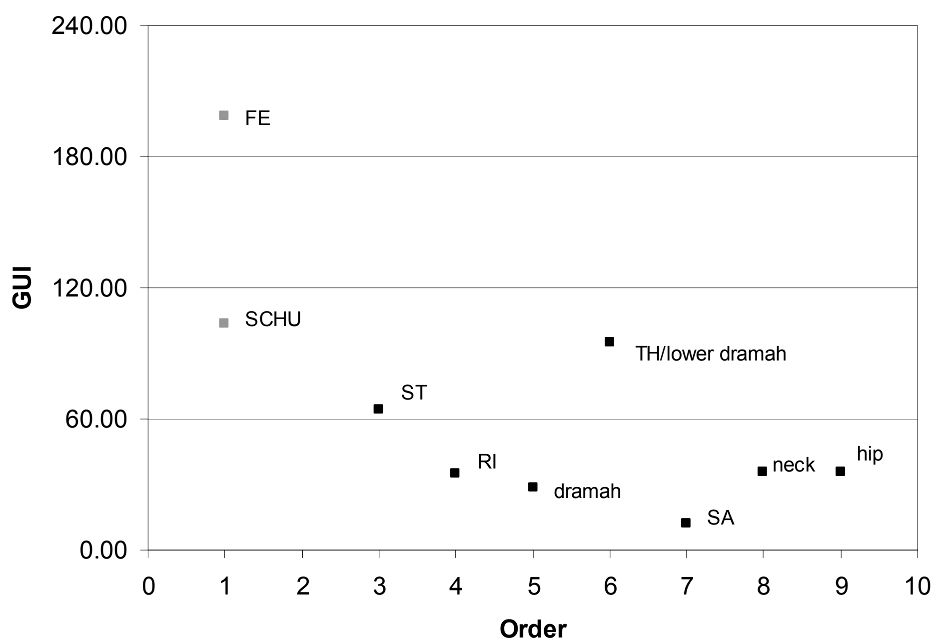


Table 6.49: Bone boiling of reindeer.

Date	5/5		
Butcher	VS		
6:00:08	6:45:51	0:45:43	VS smashes bones - axe-butt on rock. Elements seen on film: TH, RI, LU, SC, IN, FE prox, dist, HU prox, dist, CE, RAUL dist, TI dist. Vertebral body takes long. Midshafts removed and not smashed. One each of RAUL and TI dist, but others cooked bone. Put in pot, cover with water.
6:47:40	7:20:00	0:32:20	Boil bone over open fire.
6:51:49	7:02:34	0:10:45	Additional bone smashing, pulverized bone put aside for boiling the next day. Midshaft fragments thrown in fire. Dogs allowed to eat other spilled fragments.
(6:47:40)	7:40:00	0:52:20	Commence scooping grease from boiling surface of pot, with spoon.
8:13:00	9:10:00	0:57:00	Collected grease re-boiled indoors on pechka, grease scooped out into different container. (next day - cooled bone meal given to dogs)

Figure 6.50: Smashing bones prior to bone boiling.

Table 6.51: Processing time for further reduction of parts (in seconds).

a) Separation of individual vertebrae.
The CE unit is normally processed by axe, but VS and YU attempted a knife-butchery. Mean TH unit disarticulation time combines spine and joint separation.

	SA Time	VD Time	VS Time	YA Time	YU Time	All
AT		SR02 AT-CR 44	SR01 AT-CR 38			
			SR045 AT-CR 15			
			SR045 AT-CR 33			
			FR01 AT-CR 25			
		mean 44	**mean 22**			**33**
AX			SR01 AX-CE 179		SR02 AX-CE 442	
CE knife			SR01 CE-CE 238		SR02 CE-CE 68	
			SR01 CE-CE 215		SR02 CE-CE 354	
			SR01 CE-CE 150		SR02 CE-CE 393	
			mean 201		**mean 272**	**236**
CE axe		SR01 CE-TH 58	SR02 CE-TH 17	SR03 CE-TH 86		
			SR03 CE-CE 17			
		mean 58	**mean 17**	**mean 86**		**54**
TH	SR03 TH-TH 44	SR01 TH-TH 33	SR01 TH-TH 33	SR01 TH-TH 104	SR03 TH-TH 41	
		SR01 TH-TH 7	SR01 TH-TH 23	SR01 TH-TH 98	SR03 TH-TH 33	
			SR01 TH-TH 21	SR01 TH-TH 72	SR03 spines 41	
			SR01 TH-TH 20	SR01 TH-TH 71	***SR03 *one 38***	
			SR01 TH-TH 20	SR01 TH-TH 73		
			SR01 TH-TH 19	SR01 TH-TH 141		
			SR01 spines 49	FR01 TH-TH 46		
			SR01 *one 31			
			SR02 TH-TH 15			
			SR02 TH-TH 14			
			SR02 TH-TH 7			
			SR02 TH-TH 9			
			SR02 TH-TH 8			
			SR02 TH-TH 10			
			SR02 spines 32			
			SR02 *one 16			
			SR045 TH-TH 45			
			SR045 TH-TH 64			
			SR045 TH-TH 10			
			SR045 TH-TH 10			
			SR045 TH-TH 8			
			SR045 TH-TH 4			
			SR045 TH-TH 8			
			SR045 TH-TH 14			
			SR045 spines 32			
			SR045 spines 8			
			SR045 *one 25			
	mean 44	**mean 20**	**mean* 18**	**mean 86**	**mean* 37**	**41**
LU		SR01 TH-LU 61	SR02 TH-LU 38	SR02 LU-TH 110	SR03 LU-TH 143	
				SR02 LU-TH 127		
	SR03 LU-SA 94					
				SR01 LU-LU 63	SR03 LU-LU 116	
				SR01 LU-LU 66	SR03 LU-LU 60	
				SR01 LU-LU 107	SR03 LU-LU 72	
				SR01 LU-LU 102	SR03 LU-LU 59	
				SR02 LU-LU 137		
				SR02 LU-LU 172		
				SR02 LU-LU 121		
	mean 94	**mean 61**	**mean* 38**	**mean 112**	**mean* 90**	**79**

b) Ribs.

RI part = RI separation in parts butchery (for all RI in part), RI-RI = single RI disarticulation in a RI part, RI-RI* = single RI disarticulation in a *dramah* part (i.e. disarticulation from adjoining rib and adjoining vertebra). Mean is calculated for RI-RI disarticulation only.

	VD			VS			YA			YU			All
			Time			Time			Time			Time	
RI knife	SR01	RI part	130	SR02	RI part	74	SR03	RI part	154				
		RI part	90	SR02	RI part	67	SR03	RI part	61				
				FR01	RI-RI	7	SR01	RI-RI*	42	SR03	RI-RI*	24	
				FR01	RI-RI	7	SR01	RI-RI*	23	SR03	RI-RI*	24	
				FR01	RI-RI	5				SR03	RI-RI*	18	
				FR01	RI-RI	2				SR03	RI-RI*	6	
				FR01	RI-RI	9				SR03	RI-RI*	66	
				SR01	RI-RI*	13							
				SR01	RI-RI*	27							
				SR01	RI-RI*	31							
				SR01	RI-RI*	54							
				SR01	RI-RI*	33							
				SR01	RI-RI*	17							
				SR01	RI-RI*	8							
				SR01	RI-RI*	19							
				SR01	RI-RI*	25							
				SR01	RI-RI*	15							
				SR02	RI-RI*	23							
				SR02	RI-RI*	17							
				SR02	RI-RI*	30							
				SR02	RI-RI*	23							
				SR02	RI-RI*	33							
				SR02	RI-RI*	17							
				SR02	RI-RI*	11							
				SR02	RI-RI*	12							
				SR02	RI-RI*	18							
				SR02	RI-RI*	18							
		Mean	**9**		**Mean**	**25**		**Mean**	**11**		**Mean**	**28**	**21**
RI axe*				FR01	axe 1/2	20	SR01	axe 1/2	8	SR02	axe 1/2	441	
				SR01	axe 1/2	41				SR03	axe 1/2	45	

c) Skeletal elements processed with axe.
Asterisks indicate axe use. Meat = meat removal from element (knife or axe). FE ½, HU ½, IN ½ = chopping bone in half. SC pcs, ST all = SC or ST axed into fragments. SA-SA: disarticulation of half-fused SA-SA joint by knife. SA1/3 = SA chopped into three pieces by axe.

ST was usually chopped up by axe, but VS attempted a knife-butchery

	VD			VS			YA			YU			All
			Time			Time			Time			Time	
FE meat	SR02	meat	748	FR01	meat	114	SR02	meat	298				
				FR01	meat	93							
				SR02	meat	123							
													157
FE bone*				FR01	FE 1/2	51				FR01	FE 1/2	79	
				SR02	FE 1/2	47							
				SR03	FE 1/2	17							
													49
HU				FR01	SC-HU	24				SR02	SC-HU	71	
HU bone*				FR01	HU 1/2	7				SR02	meat/axe	105	
				SR03	HU 1/2	11				SR02	meat/axe	53	
SC meat							SR02	meat	192	SR02	meat	57	
SC bone*	FR01	SC pcs	196							SR02	SC pcs	65	
										SR02	SC pcs	31	
IN meat							FR01	meat	86				
IN bone*				SR02	meat/axe	54	FR01	IN 1/2	11				
							FR01	meat/axe	54				
							SR02	meat/axe	193				
SA				FR01	SA-SA	62							
SA*				SR02	SA 1/3	21							
ST				SR01	ST	25							
				SR01	ST	103							
				SR01	ST	90							
				SR01	ST	92							
					Total knife	***410***							
ST*				SR02	ST all	130							
				SR03	ST all	167							
				FR01	ST all	128							
				SR045	ST all	104							
					mean	**132**							

This table lists disarticulation and processing times that were not covered in Tables 6.31, 6.36, and 6.42 (except for AT).

Figure 6.52: Processing time by individual.
RI values are for individual RI disarticulation.

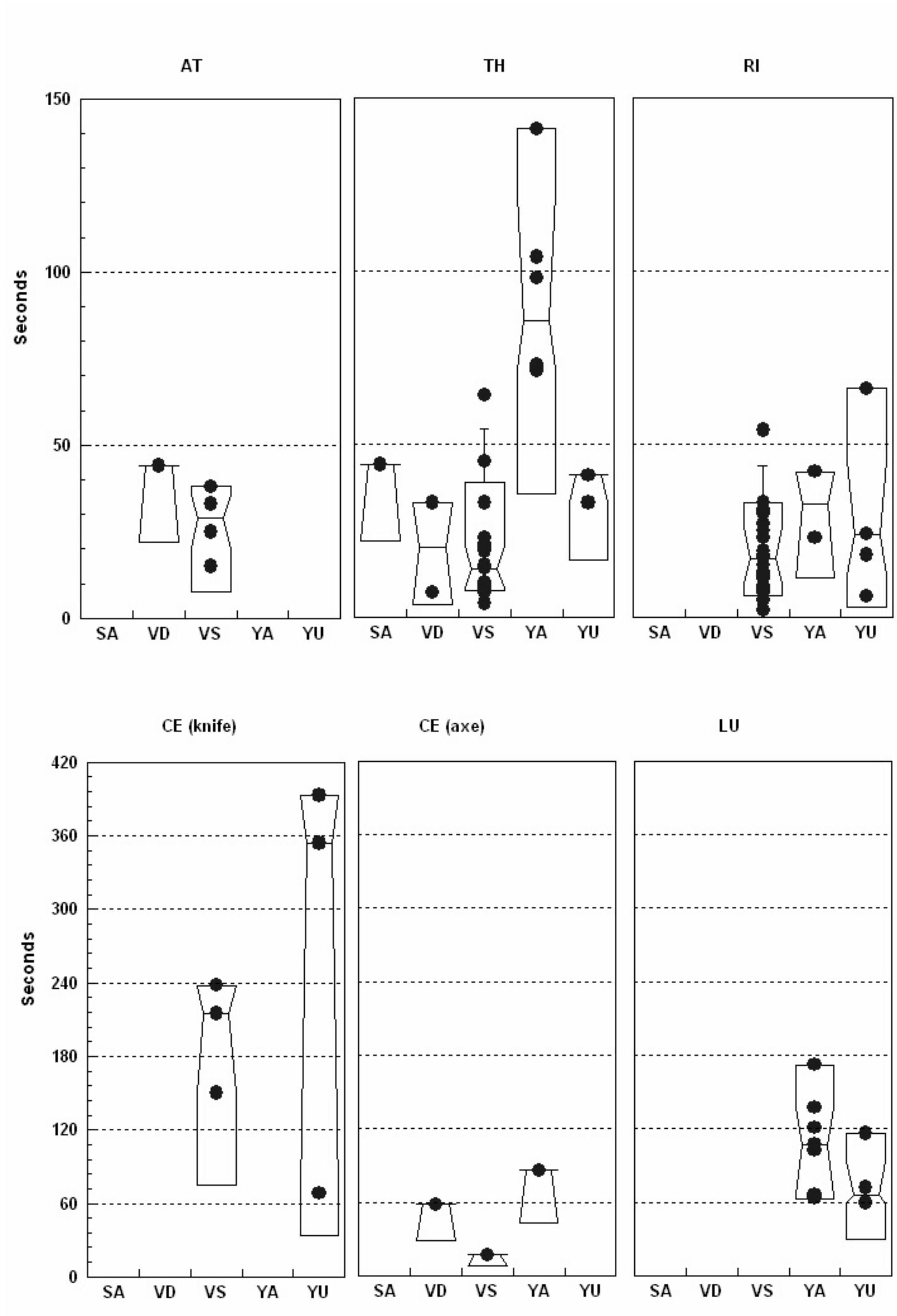
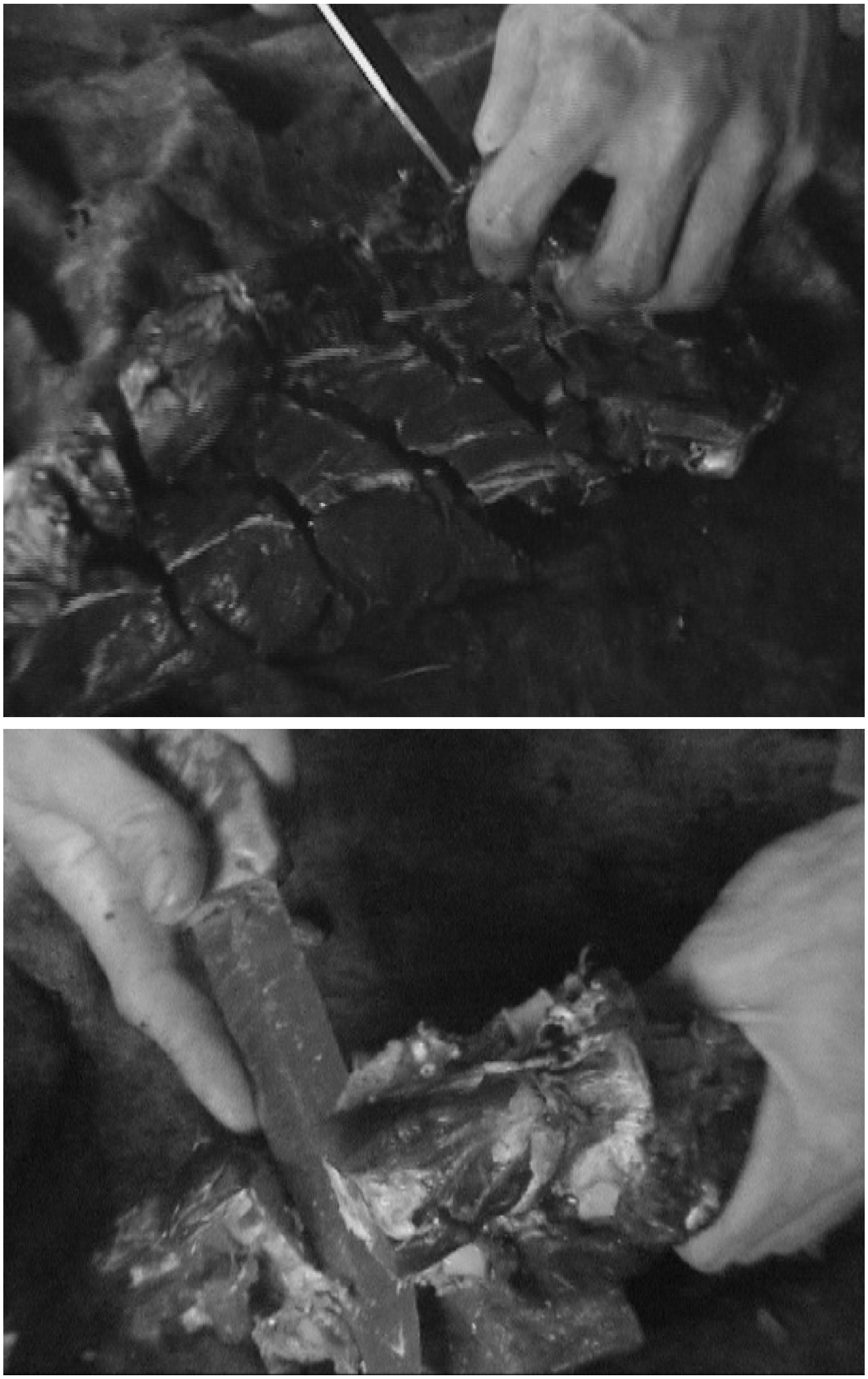


Figure 6.53: Reindeer cooking butchery.

a) Cutting between dorsal processes of TH; disarticulation of each TH (SR01).



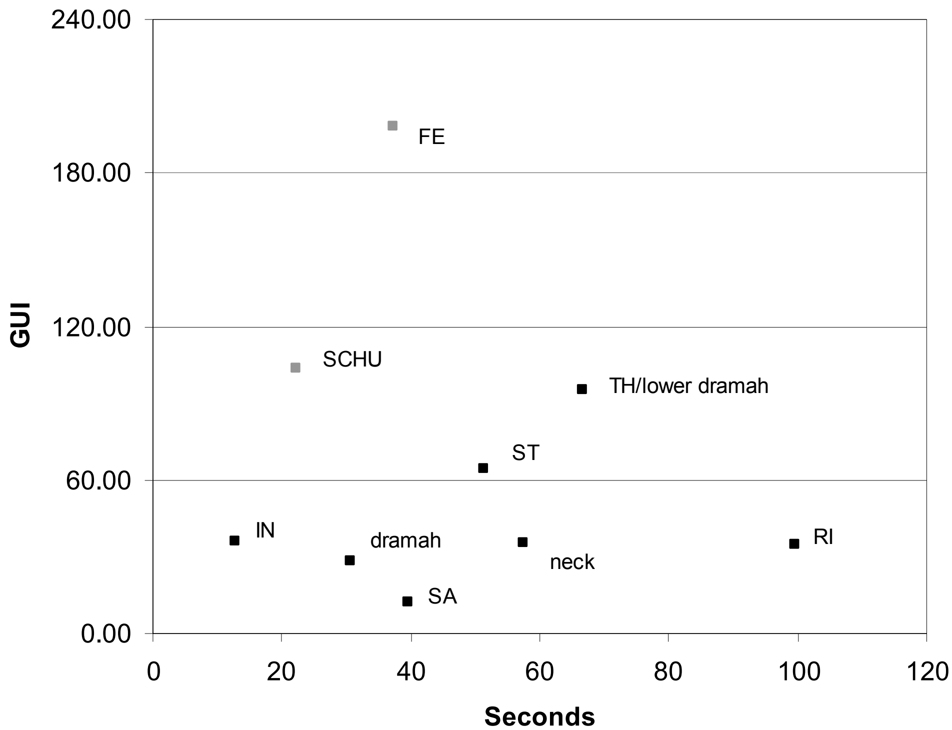
b) Chopping RI in half by axe (SR02).

c) Femur meat removal by axe; chopping bone in half by axe (SR02).

Figure 6.54: Processing time vs. GUI for reindeer.

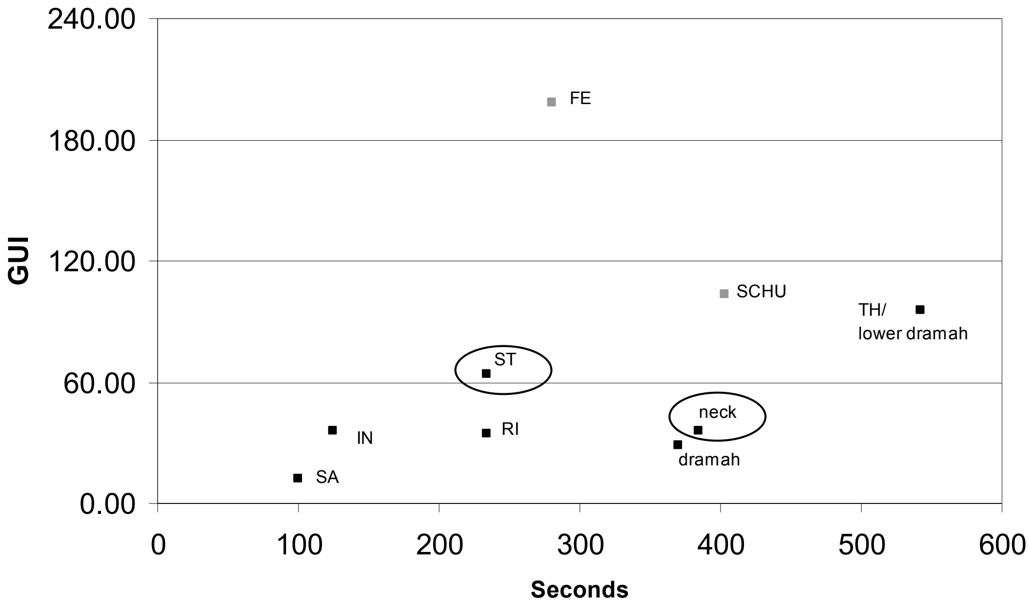
a) For parts butchery.

There is no significant linear correlation, coefficient = -0.126 (critical value was 0.666 for p< .05, n=9) when FE and SCHU are included, not significant for knife-butchered axial parts, (0.368 with critical value 0.609 for p< .05, n=4), and not significant (-0.284) for all axial parts (critical value 0.754 for p< .05, n=7).



b) Total processing time spent on each part.

There was no significant linear correlation, correlation coefficient = 0.327 (critical value 0.666 for p< .05, n=9) when FE and SCHU are included, and not significant for axial parts (0.684 with critical value 0.754 for p< .05, n=7).
The experimental knife butcheries of ST and neck parts are not included in the chart or the calculation of the correlation coefficients.



	Mean time part butchery	cooking butchery		total	GUI
FE	37	243	meat cutting and bone in 1/2	281	198.32
SCHU	22	380	SC-HU disarticulation, meat/bone for SC and HU	403	103.28
ST axe*	51	183	by axe	234	64.13
RI	100	135	7 RI (0'05" ea.)	234	34.84
upper dramah	31	340	4 RI* + 5 TH	370	28.59
TH/lower dramah	67	476	1 TH + 2 RI + 4 LU	542	95.30
neck axe*	57	327	5 CE by axe	385	35.71
SA*	40	61	by axe	100	11.97
IN*	13	112	by axe	125	35.92
(experimental)			(not included in chart)		
neck knife		1416	6 CE by knife	1416	35.71
ST knife	51	461	by knife	513	64.13

c) Difference between knife and axe butchery (total processing time spent on each part).
Trendline is for axial elements *without* the experimental ST and neck knife butcheries. Circle is another estimate for knife butchery of neck (see text).

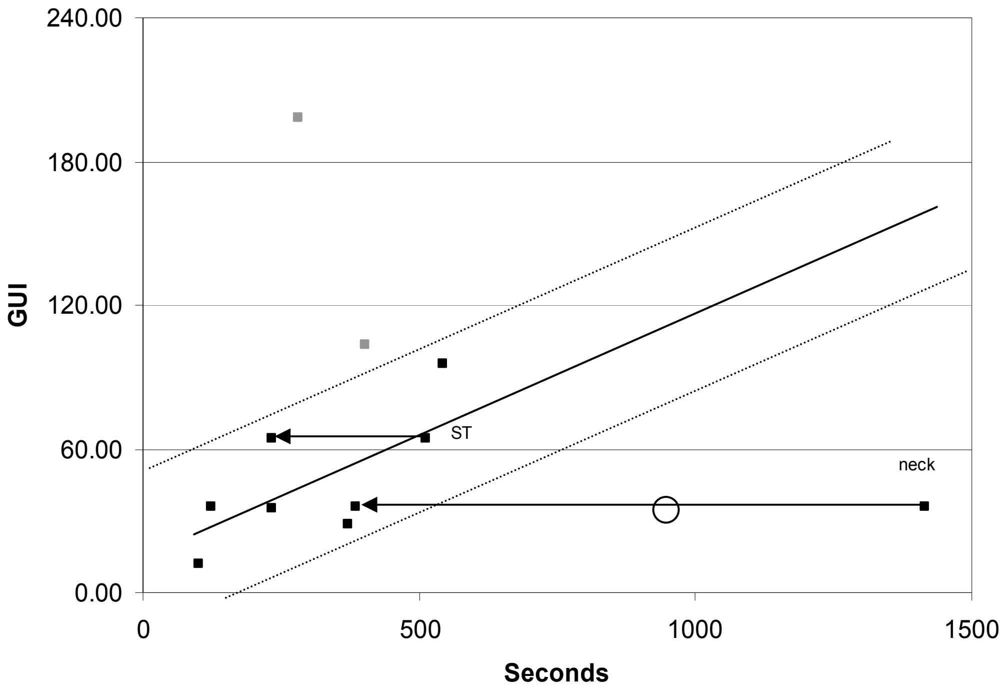
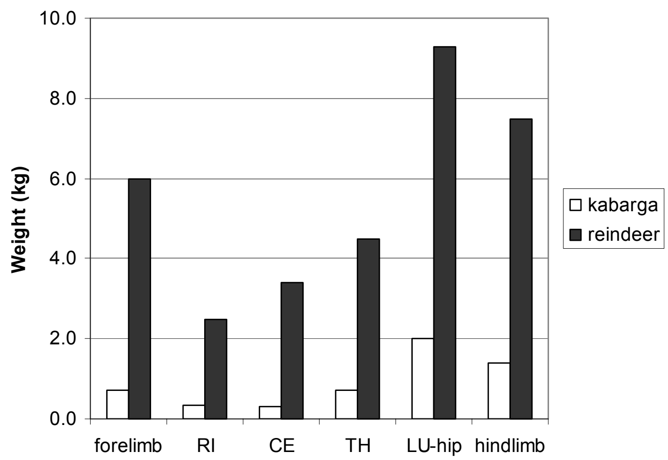


Figure 6.55: Comparison of *kabarga* and reindeer processing time.

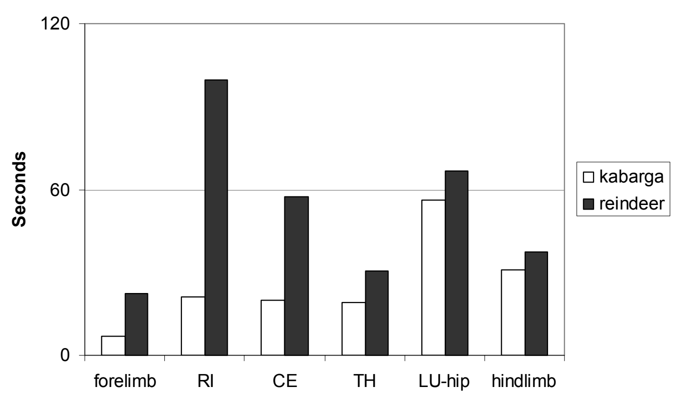
a) Part weight variation between *kabarga* and reindeer.

The weights are averaged from the weights of parts created in parts butchery (which varied in skeletal element composition), and *not* an accurate calculation from the sum of weights of individual skeletal elements.



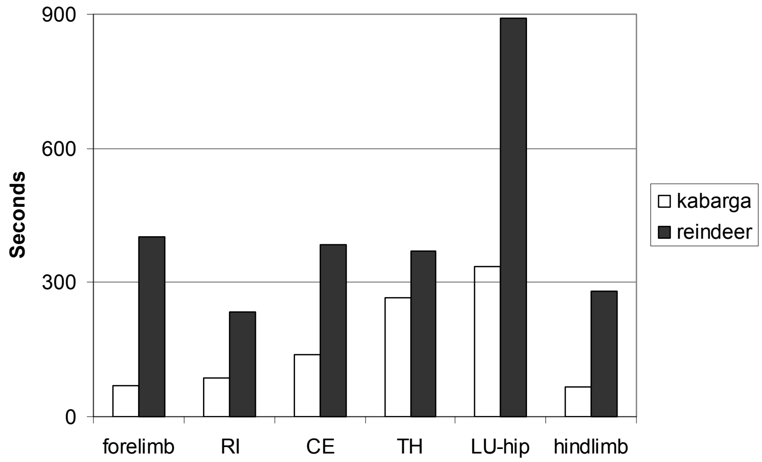
	kabarga	reindeer	reindeer parts	ratio (R/K)
forelimb	0.7	6.0	SCHU	8.6
RI	0.4	2.5	RI	7.1
CE	0.3	3.4	neck	11.3
TH	0.7	4.5	upper dramah	6.4
LU-hip	2.0	9.3	TH/lower dramah, SA, IN, IN	4.7
hindlimb	1.4	7.5	FE	5.4

b) Variation of parts butchery time between *kabarga* and reindeer.



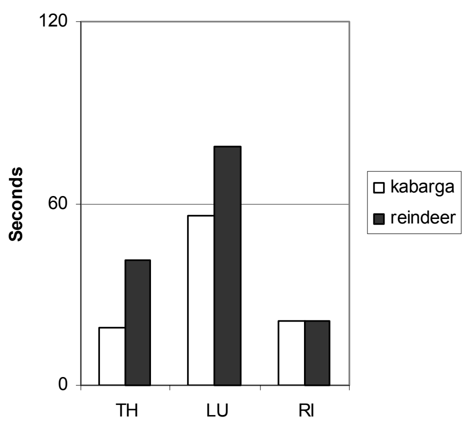
	kabarga	reindeer	reindeer parts	ratio (R/K)
forelimb	7	22	SCHU	3.2
RI	21	100	RI	4.7
CE	20	57	neck	2.9
TH	19	31	upper dramah	1.6
LU-hip	56	67	TH/lower dramah, SA, IN, IN	1.2
hindlimb	31	37	FE	1.2

c) Variation of total butchery time ('total effort') between *kabarga* and reindeer.



	kabarga	reindeer	reindeer parts	ratio (R/K)
forelimb	70	403	SCHU	5.8
RI	86	234	RI	2.7
CE	140	385	neck	2.7
TH	266	370	upper dramah	1.4
LU-hip	336	892	TH/lower dramah, SA, IN, IN	2.7
hindlimb	68	281	FE	4.1

d) Variation in disarticulation time for one element, between *kabarga* in reindeer.



	kabarga	reindeer	reindeer parts	ratio (R/K)
TH	19	41	upper dramah	2.2
LU	56	79	TH/lower dramah, SA, IN, IN	1.4
RI	21	21	RI	1.0

e) Comparison of reindeer:*kabarga* ratio for a-d.
Ratio values from a-d were scaled to a % value (with largest data point in group being 100%).

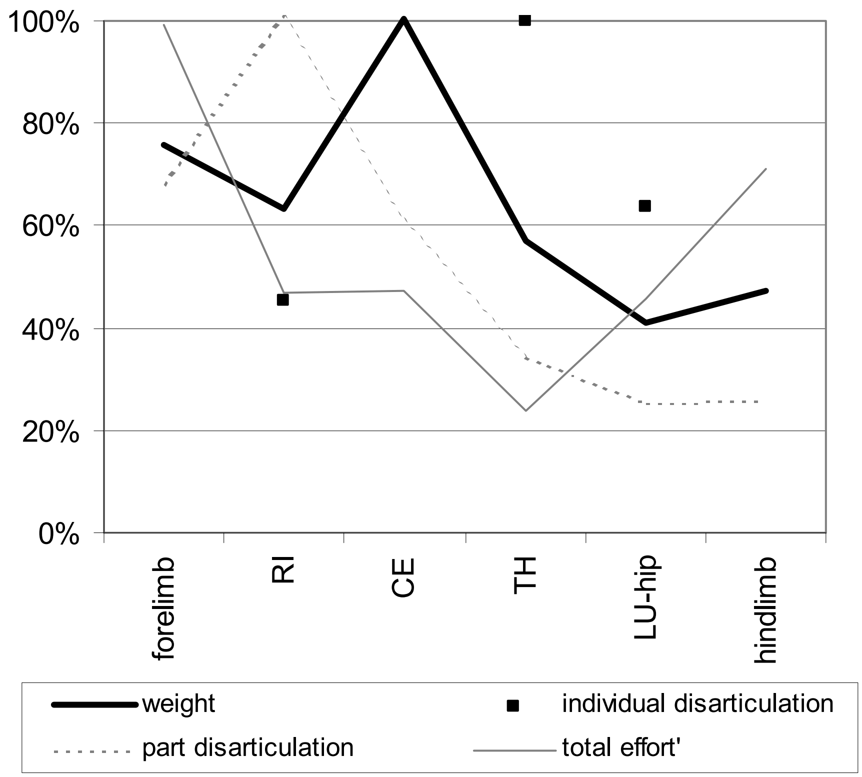


Figure 6.56: Comparison of processing times.

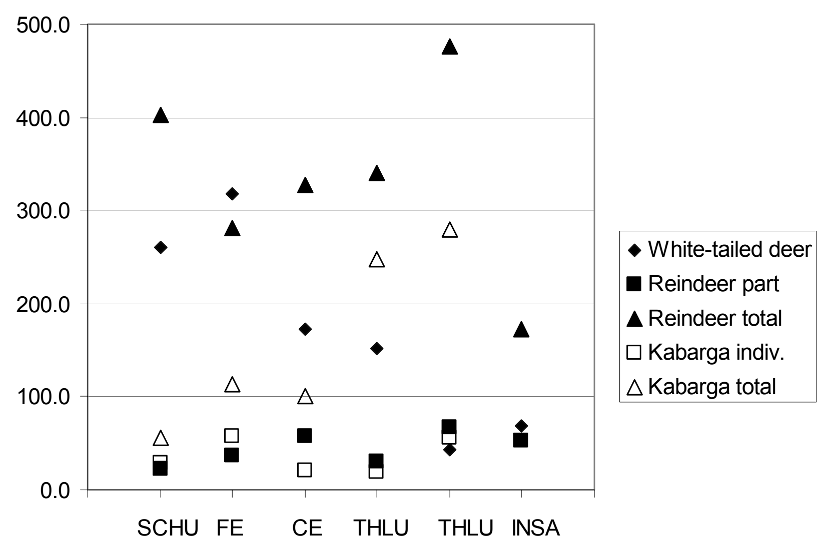
a) Processing times.

Meaty parts:	White-tailed deer	Reindeer		Kabarga		
		Part butchery	Total effort	Individual (IT)	Total effort (TE)	
SC	167.3			7.0	14.0	TE = ITx2
HU	93.8			21.0	42.0	TE = ITx2
SC+HU		22.0	403.0			
RAUL	41.5			58.0	116.0	TE = ITx2
FE	318.0	37.0	281.0	57.0	114.0	TE = ITx2
TI	117.2			37.0	74.0	TE = ITx2
CE	172.5	57.0	327.0	20.0	100.0	IT x 5
TH	152.2			19.0	247.0	IT x 13
upper dramah		31.0	340.0			
TH/lower dramah		67.0	476.0			
LU	43.2			56.0	280.0	IT x 5
RI	411.7			21.0	546.0	IT x 26
IN		13.0	61.0			
SA		40.0	112.0			
INSA	69.3					

Marrow:	White-tailed deer	Caribou	Hartebeest/ wildebeest	Reindeer	Kabarga
RA	321.5	540.0	216.3		
MC	309.0	486.0	173.3		
RA+MC				197-360	455-568
TI	413.0	522.0	170.8		
MT	236.5	426.0	159.8		
TI+MT				110-440	553-1298

Sources:
White-tailed deer: Marean and Cleghorn (2003) from Madrigal and Holt (2002)
Caribou: Binford (1978)
Hartebeest/wildebeest: Lupo (1998)

b) Processing time for approximately comparable parts.
Note: TH, LU, dramah parts are shown in two columns.



c) “Complete” defleshing cost vs. total boiling butchery time.
Defleshing: from Marean and Cleghorn (2003:26).
Boiling: from Figure 6.55c.

Skeletal element	**Defleshing**	**Boiling**	
		Reindeer	**Kabarga**
Femur	Low	Low	Low
Rib	High	Low	Low
Innominate	High	High	High
Thorasic	High	Low	High
Cervical	High	High	High
Scapula/Humerus	Low	High	Low

Table 6.57: Differences between study group and other groups (Nunamiut, !Kung, Hadza, and Okiek)

	Nunamiut (Binford 1978)	**!Kung** (Yellen 1977)
General conditions	- 130 people, 21 households in residential camp - Spring/fall hunting by logistical mobility - Open envirionment	- Multiple nuclear family units - Residential mobility - Open environment
Hunting strategy	- Varies by season/circumstance Use hunt stands, blinds to ambush large herds (caribou, spring/fall) Encounter hunting (individual sheep and dispersed caribou herds, summer)	- Redundant: encounter hunting Multiple hunters to find and wound animal with poison arrow Tracking and kill usually on following day
Means of transport	- Varies by season/circumstance (Airplane), snowmobile, dog sled (spring/fall) If on foot, cache and transport later (summer)	- Redundant: on foot, by multiple carriers Carriers take part in second-day tracking
Butchery	- Varies by season/circumstance Carcasses sometimes butchered without prior skinning (p. 48-49) Kill site butchery varies by number of animals to be processed Occasional foot-hanging butchery for large animals caribou (p. 50) - Filleting is standard procedure - Mass processing of carcasses Marrow processing *en masse* (and uses phalange marrow)	- Redundant Butchery order and parts consistent Vertebrae shattered and made pliable for carrying - Filleting is standard procedure Usually at residential camp
In situ consumption	- Varies by season/circumstance Consumption at kill sites/logistical camps common	- Varies by prey size/circumstance Innards, metatarsal for marrow, ribs eaten first If transport is hard, try to consume on site
Transport decision	- Varies by season/circumstance - Abandons parts (without intent of future use) Abandonment decisions vary by number of animals killed (p. 61) Abandonment decisions vary by season (p. 76-77) Heads often abandoned (after removing tongue) Vertebrae commonly abandoned - Caches	- Varies by prey size/circumstance Intent is to carry everything back
Storage	- Dried Filleted meat parts, dried parts (including bone) - Frozen	- Dried Filleted meat strips
Culinary practices	- Dried meat - Raw meat - Boiled meat/bone Vertebrae, scapula, and meat for stew (p. 145) - Marrow usually roasted - "Bone juice" (p. 164-5)	- Dried - Roasted (open fire, or pit) Boiled meat/bone (preferred) Raw marrow sometimes added to create gravy; fragmented bones after marrow or meat removal used with previously removed meat chunks - Marrow usually roasted - Femur/humerus treated as marrow bone
Sharing	- Varies by season/circumstance Equal allocation after group hunting (p. 140) Fresh meat (after single-animal-kills) shared widely	- Strict rules for sharing Carrier receives share, hunter does not receive larger share Parts and recipients rigidly culturally proscribed
Other	Bones used as butchery tool (bludgeon) Fetuses fed to dogs (p. 86) Larger number of dogs to feed and maintain	

	Hadza (O'Connell et al. 1988 unless otherwise noted)	**Okiek** (Marshall 1991, 1994)
General conditions	- 200 people in residential camp - Residential mobility - Rather densely covered environment	- Nuclear family settlements, close neighbors - Sedentary - Forested environment
Hunting strategy	- Encounter and ambush Poison arrow, uses dry-season blinds - Scavenging	- Varies in methodology Dogs, spears, bow and arrow, traps
Means of transport	- Redundant: on foot, by multiple carriers Carriers take part in second-day tracking	- Redundant: on foot
Butchery	- Somewhat redundant Some variation by prey species in degree of skinning, disarticulation, filleting - Filleting is standard procedure	- Redundant within species Different butchery between species due to carrying constraints Butchery at residence - Filleting back at residence
In situ consumption	- Limited in principle Marrow, rib and rib-marrow, meat bits adhering to bones being discarded	- Rare to none Occasional eating of liver
Transport decision	- Varies by prey size - Abandon bones after filleting Depends on prey size (mostly complete transportation up to zebra size) Easily filleted parts more commonly discarded from fresh kills	- Redundant: complete transport Fluids discarded to reduce weight Transport not dependent on body size or distance
Storage	- Not much Most meat consumed within 3 days	- None (delayed-return sharing system) Other sources of food (stored honey, maize, domesticated animals)
Culinary practices	- Roasted - Boiled Vertebrae pulverized before boiling, lots of pot-sizing fragmentation - Marrow usually roasted	
Sharing	- Strict rules for sharing Deliberate avoidance of sharing by *in situ* consumption (Bunn 1988:442)	- Strict rules for sharing Kin and neighbors get portion; varied distribution of parts Smaller species not shared
Other	Head-bashing against tree (zebra) No periosteum removal	

Table 6.58: Reindeer part use in meals.
Cooking (and cooking butchery) accompanied these meals unless marked 'leftover'.

SR01 and SR02 were killed at the same hunt, and were consumed together. Arrows and lines show how parts of SR02 fit into the order of SR01. The soft parts (*) were eaten as a single meal.

	FR01	SR01	SR02
Meal 1	blood, intestines, kidney, marrow, tendons	marrow, heart	meat cutlets, hooves, intestines, blood, kidney * (A)
Meal 2	heart	liver	RI
Meal 3	FE meat	meat cutlets, hooves, intestines, blood, kidney *	leftover A
Meal 4	ST soup, hooves	RI soup	ST soup (B)
Meal 5	liver (snack)	RI soup	leftover B
Meal 6	lungs FE IN meat pirojok (A)	ST soup	RI soup(C)
Meal 7	leftover A	ST meat	leftover C
Meal 8	head	head	heart
Meal 9	RI soup (B)	TH soup (A)	LU TH soup (D)
Meal 10	FE meat	TH meat	leftover D
Meal 11	TH soup	leftover A	TH RI soup (E)
Meal 12	FE IN meat	meat, brains	leftover E
Meal 13	FE IN bone soup	IN soup (B)	meat
Meal 14	SC HU meat, brain	leftover B	FE meat
Meal 15	SC HU bone soup(C)	meat	FE meat (pirojok)
Meal 16	leftover C	FE	FE meat
Meal 17	leftover B	TH, IN	head
Meal 18	dramah meat	FE meat (pirojok)	FE IN SA soup
Meal 19	LU bone soup (D)	FE meat	IN soup
Meal 20	leftover D	FE meat	liver
Meal 21	neck meat	FE meat	SC HU soup
Meal 22	neck meat	FE meat	SC HU meat
Meal 23	neck soup	SCHU	CE soup
Meal 24	neck soup	SCHU meat	chachaki
Meal 25	IN FE soup	CE	
Meal 26	SC soup	SA	
Meal 27	meat	liver (leftover)	
Meal 28	meat	chachaki	
Meal 29	meat		
	(11/3-12/7, 29/136 meals)	(3/24-4/24) 28/133 meals	(3/25-4/22) 25/126 meals

Table 6.59: Raw rank order of use for reindeer.
Gray shading indicates significant relationship.

a) All parts.

	SR01	SR02	FR01
marrow	1	3	1
heart	1		2
liver	2	13	4
innards/blood	2	1	1
kidney	3	1	1
RI 1	4	2	7
RI 2	4	5	8
ST	5	4	3
head	6	9	6
brain	8	10	11
CE	16	16	12
lower dramah	7	6	8
TH	12		8
upper dramah	10	7	13
FE 1	11	8	5
FE 2	14	11	9
IN 1	9	11	5
IN 2	13	12	9
SA	17	11	
SCHU 1	15	14	10
SCHU 2		15	10

n=21

<0.05	0.433
<0.01	0.509

	SR01	*SR02*	*FR01*
SR01	1		
SR02	0.527	1	
FR01	0.818	0.445	1

b) Parts excluding soft parts, sided elements separate.

	SR01	SR02	FR01
marrow	1	3	1
RI 1	4	2	7
RI 2	4	5	8
ST	5	4	3
head	6	9	6
CE	16	16	12
lower dramah	7	6	8
TH	12		8
upper dramah	10	7	13
FE 1	11	8	5
FE 2	14	11	9
IN 1	9	11	5
IN 2	13	12	9
SA	17	11	
SCHU 1	15	14	10
SCHU 2		15	10

n=16

<0.05	0.498
<0.01	0.623

	SR01	*SR02*	*FR01*
SR01	1	--	--
SR02	0.846	1	--
FR01	0.762	0.555	1

c) Parts excluding soft parts, with sided elements combined.

	SR01	SR02	FR01
marrow	1	1	1
RI	2	2	6
ST	3	3	2
head	4	6	3
CE	11	11	10
lower dramah	5	4	7
TH	9		7
upper dramah	7	5	11
FE	10	7	4
IN	8	8	4
SA	11	9	
SCHU	6	10	9

n=12

<0.05	0.576
<0.01	0.708

	SR01	*SR02*	*FR01*
SR01	1	--	--
SR02	0.8269	1	--
FR01	0.6626	0.566	1

Table 6.60: Reindeer use order vs. GUI.

a) All parts with bone, excluding marrow.

	SR01	SR02	FR01	GUI	GUI details
RI 1	4	2	7	33.18	2/3 RI
RI 2	4	5	8	33.18	2/3 RI
ST	5	4	3	64.13	
head	6	9	6	47.75	
CE	16	16	12	35.71	
lower dramah	7	6	8	43.43	1/4 TH + LU
TH	12		8	22.76	1/2 TH
upper dramah	10	7	13	27.97	1/4 TH + 1/3 RI
FE 1	11	8	5	198.32	
FE 2	14	11	9	198.32	
IN 1	9	11	5	47.89	
IN 2	13	12	9	47.89	
SA	17	11		11.9725	
SCHU 1	15	14	10	103.28	
SCHU 2		15	10	103.28	

	SR01	SR02	FR01		
				n=15	
GUI	0.249	0.045	-0.191	<0.05	0.514

There was no significant linear correlation.

b) Rib, sternum, and axial elements.

	SR01	SR02	FR01	GUI	GUI details
RI 1	4	2	7	33.18	2/3 RI
RI 2	4	5	8	33.18	2/3 RI
ST	5	4	3	64.13	
CE	16	16	12	35.71	
lower dramah	7	6	8	43.43	1/4 TH + LU
TH	12		8	22.76	1/2 TH
upper dramah	10	7	13	27.97	1/4 TH + 1/3 RI

	SR01	SR02	FR01		
GUI	-0.240	-0.534	-0.524	n=7	
				<0.05	0.754

There was no significant linear correlation.

Figure 6.61: Average reindeer use order vs. GUI.

a) Averaged reindeer use order (FR01, SR01, SR02).

	Average rank	GUI
ST	1	64.13
RI 1	2	33.18
RI 2	3	33.18
head	4	47.75
lower dramah	4	43.43
FE 1	6	198.32
IN 1	7	47.89
upper dramah	8	27.97
FE 2	9	198.32
IN 2	9	47.89
SCHU 1	11	103.28
TH	12	22.76
CE	13	35.71
SCHU 2	14	103.28
SA	15	11.973

b) Rank order vs. GUI.
Gray = limb parts and associated elements (FE, SCHU, IN, SA). Black = ribs, sternum, and axial elements.

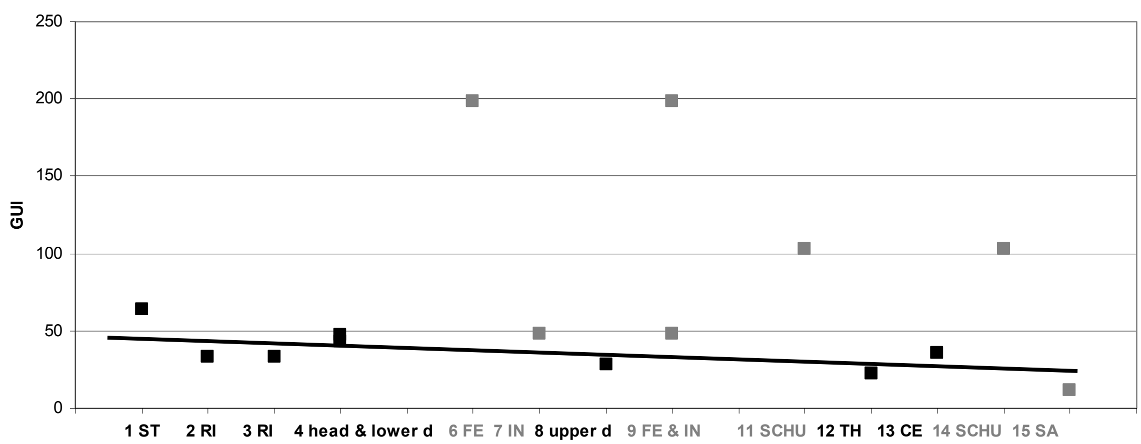


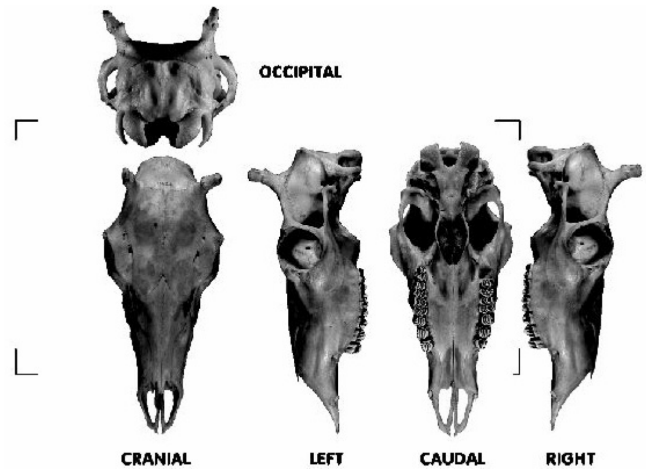
Table 6.62: Comparison of *kabarga* and reindeer rank order.
There was a significant correlation (0.608, with critical value 0.576 for p< .05 and 0.708 at p< .01, N=12).

	Kabarga	Reindeer	Reindeer parts
Head unit	2	4	head
Neck unit	7	11	CE
Th/dramah	3	8	TH, upper dramah
RI 1	5	2	RI 1
RI 2	7	3	RI 2
ST	3	1	ST
LU	1	4	lower dramah
Hip	6	9	IN1, IN2, SA
Forelimb 1	11	10	SCHU 1
Forelimb 2	12	12	SCHU 2
FE 1	10	6	FE 1
FE 2	9	7	FE 2

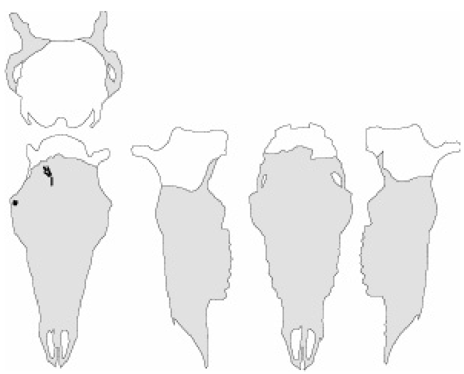
Kabarga rank order averaged from animals butchered in the ‘soup’ pattern.

Figure 7.1: Condition of bones at time of recording.

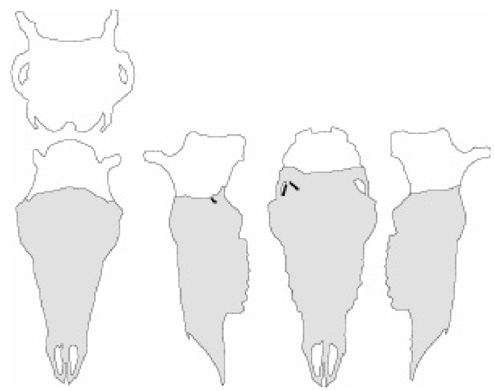
Figure 7.2: *Kabarga* cranium.
a) Template and individual specimens.
Template.



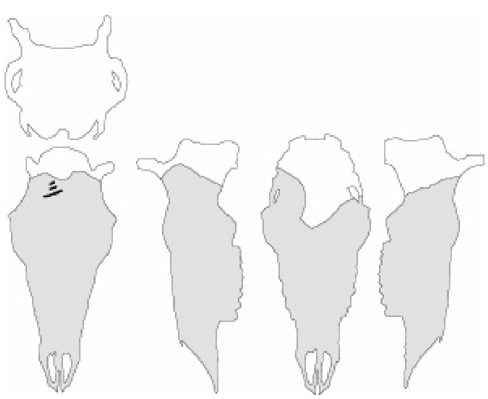
FK01, normal parts butchery by VD.



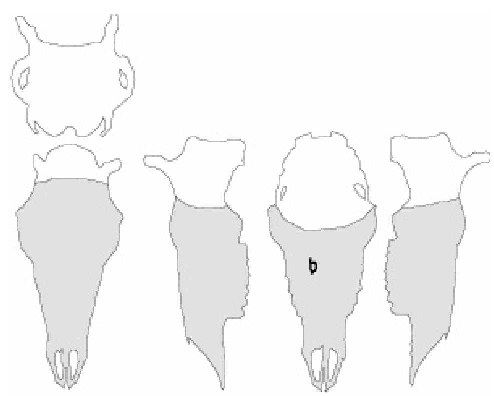
FK02, normal parts butchery by YA.



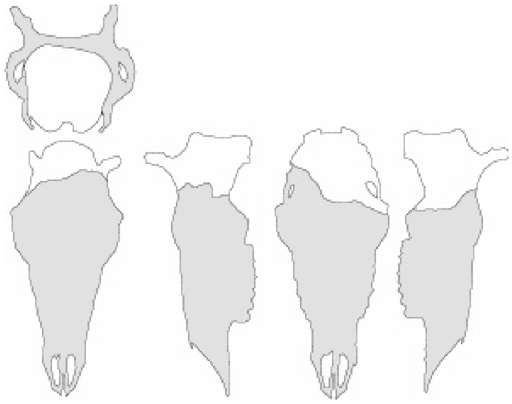
FK03, butchery by VS/VD in field.



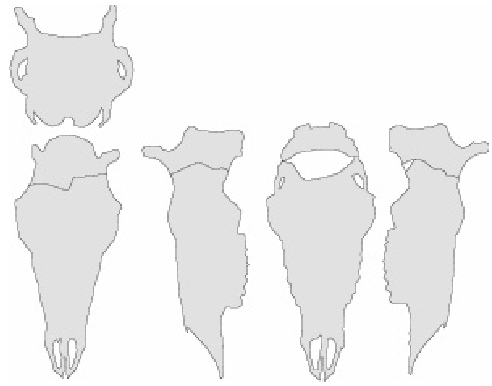
FK05, normal parts butchery by YA.



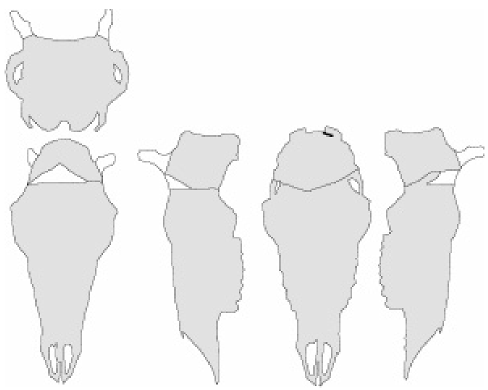
FK06, normal parts butchery by YA.



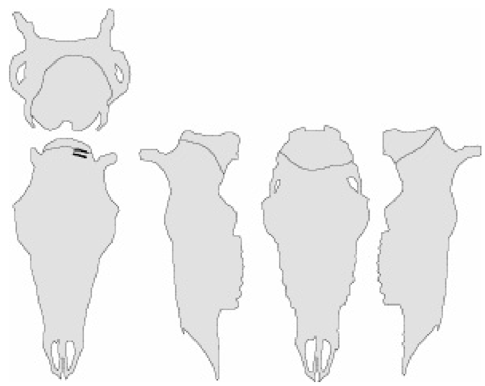
FK07, floor parts butchery by VS/VD.



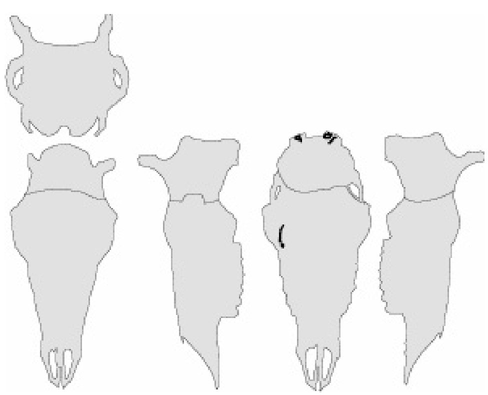
FK09, normal parts butchery by VS.



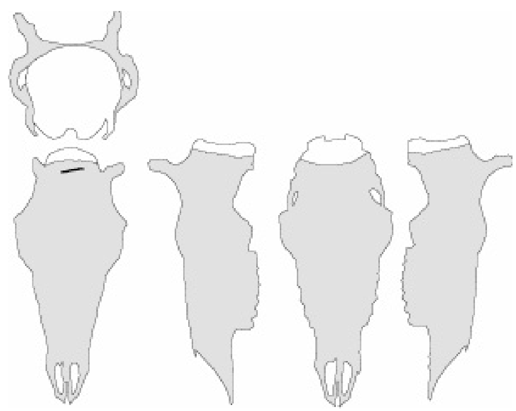
FK10, normal parts butchery by VS.



FK11, normal parts butchery by YA.



SK02, normal parts butchery by YU.

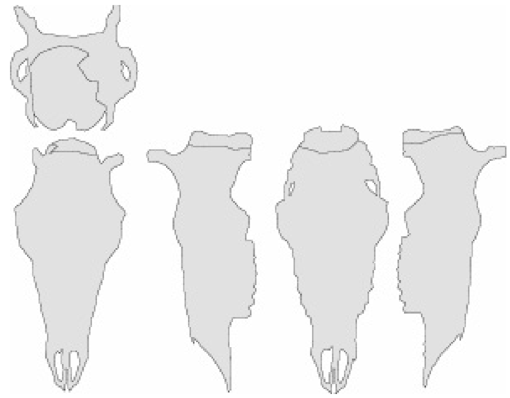


Cranial Left Caudal Right

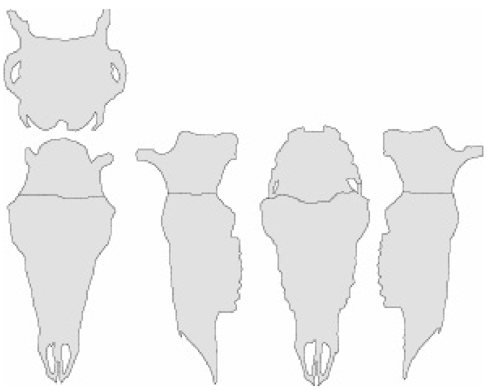
Cranial Left Caudal Right

SK03, dog butchery by SA.

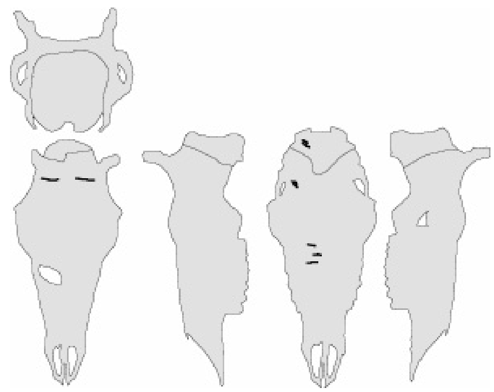
SK05, normal parts butchery by VS.



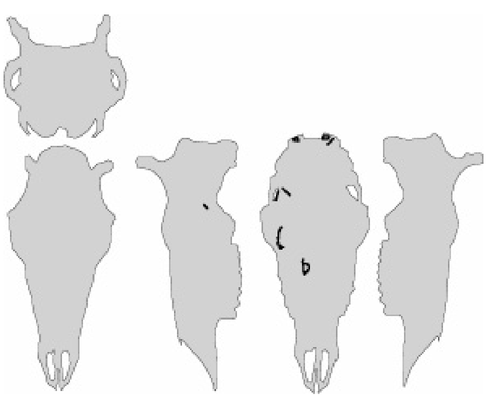
SK08.



SK16.

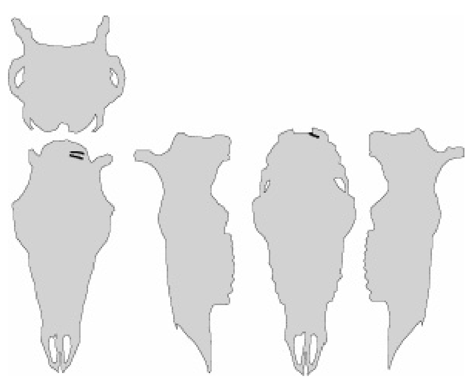


b) Comparison between butchers.
Marks by YA.
(FK02, FK05, FK06, FK07)



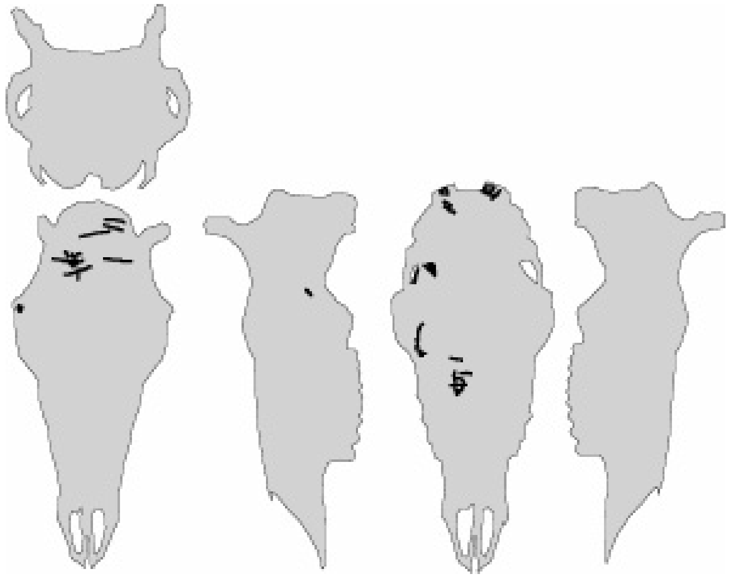
Cranial Left Caudal Right

Marks by VS.
(FK09, SK08, SK14)

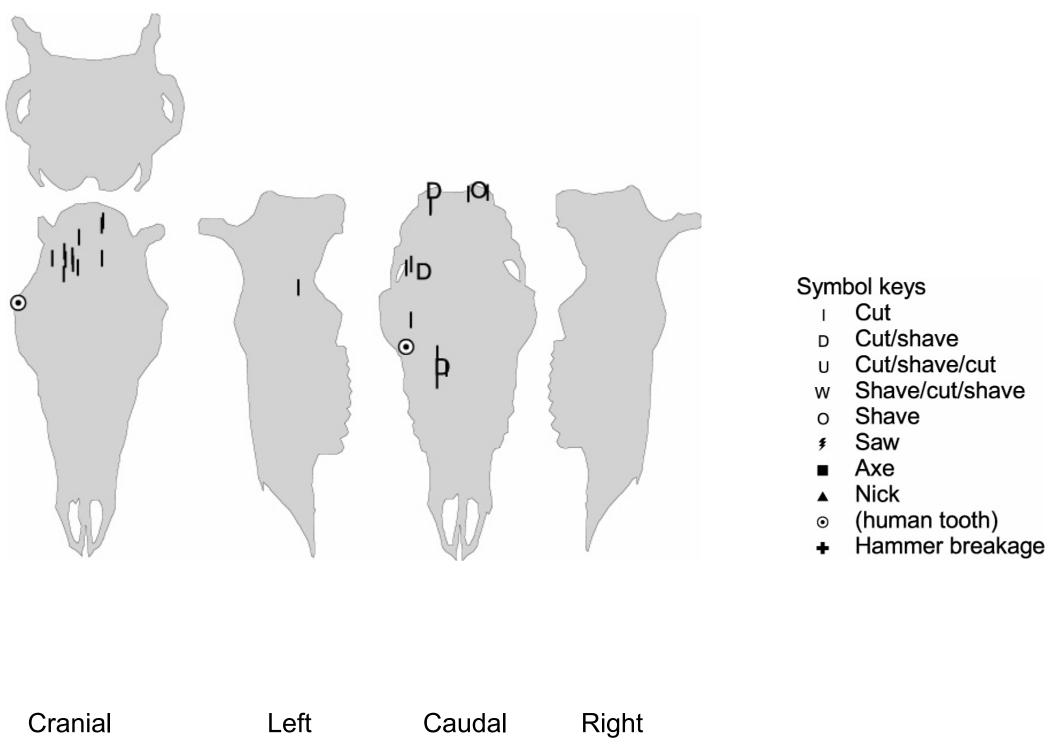


Cranial Left Caudal Right

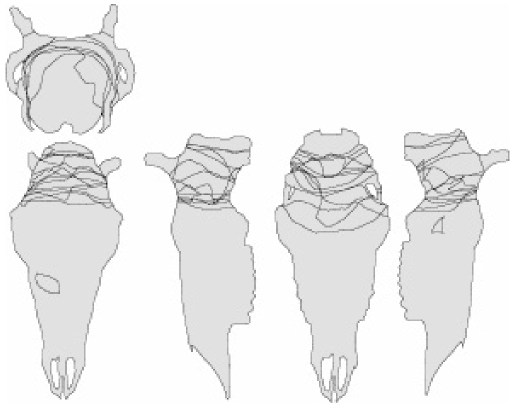
c) Distribution of all marks (accurate drawing).
(14 crania)



d) Distribution of all marks (symbol).
(14 crania)

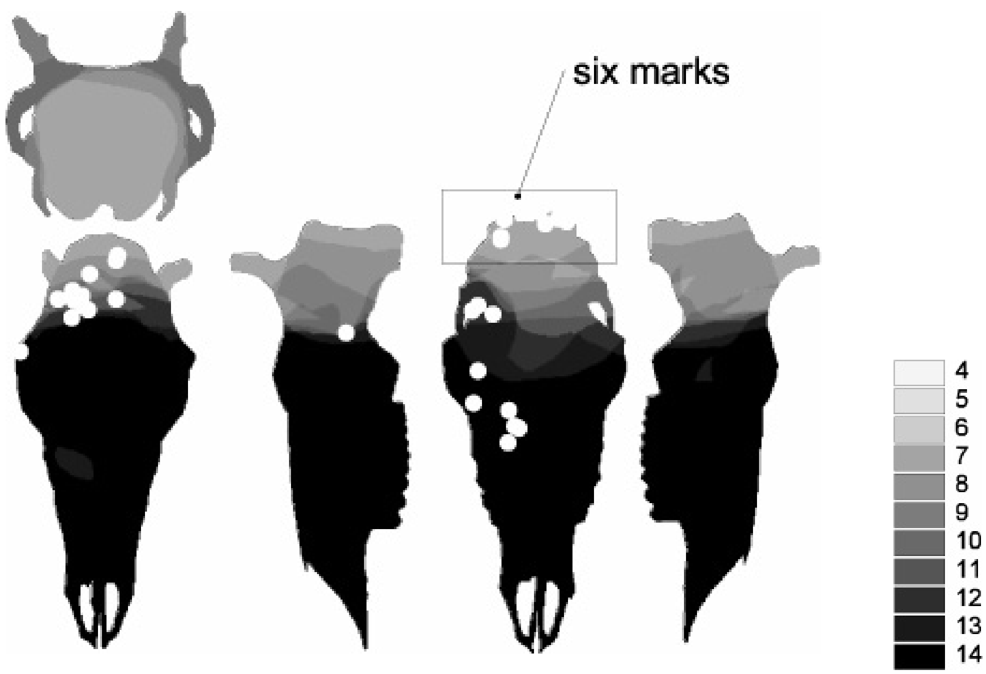


e) Fracture pattern (at eating).
(14 crania)



f) Loss of occipital fragments.
Grayscale key in f). (84.3% completeness)

g) Distribution of marks over MNE map (white dot = mark).
Six marks observed in occipital area, where MNE<7.



Cranial Left Caudal Right

Table 7.3: Calculation of corrected cutmark counts for *kabarga* CR, using the GIS method.

a) Flow of calculation.
Pixel counts for areas with different MNE representation (see gradated figure in Figure 1) are entered into spreadsheet (in boxed area below) and calculated as follows (see also Abe et al. 2002).

(1) RAW AREA (pixel count)

portion	total	MNE 4	5	6	7	8	9	10	11	12	13	14
all	21,996,099	3	1	1644	3174775	2149779	1080608	999971	397323	784283	881644	12526068
occipital (MNE<7)	3,176,423	3	1	1644	3174775							
other (MNE>8)	18,819,676					2149779	1080608	999971	397323	784283	881644	12526068

(2) AREA CORRECTED BY MNE (pixel count * MNE value)

portion	total	4	5	6	4	5	6	4	5	6	7	8
all	259,764,993	12	5	9864	22223425	17198232	9725472	9999710	4370553	9411396	11461372	175364952
occipital (MNE<7)	22,233,306	12	5	9864	22223425	0	0	0	0	0	0	0
other (MNE>8)	237,531,687	0	0	0	0	17198232	9725472	9999710	4370553	9411396	11461372	175364952

(3) % ZONE REPRESENTED BY FRAGMENT ((2)/(1))

portion	%zone
all	1180.96%
occipital (MNE<7)	699.95%
other (MNE>8)	1262.15%

(4) # CUTMARKS PER ZONE

portion	for all cuts	for non-eating
all	29	27
occipital (MNE<7)	6	6
other (MNE>8)	23	21

(5) # CUTMARKS CORRECTED ((4)/(3))

portion	for all cuts	for non-eating
all	2.46	2.29
occipital (MNE<7)	0.86	0.86
other (MNE>8)	1.82	1.66
occipital+other	2.68	2.52

b) Expected number of marks per cranium in *kabarga*, from calculation in a).

Expected number of marks per bone (average whole CR)	2.5 (2-3)
Expected number of marks with occipital loss taken into account	2.7 (2-3)
Expected disarticulation marks (occipital)	0.9 (0-1)
Expected skinning marks (non-occipital)	1.8 (1-2)

Table 7.4: Cutmarks on *kabarga* CR.

a) Marks by type.

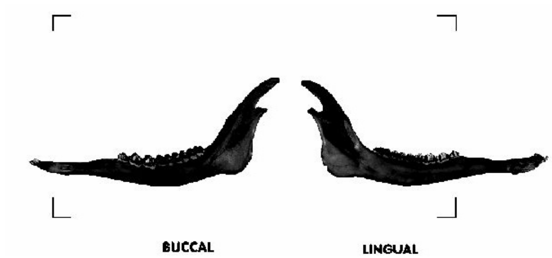
	Total	Cutmark types			
		cut	c/s	shave	tooth
Disarticulation marks (occipital)	**6**	4	1	1	
Skinning marks (non-occipital)	**21**	19	2		
Eating marks	**2**				2
Total	**29**	**23**	**3**	**1**	**2**

b) Marks by butcher.
Excludes eating marks – marks associated with parts butchery only.

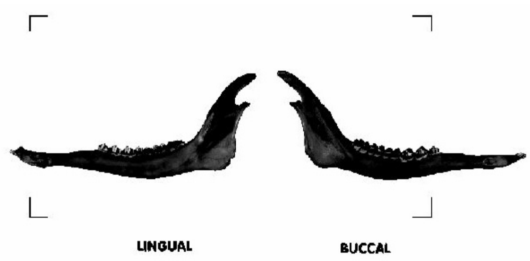
Parts butcher		**Cutmarks**	**Notes**	**Range**
SA	SK03	0	Dog butchery	0
VS	FK09	1		
	FK10	2		
	SK05	0		0-1
VD	FK01	4		4
YA	FK02	3		
	FK05	1		
	FK06	0		
	FK11	4		0-4
YU	SK02	1		1
VSVD	FK07	0	Floor	
	FK03	3	In field for backpack	
?	SK08	0		
	SK16	8		

Figure 7.5: *Kabarga* mandibles (L, R).
a) Template and individual specimens.

Template L.

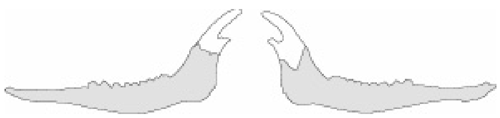


Template R.

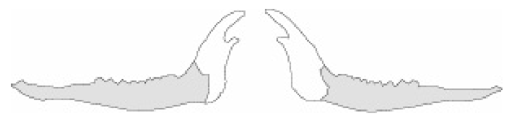


FK01, normal parts butchery by VD.

L

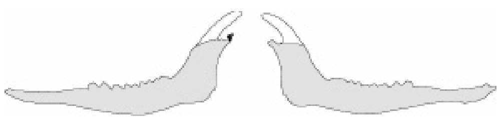


R

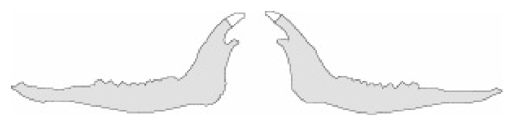


FK02, normal parts butchery by YA.

L

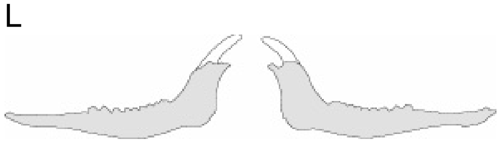


R

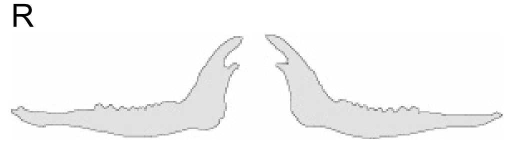


FK03, butchery by VS/VD in field.

L

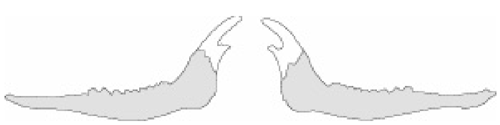


R

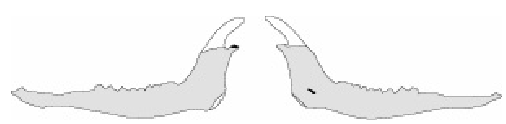


FK05, normal parts butchery by YA.

L

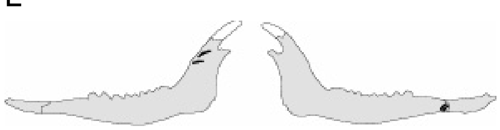


R

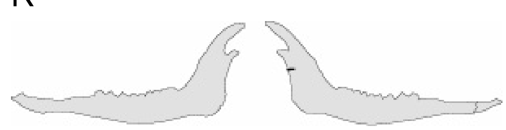


FK06, normal parts butchery by YA.

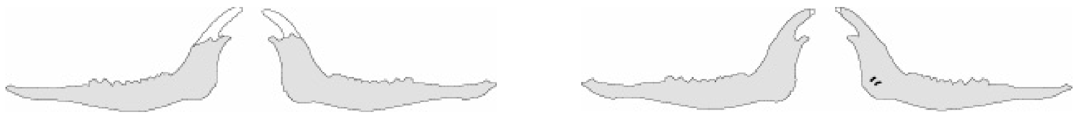
L



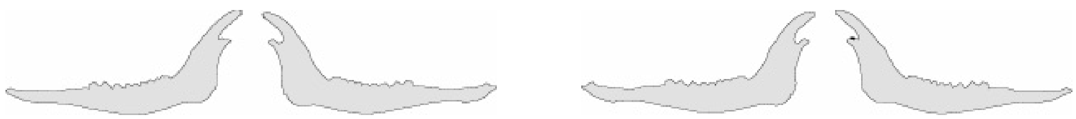
R



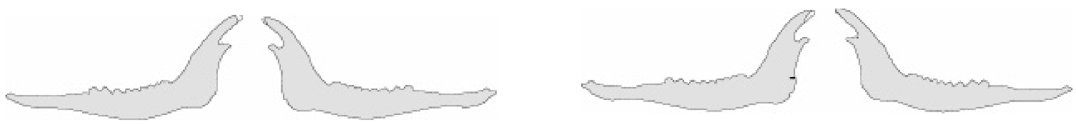
FK07, floor parts butchery by VS/VD.
L R



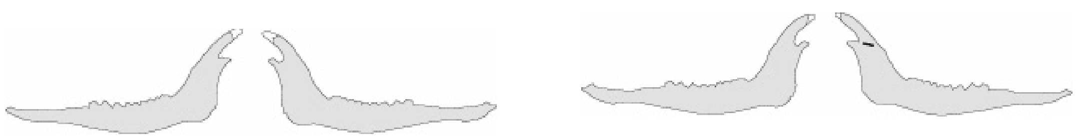
FK09, normal parts butchery by VS.
L R



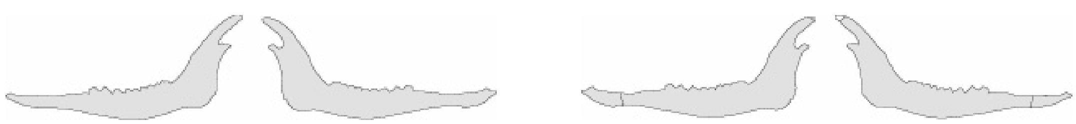
FK10, normal parts butchery by VS.
L R



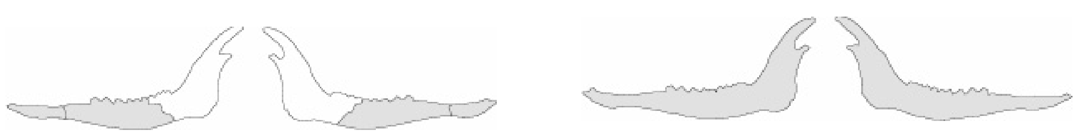
FK11, normal parts butchery by YA.
L R



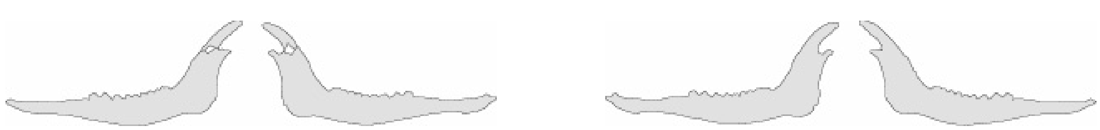
SK02, normal parts butchery by YU.
L R



SK03, dog butchery by SA.
L R



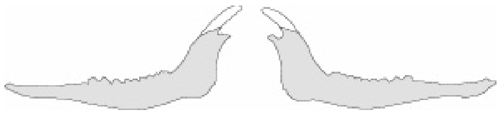
SK05, normal parts butchery by VS.
L R



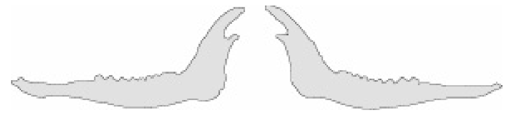
Buccal Lingual Buccal Lingual

SK08.

L

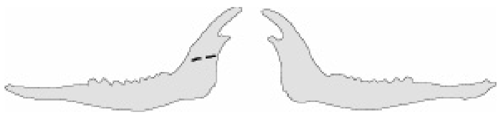


R

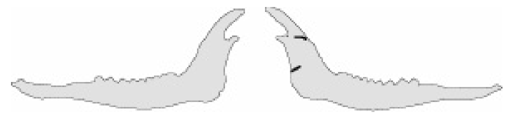


SK16.

L

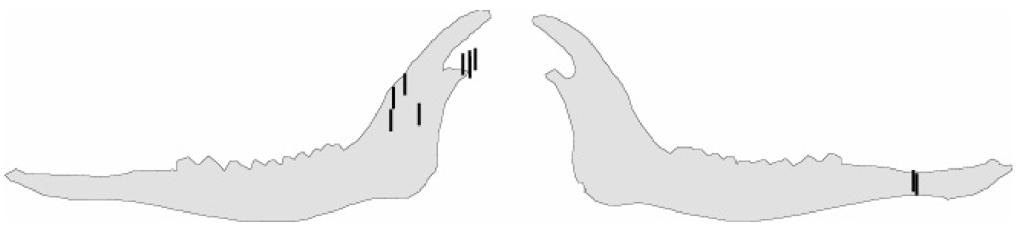


R



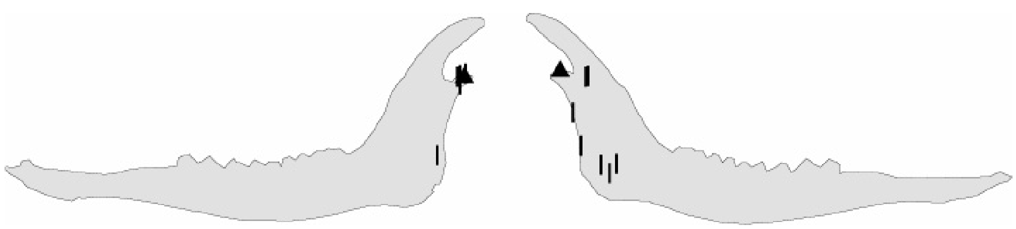
b) Distribution of all marks (symbol key below). 14 mandibles.

L: 12/12 type ‘cut’.



Buccal Lingual

R: 8/10 cuts were type ‘cut’; 2/10 were type ‘nick’ with one on buccal made at eating.

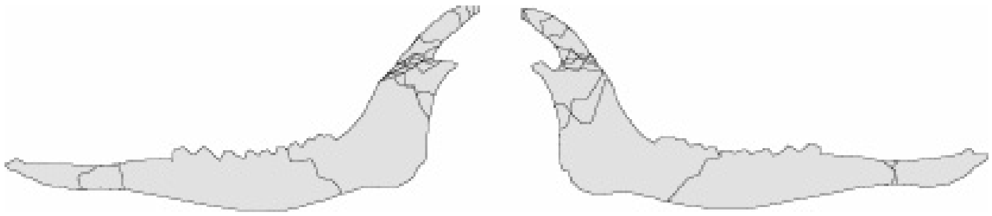


Lingual Buccal

Symbol keys

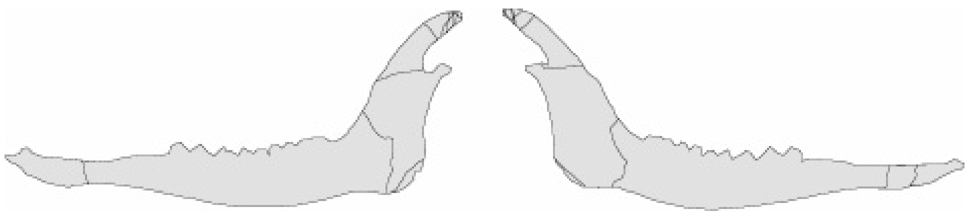
- I Cut
- D Cut/shave
- U Cut/shave/cut
- W Shave/cut/shave
- O Shave
- ⚡ Saw
- ■ Axe
- ▲ Nick
- ⊙ (human tooth)
- ✚ Hammer breakage

c) Fracture pattern (14 mandibles).
L



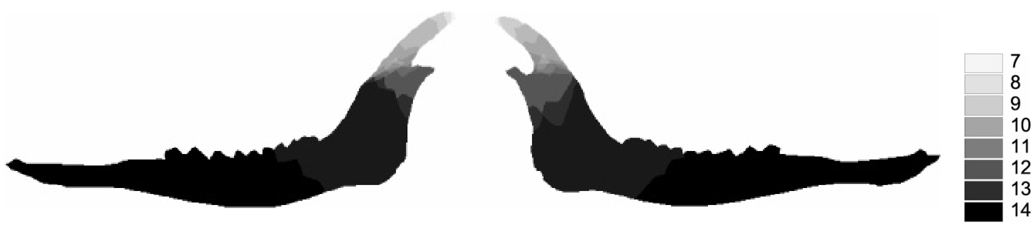
Buccal Lingual

R



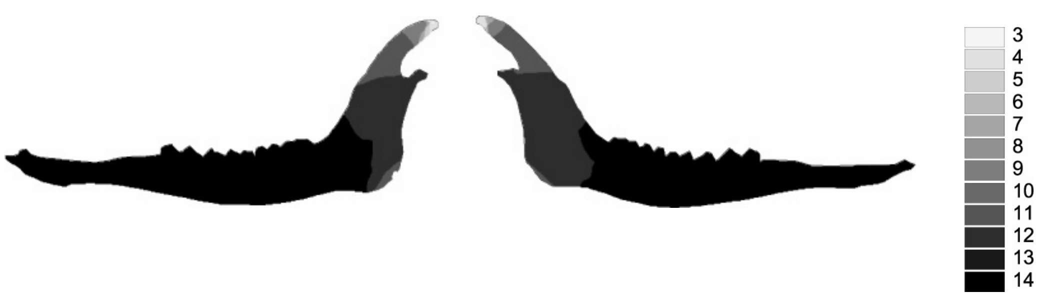
Lingual Buccal

c) MNE map and loss of condyle fragments.
L (92% complete)



Buccal Lingual

R (92% complete)



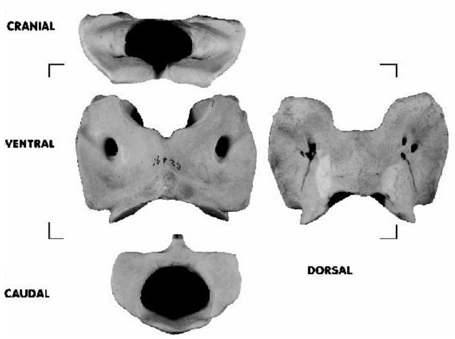
Lingual Buccal

Table 7.6: Cutmarks on *kabarga* MD by butcher.

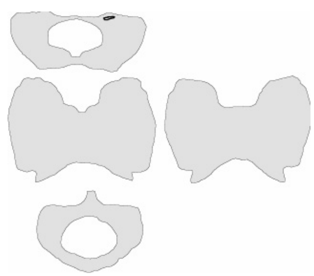
Parts butcher		Cutmarks (L,R)	Notes	Range	Butcher who opened jaw
SA	SK03	0,0	Dog butchery	0	?
VS	FK09	0,1			VS
	FK10	0,1			VS
	SK05	0,0		0-1	VS
VD	FK01	0,0		0	YA?
YA	FK02	4,0			YA?
	FK05	0,0			YA
	FK06	4,1			YA
	FK11	0,1		0-4	YA?
YU	SK02	0,0		0	YU?
VSVD	FK07	0,2	Floor		VSVD?
	FK03	0,0	In field for backpack		YA
?	SK08	0,0			?
	SK16	4,2			?

Average number of marks per mandible (CNC): L 0.9, R 0.6, combined 0.7

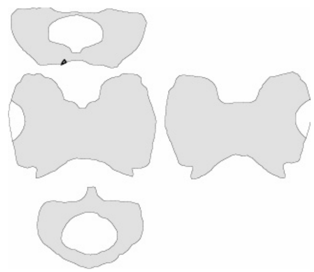
Figure 7.7: *Kabarga* atlas.
a) Template and individual specimens.
Template.



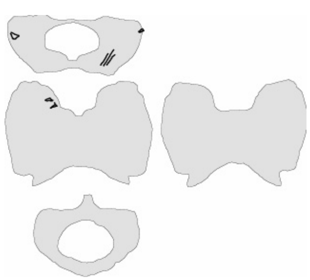
FK05, normal parts butchery by YA.



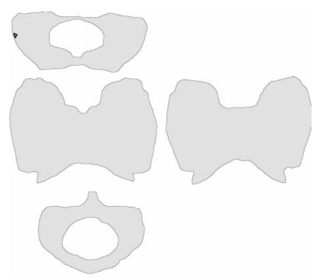
FK11, normal parts butchery by YA.



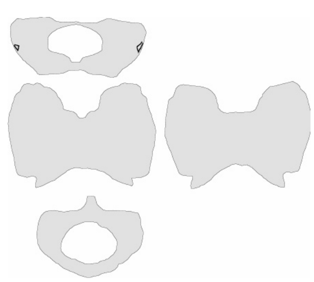
SK02, normal parts butchery by YU.



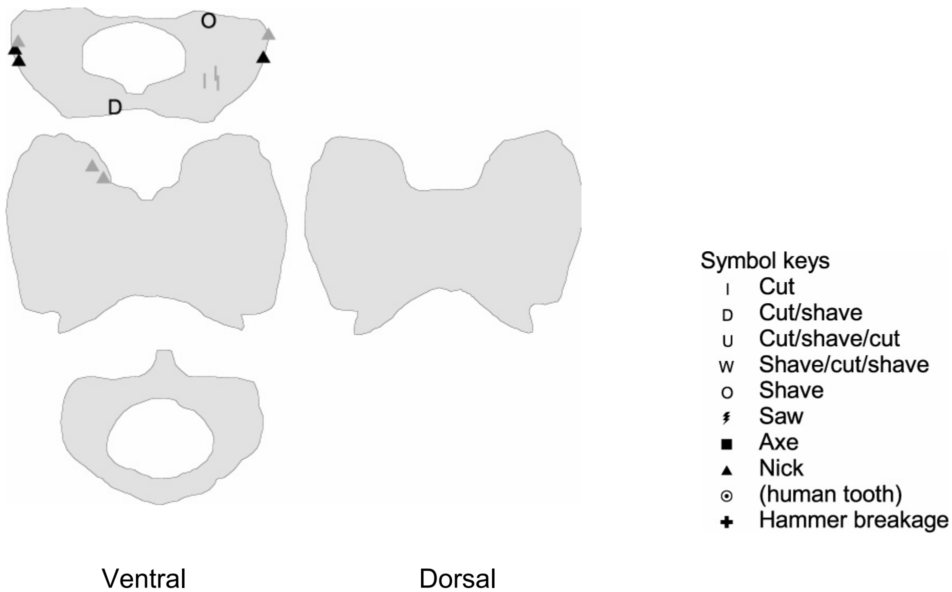
FK03, butchery by VS/VD in field.



SK05, parts butchery by VS (marks from disarticulation at eating).



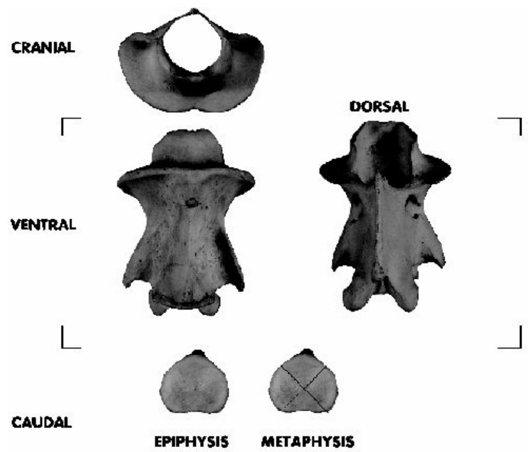
b) Distribution of all marks. (YU's marks on SK02 are shown in gray).



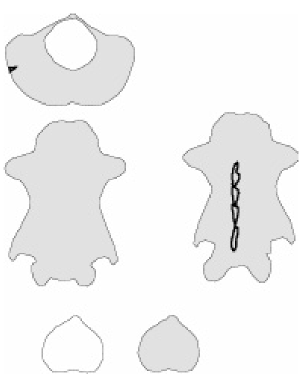
Parts butcher		Total	cut	c/s	shave	nick	nick (eat)
VS	SK05	0					2
YA	FK05	1			1		
	FK11	4		1			
YU	SK02	7	3			4	
VSVD	FK03	1				1	

Average number of marks per atlas (CNC): 2.6

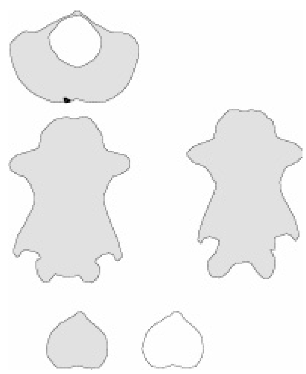
Figure 7.8: *Kabarga* axis.
a) Template and individual specimens.
Template.



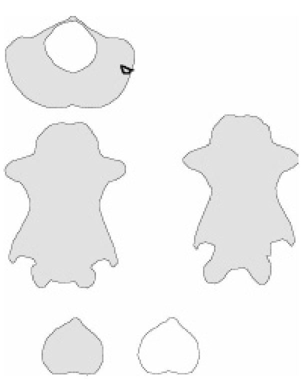
FK05.



FK03.



SK02.



b) Distribution of all marks.
1 cut/shave, 2 nicks, 4 shaves on dorsal process.
7 cuts total, average number of marks (CNC) = 2.3

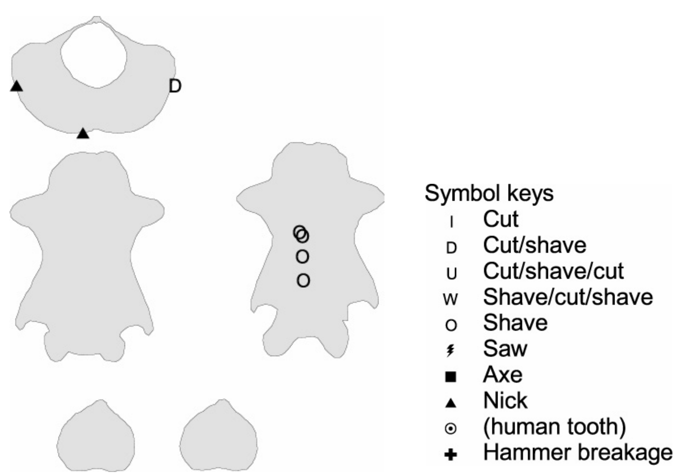
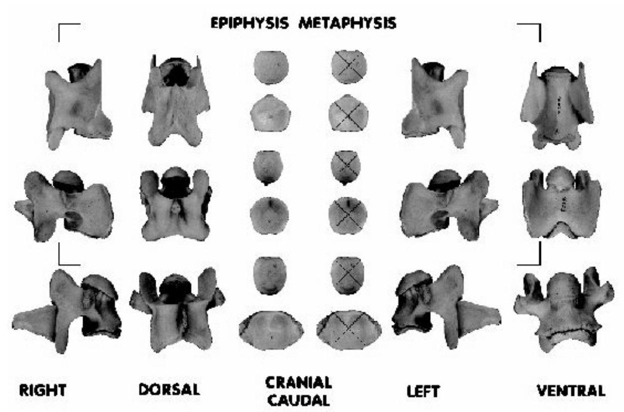
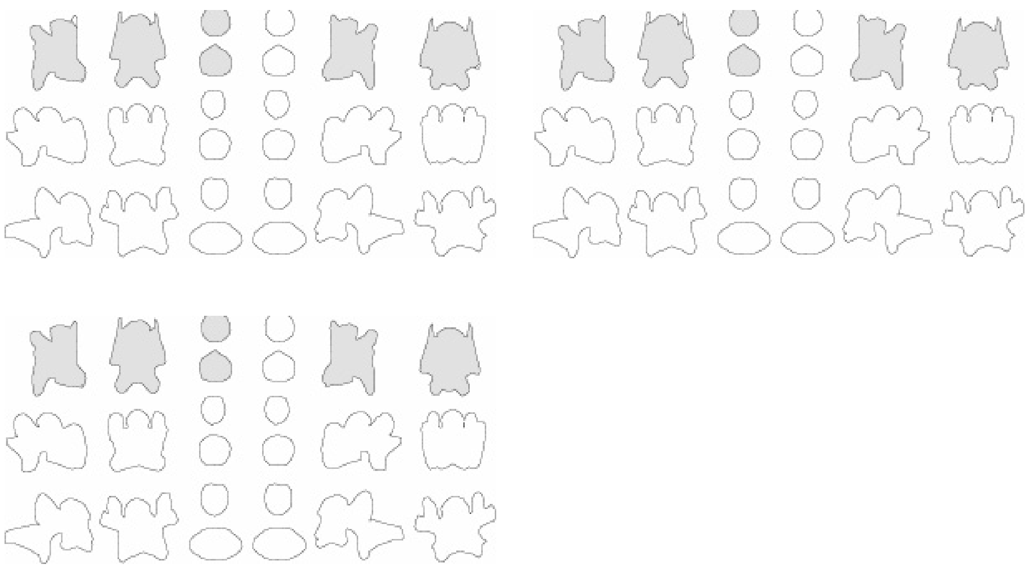


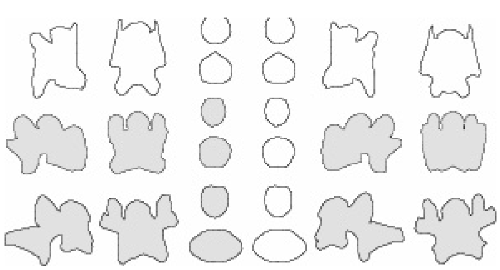
Figure 7.9: *Kabarga* cervical.
a) Template and individual specimens.
Template.



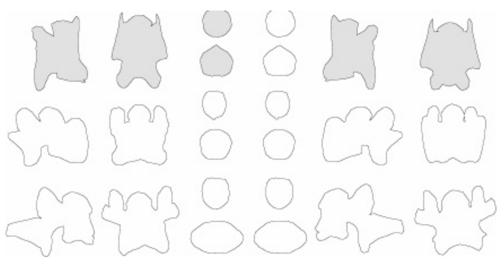
FK05 (3 CE).

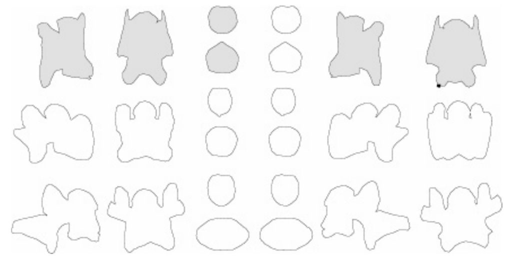


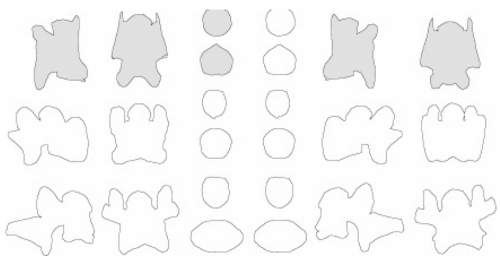
SK02 (2 CE).



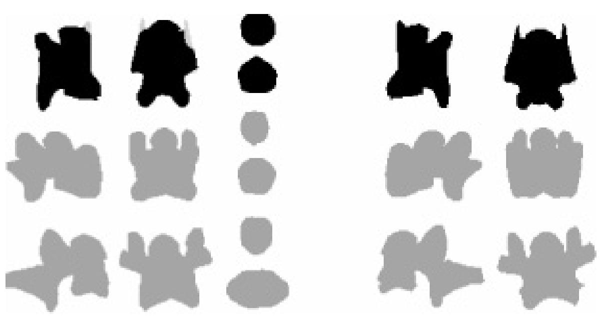
SK05 (3 CE. One on right had two marks, of type ‘cut’, on caudal articular process).







b) MNE map and preservation of CE.



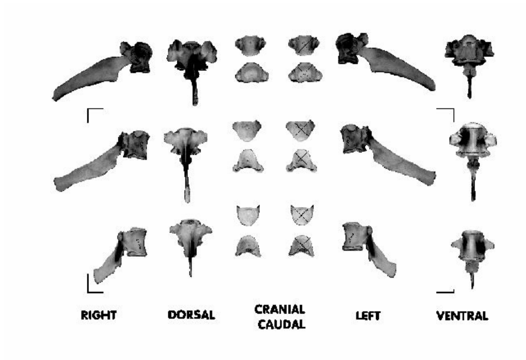
→ 6 CE (1 with missing cranial articular process)

→ 1 CE (complete)

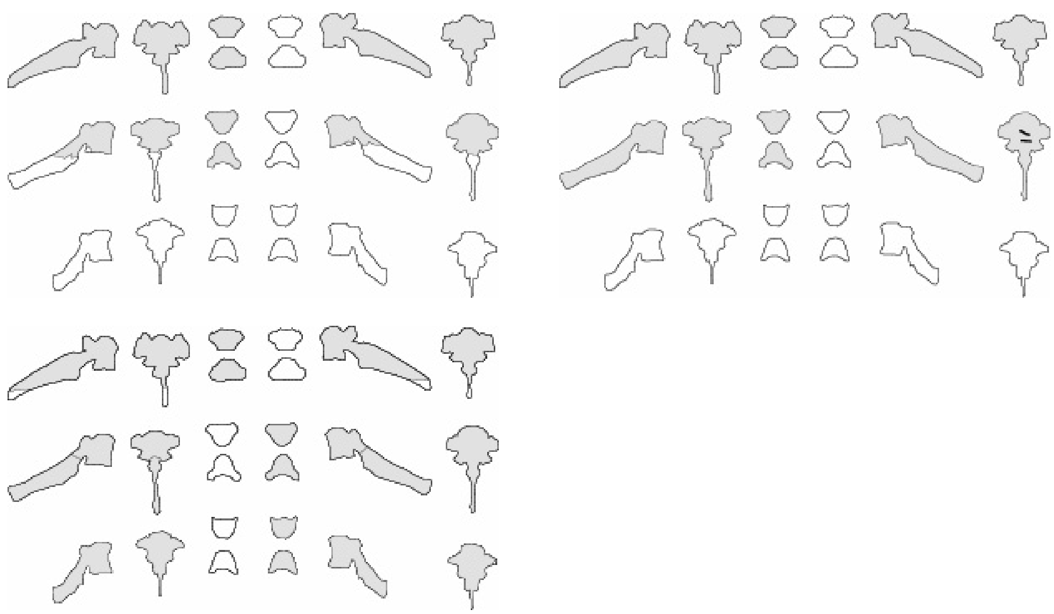
→ 1 CE (complete)

Right Dorsal Left Ventral

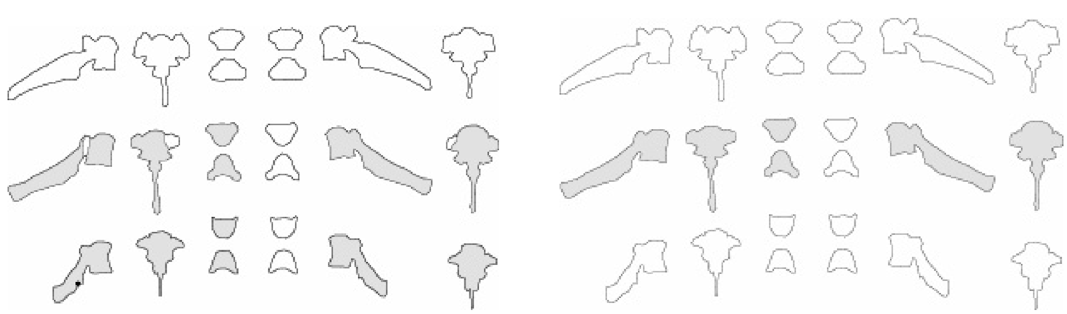
Figure 7.10: *Kabarga* thoracic.
a) Template and individual specimens.
Template.



FK05 (7 TH)

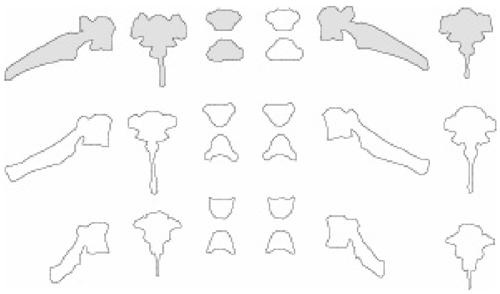


FK06 (3 TH)

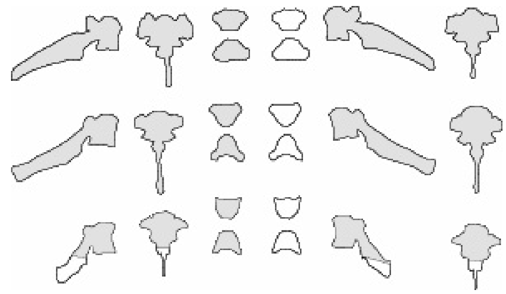


Right Dorsal Left Ventral Right Dorsal Left Ventral

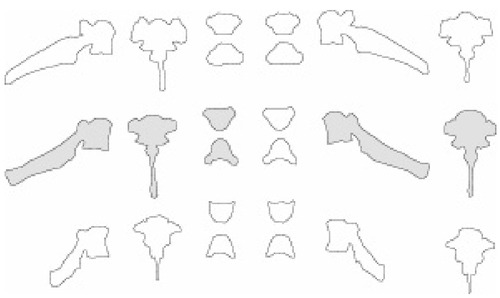
FK10 (1 TH)



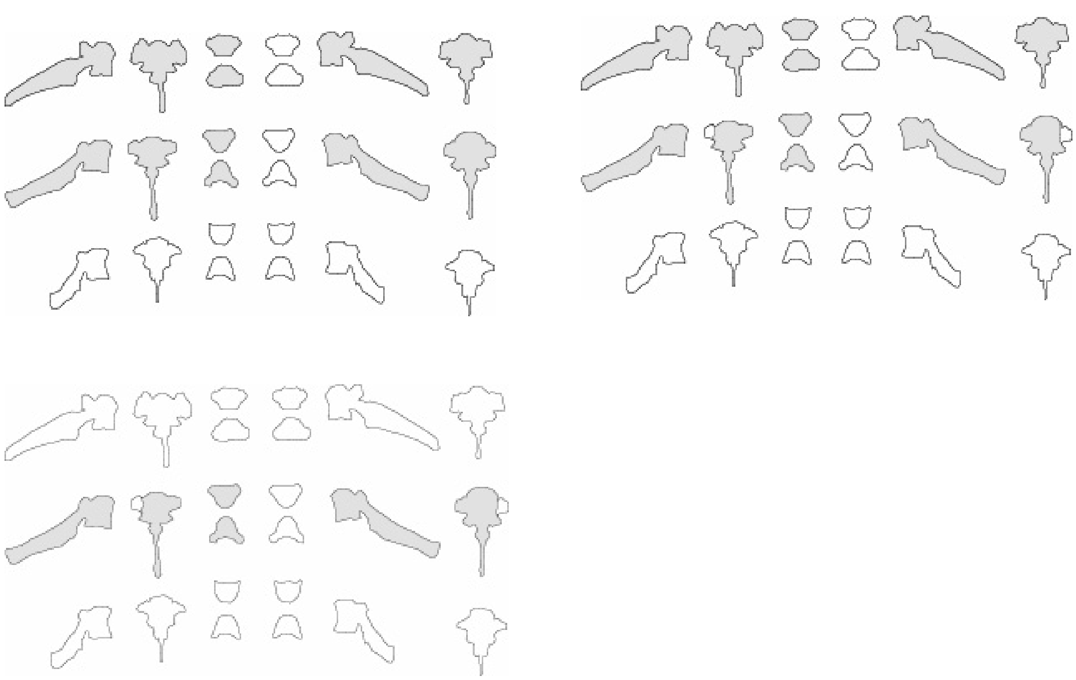
FK11 (3 TH)



SK02 (1 TH)

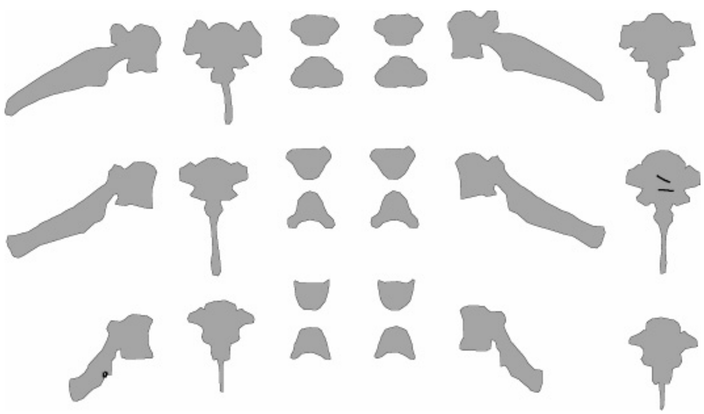


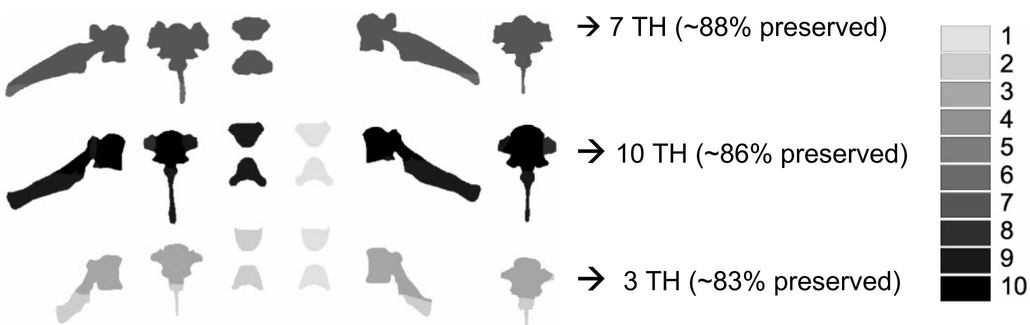
SK05 (5 TH)



Right Dorsal Left Ventral Right Dorsal Left Ventral

b) Distribution of all marks (2 of type ‘cut’ on ventral centrum and 1 eating toothmark on lateral dorsal process). Note: 20 out of 84 (anatomically present) TH recorded. Second figure shows MNE map used in the calculation of CNC (see Table 7.11).





c) Fracture pattern.

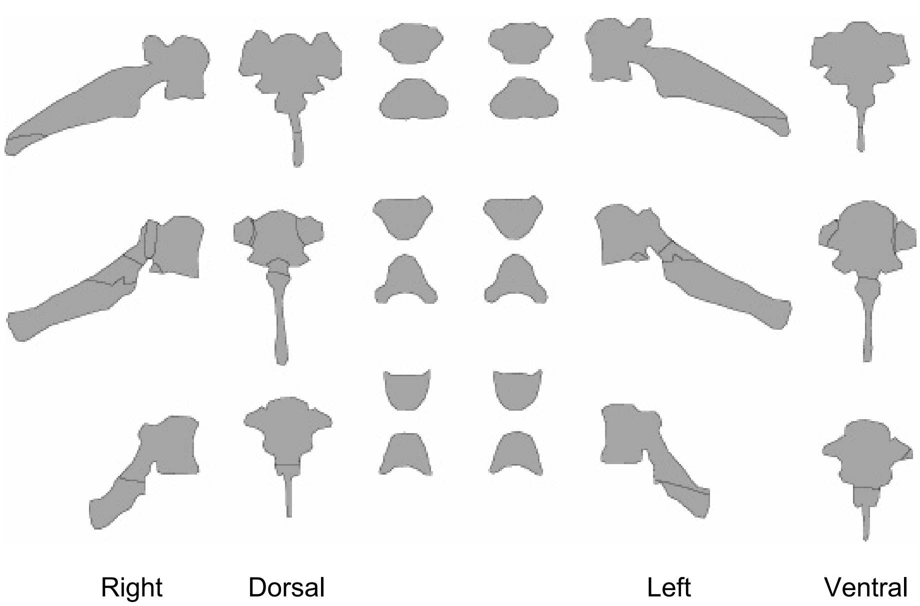
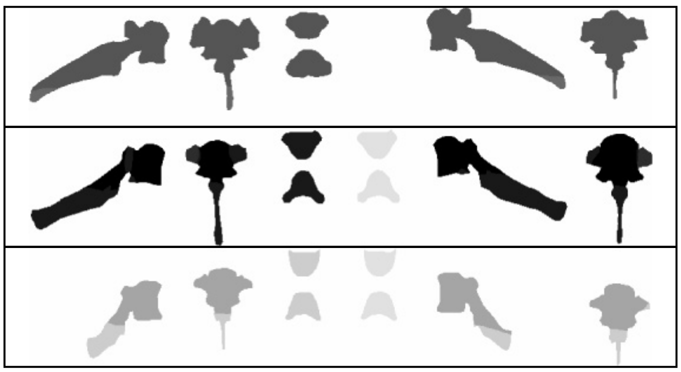


Table 7.11: Calculation of % preservation values using the GIS method, using *kabarga* TH as an example.

Vertebrae (CE, TH, LU) and ribs were drawn on templates that gave a choice of three different forms of these elements. These elements vary in shape from cranial to caudal and these templates were devised to reduce the approximation and researcher-induced bias going into the drawing of the fragment/element. The MNE and % preservation values for vertebrae (CE, TH, LU) and RI were calculated separately for each form of vertebra/rib (top, middle, and bottom) by utilizing the spatial query function in GIS software. The calculation is identical to the method described in Table 7.3.

Key to A, B, and C in table:



More cranial (A)

Middle (B)

More caudal (C)

(1) RAW AREA (pixel count)

Vertebrae	total	MNE value 0	1	2	3	4	5	6	7	8	9	10
A	4,015,243.00	441675						145101	3428467			
B	3,642,680.00		384751							104284	1582994	1570651
C	2,680,727.00		326622	721810	1632295							

(2) AREA CORRECTED BY MNE (pixel count * MNE value)

portion	total	0	1	2	3	4	5	6	7	8	9	10
A	24,869,875.00	0	0	0	0	0	0	870606	23999269	0		
B	31,172,479.00	0	384751	0	0	0	0	0	0	834272	14246946	15706510
C	6,667,127.00	0	326622	1443620	4896885	0	0	0	0	0		

(3) % ZONE REPRESENTED BY FRAGMENT ((2)/(1))

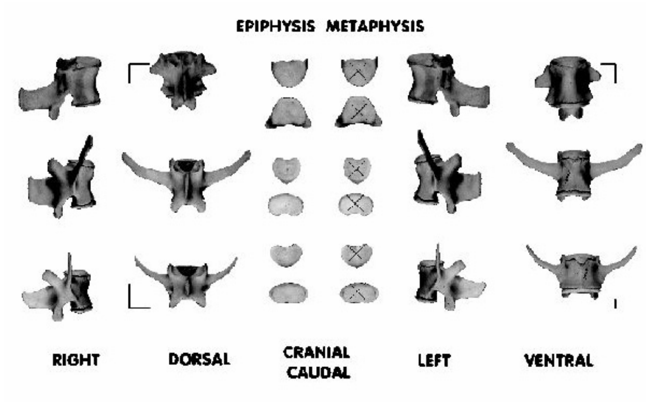
	portion	%zone (a)	# bones drawn (=MNE) (b)
	A	619.39%	7
1	B	855.76%	10
1	C	248.71%	3

(4) % PRESERVATION ((3a)/(3b))

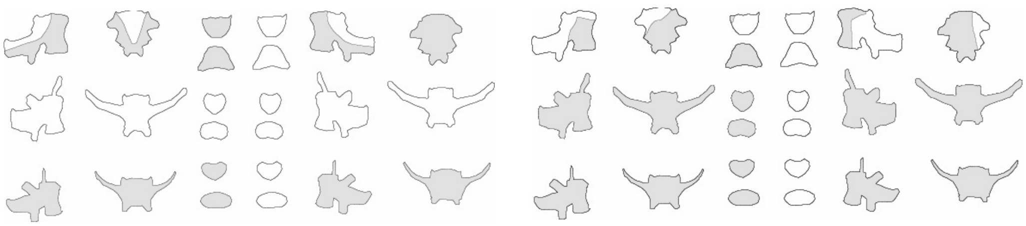
	portion	% preservation
	A	88%
1	B	86%
1	C	83%
	Total number of vertebrae	

Note: % preservation values calculated for vertebrae (CE, TH, LU), SC, and SA are somewhat skewed towards the lower, as these particular templates depicts (and counts) caudal/cranial areas twice as epiphysis and metaphysis. While it is possible (and necessary) to correct for this problem in the calculation for archaeological collections, this step is omitted in the current ethnoarchaeological study.

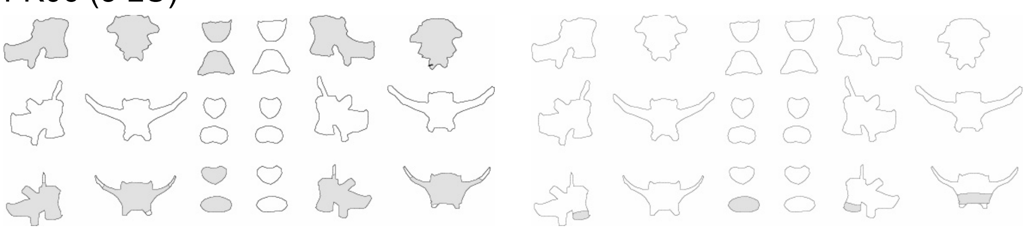
Figure 7.12: *Kabarga* lumbar.
a) Template and individual specimens.
Template.



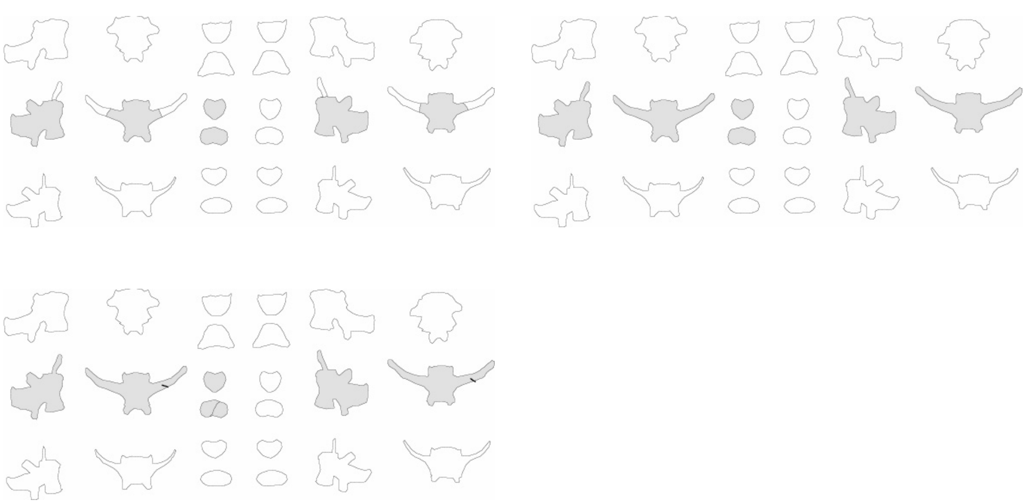
FK05 (5 LU)



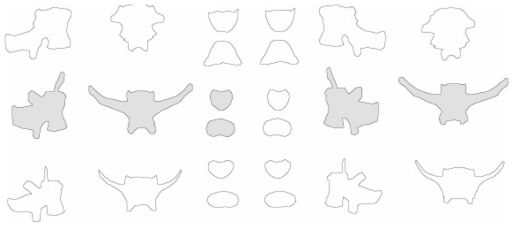
FK06 (3 LU)



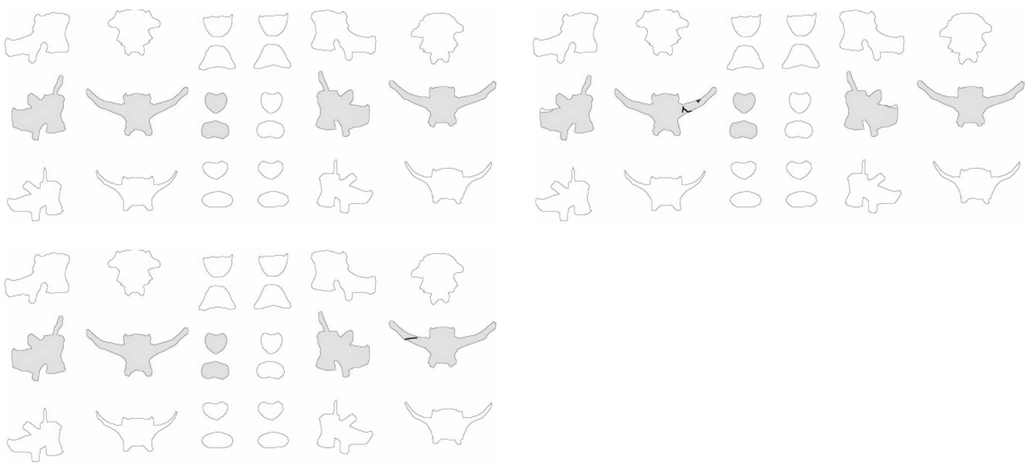
FK09 (3 LU)



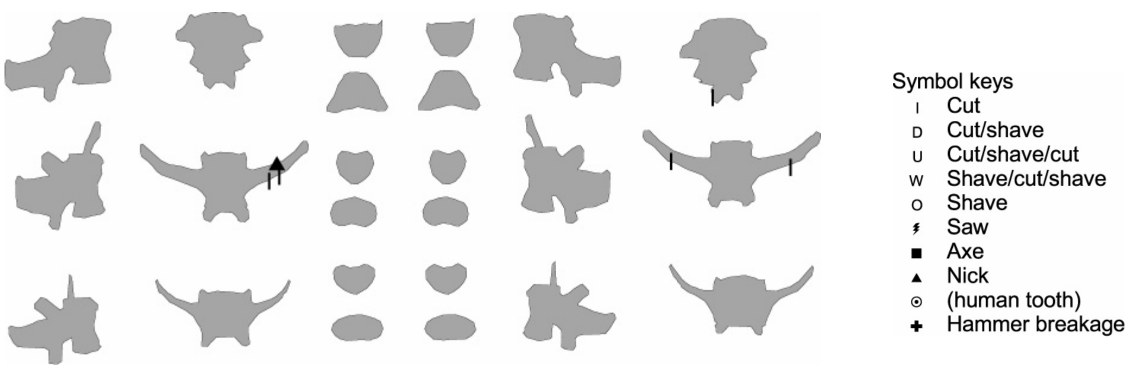
FK10 (1 LU)

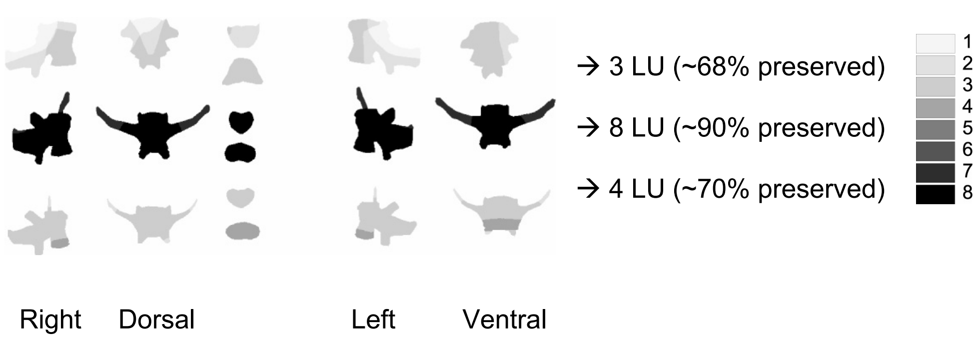


FK11 (3 LU)

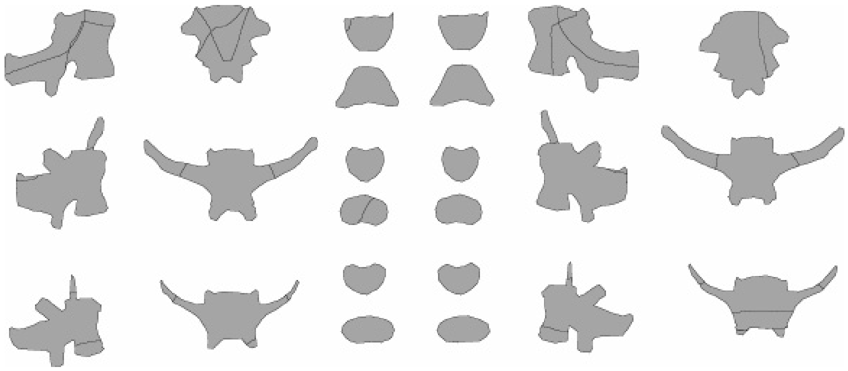


b) Distribution of all marks (5 type ‘cut’s, and 1 type ‘nick’).
Note: 15 out of 25 anatomically possible LU recorded. Second figure shows MNE map of recorded LU for comparison with the distribution of marks.





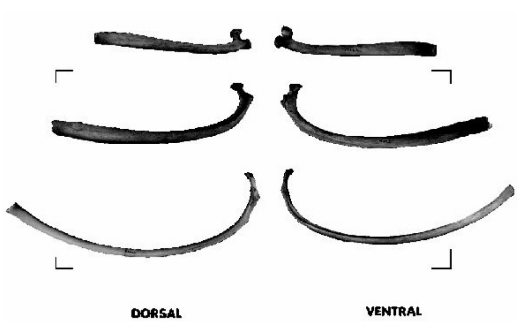
c) Fracture pattern.



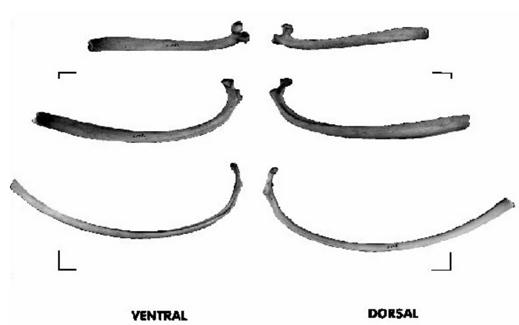
Right Dorsal Left Ventral

Figure 7.13: *Kabarga* ribs (L and R).
a) Template and individual specimens.
Templates.

L



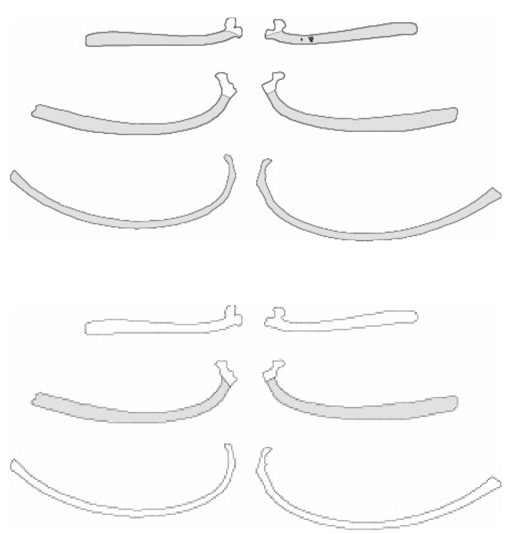
R



FK03

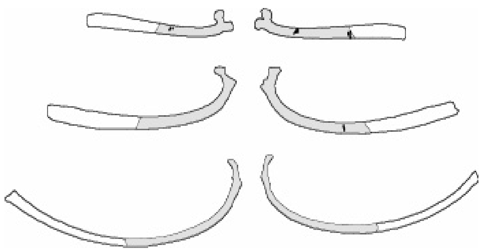
L (none recorded)

R (4 RI)

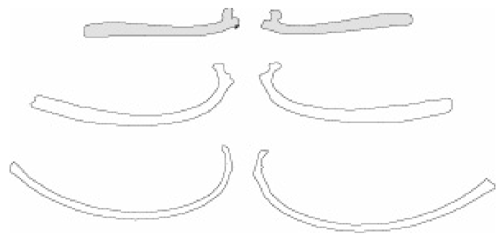


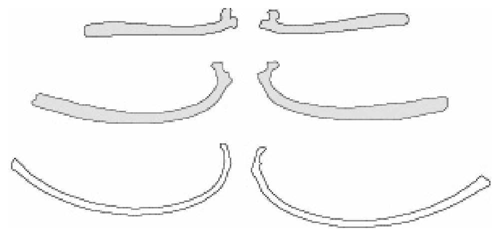
FK05

L (3 RI)



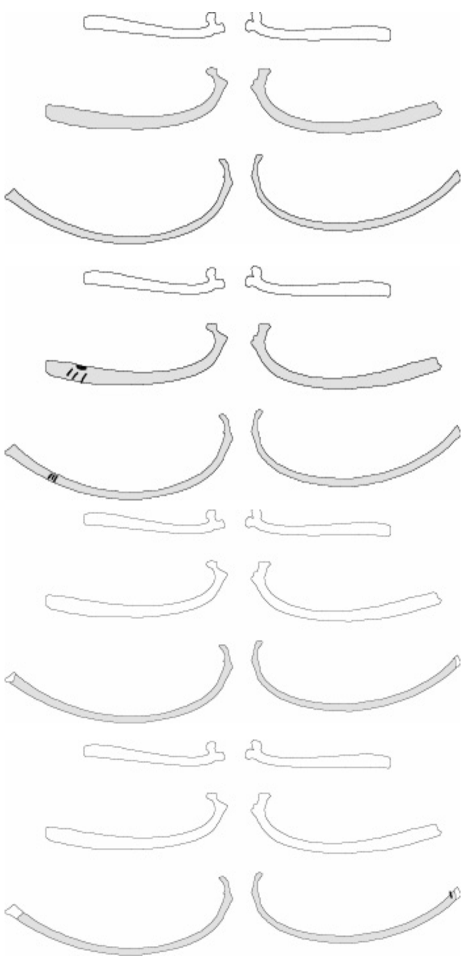
R (3 RI)





FK06

L (6 RI)



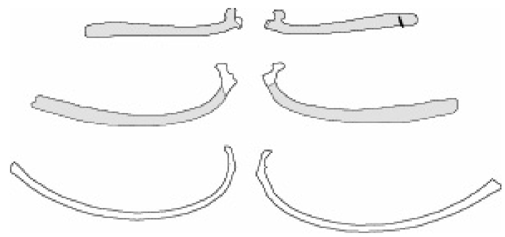
R (none recorded)

Dorsal Ventral Ventral Dorsal

FK09

L (none recorded)

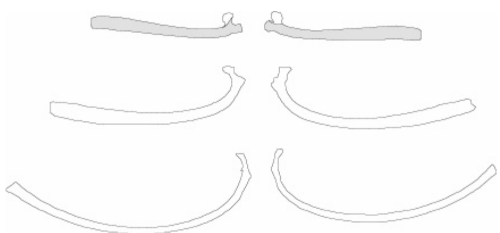
R (2 RI)

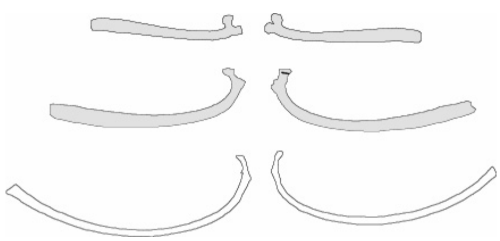


FK10

L (3 RI)

R (none recorded)

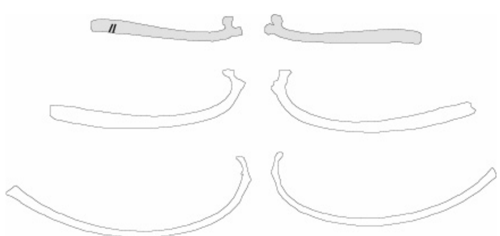


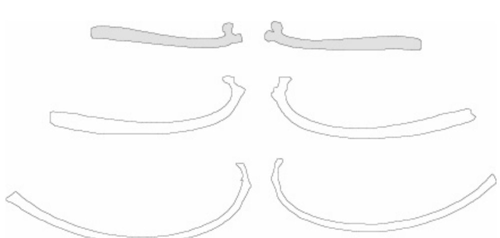


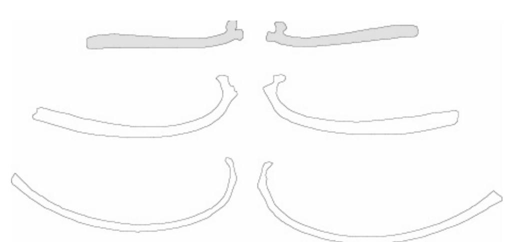
SK05

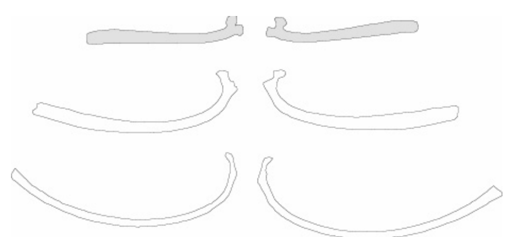
L (3 RI)

R (3 RI)



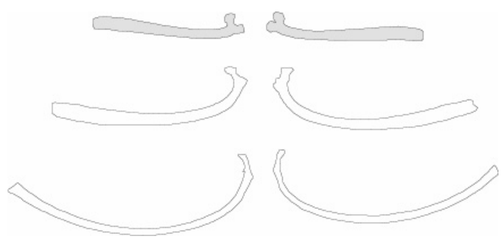


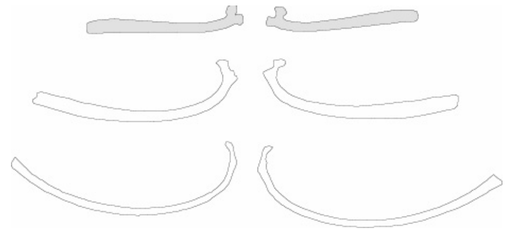




Dorsal Ventral Ventral Dorsal

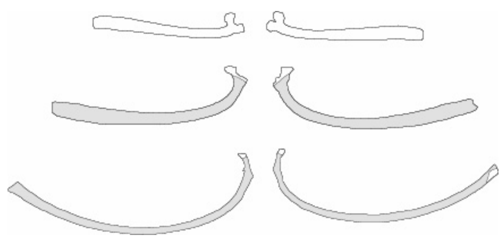
SK05 (continued)

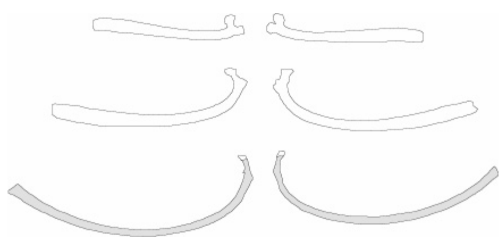




SK08

L (3 RI) R

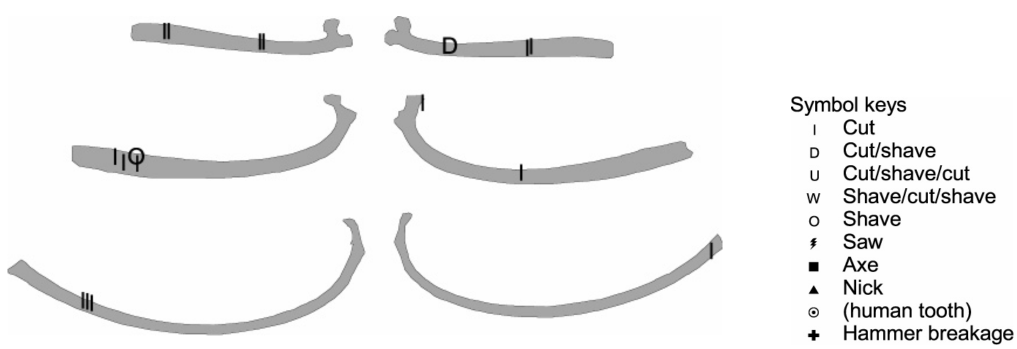


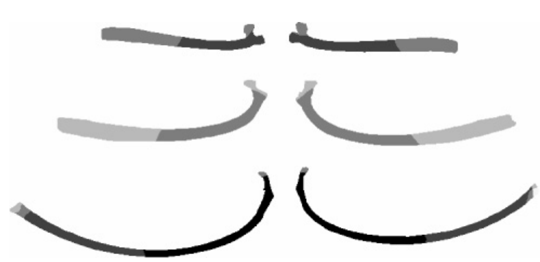


Dorsal Ventral Ventral Dorsal

b) Distribution of all marks, and MNE map of recorded RI for comparison with distribution of marks

L: 18 out of 70 anatomically possible RI recorded.

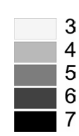




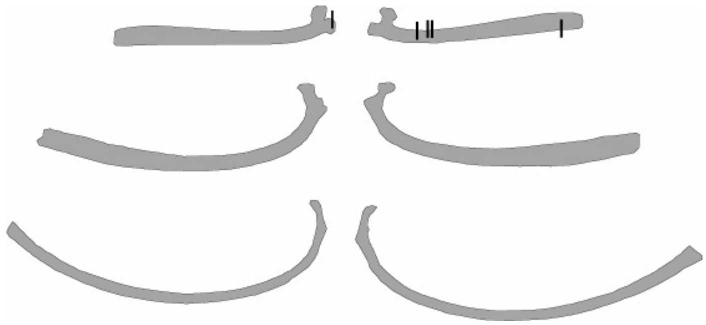
→ 6 RI (~92% preserved)

→ 5 RI (~89% preserved)

→ 7 RI (~91% preserved)



R: 12 out of 56 possible RI recorded.



Cutmark count by type:

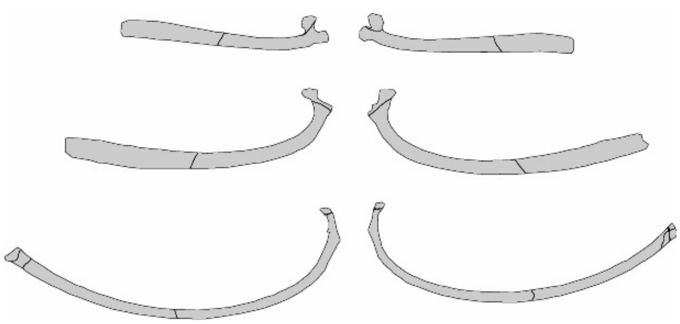
	Total	cut	c/s	shave
RIL	17	15	1	1
RIR	5	5		
RI both sides	22	20	1	1

Cutmark count by area:

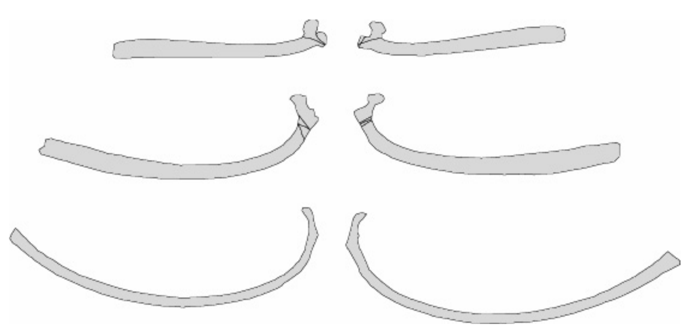
	rib head	ventral	dorsal	overall
L	1	5	11	17
R	1	0	4	5
Total	2	5	15	22

c) Fracture pattern.

L



R



Dorsal Ventral Ventral Dorsal

Table 7.14: Summary of *kabarga* rib surface modification.

a) Number of recorded ribs.

	upper ribs	middle ribs	lower ribs	overall
L	6	5	7	18
R	7	4	1	12
Total	13	9	8	30

b) % preservation.

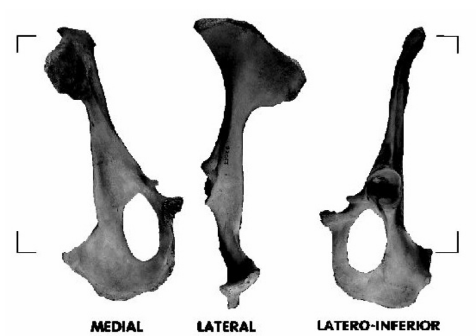
	upper ribs	middle ribs	lower ribs	overall
L	91%	89%		91%
R	98%	93%	100%	97%
Total	95%	91%	96%	94%

c) Number of cutmarks and expected number of cutmarks (CNC).

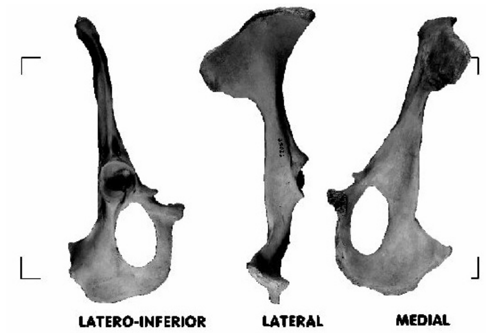
		upper ribs	middle ribs	lower ribs	overall	expected # cuts per RI (overall/ (#RI*preservation)
all cuts (1)	L	7	6	4	17	1.0 (1)
	R	5	0	0	5	0.4 (0-1)
	Total	12	6	4	22	0.8 (0-1)
# missing ribhead (2)	L	1	1	2	4	
	R	1	3	0	4	
	Total	2	4	2	8	
(1) + (2)	L	8	7	6	21	1.3 (1-2)
	R	6	3	0	9	0.8 (0-1)
	Total	14	10	6	30	1.1 (1-2)

Figure 7.15: *Kabarga* innominate (L and R).
a) Template and individual specimens. Parts butchery butcher in parentheses.
Template.

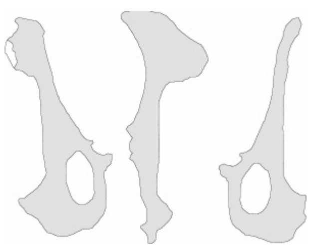
L



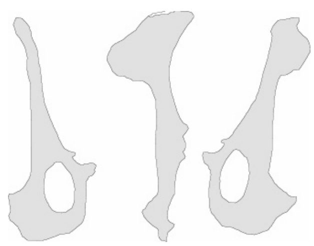
R



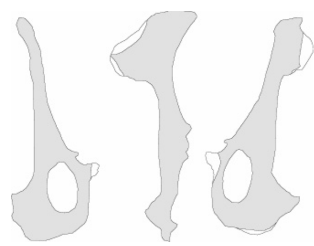
FK09 (VS)
L



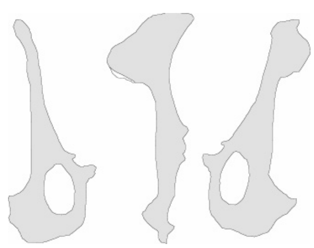
FK02 (YA)
R



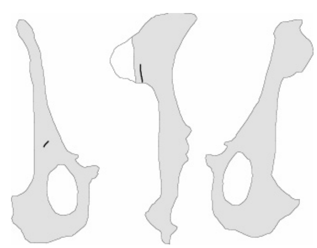
FK05 (YA)
R



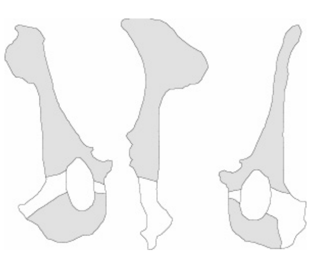
FK10 (VS)
R



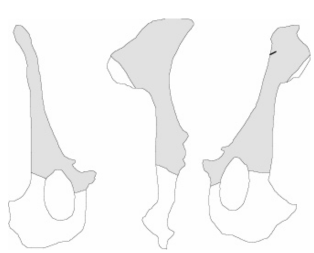
FK11 (YA)
R



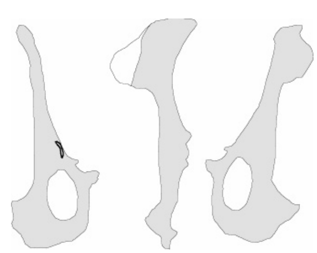
SK08 (?)
L



SK08 (?)
R



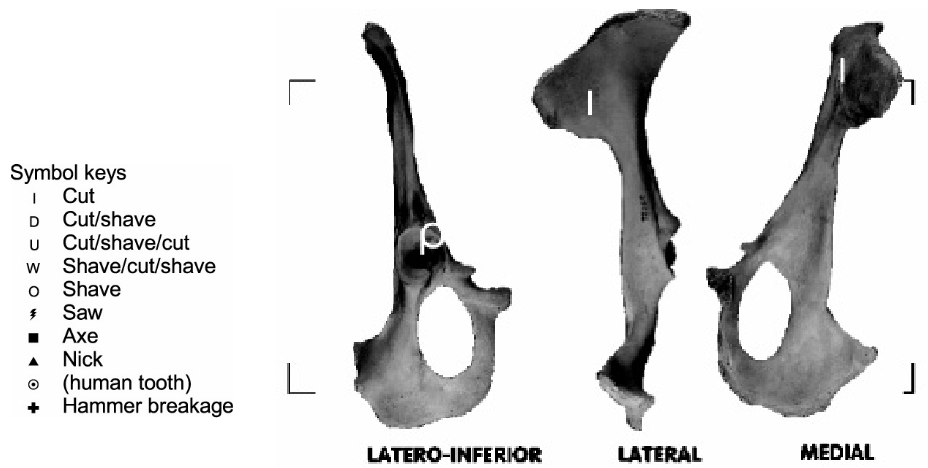
SK02 (YU)
R

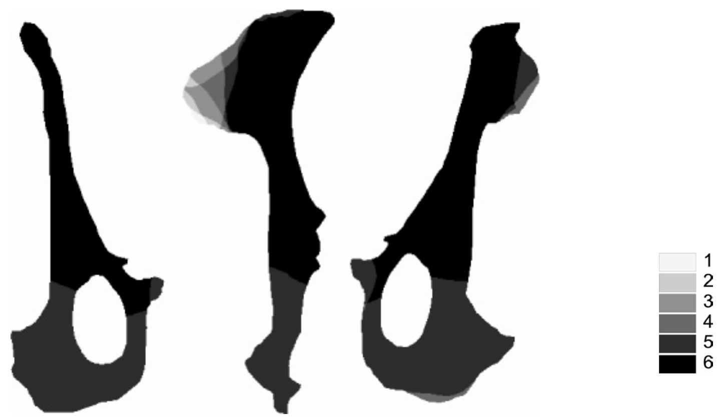


b) Distribution of all marks.
Second figure is MNE map of IN R for comparison with distribution of marks.

L (no marks)

R (3 type ‘cut’s, 1 type ‘shave’.
Cut on lateral view made by axe.)





c) Fracture pattern.

L

R

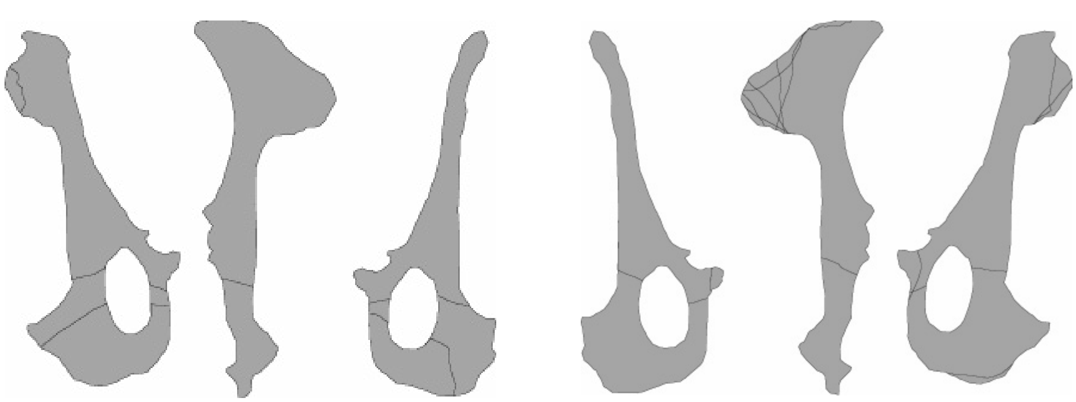
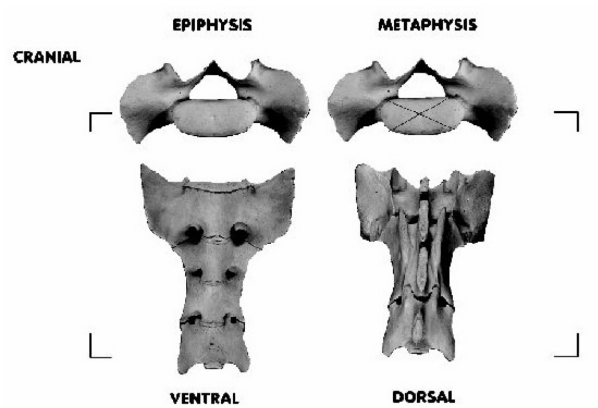
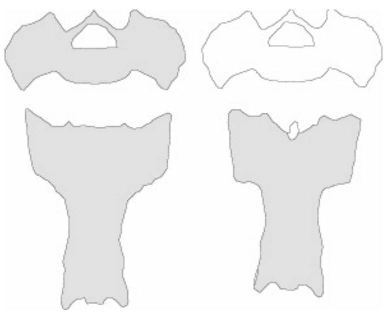


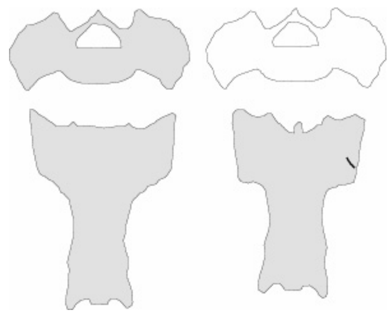
Figure 7.16: *Kabarga* sacrum.
a) Template and individual specimens.
Template.



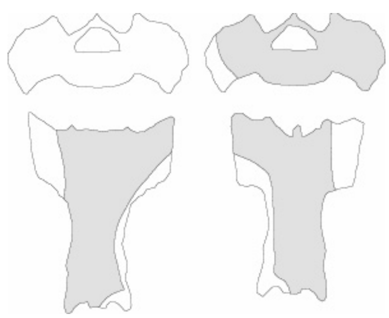
FK02



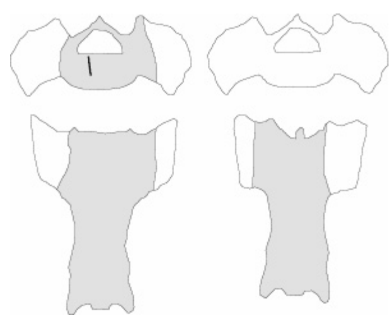
FK10



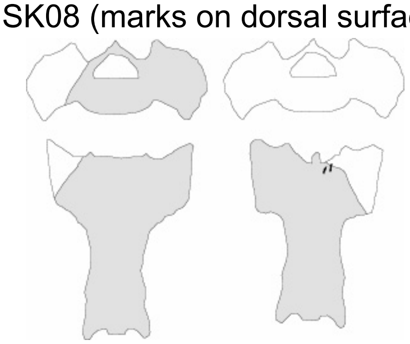
FK11



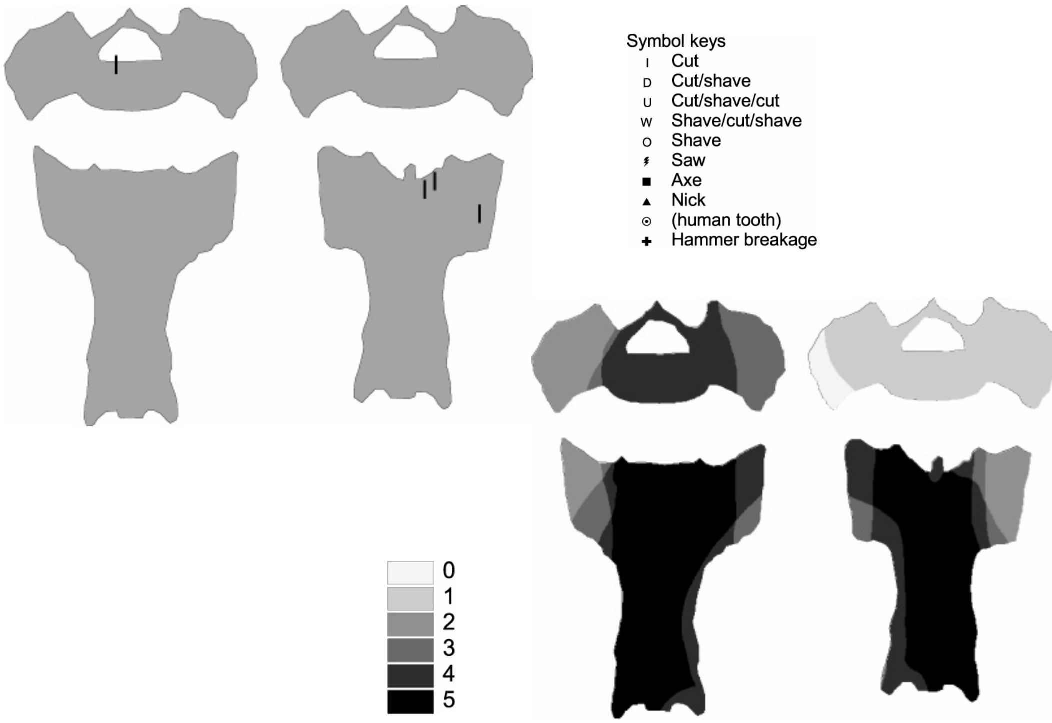
SK02



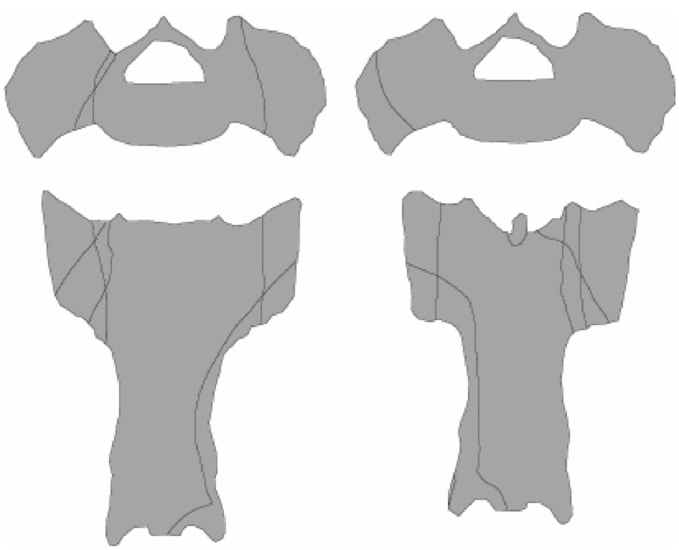
SK08 (marks on dorsal surface of centrum, inside neural canal)



b) Distribution of all marks.
Second figure shows MNE map of SA for comparison with distribution of marks.

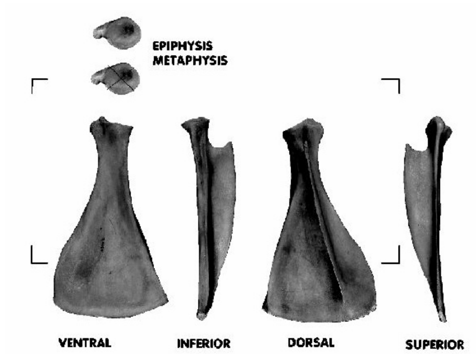


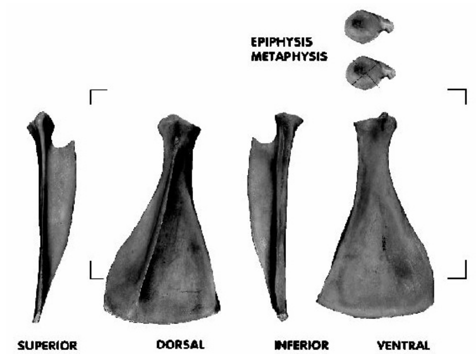
c) Fracture pattern.



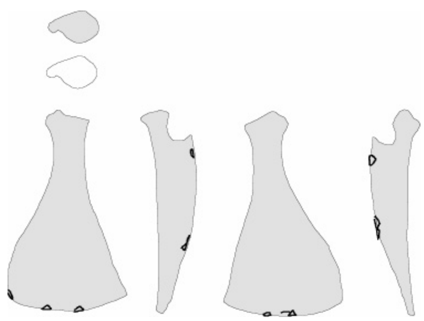
Ventral Dorsal

Figure 7.17: *Kabarga* scapula (L and R).
a) Template and individual specimens.
Templates.

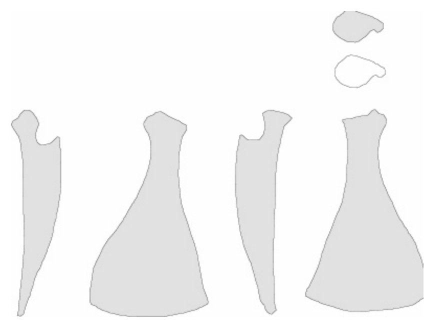




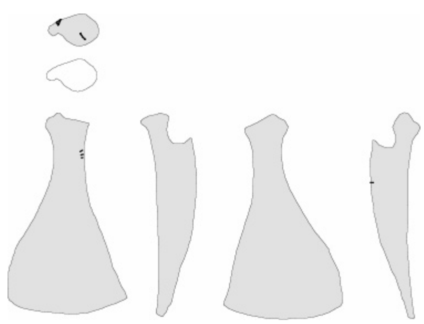
FK02
L



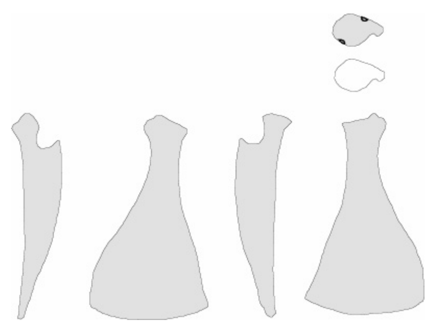
R



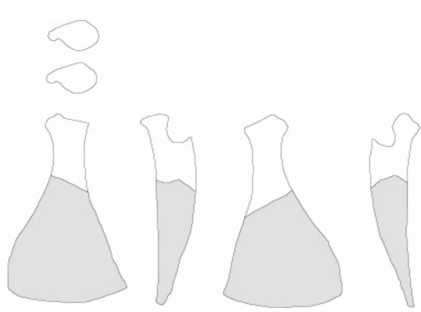
FK03 (cooking butchery: YA)
L



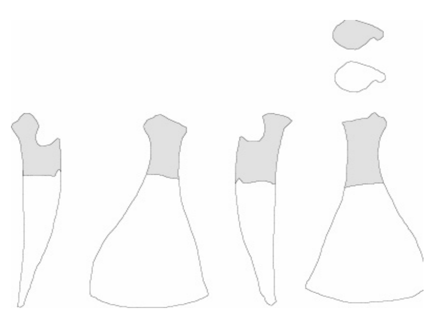
R



FK04
L

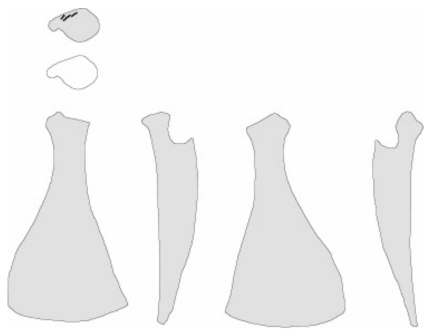


R

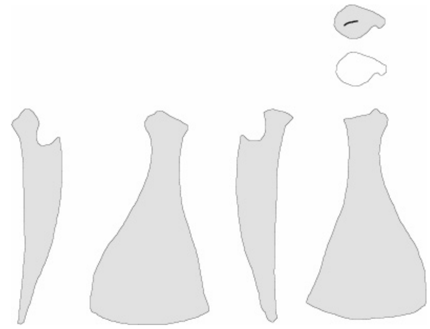


FK05 (cooking butchery: YA)

L

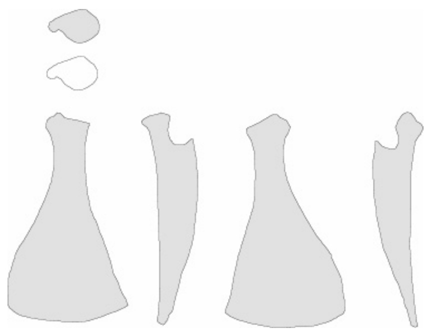


R



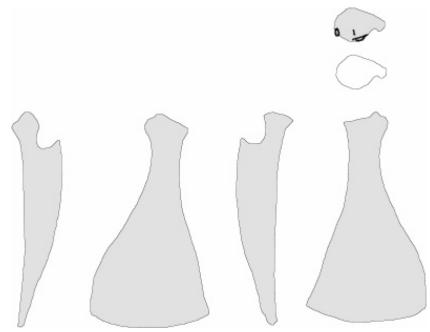
SK03

L



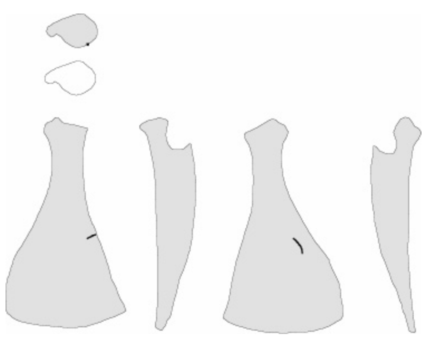
FK10 (cooking butchery: VS)

R



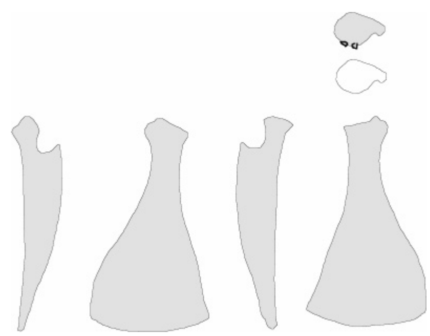
SK15 (cooking butchery: VS)

L



FK11 (cooking butchery: YA.
Marks from eating.)

R

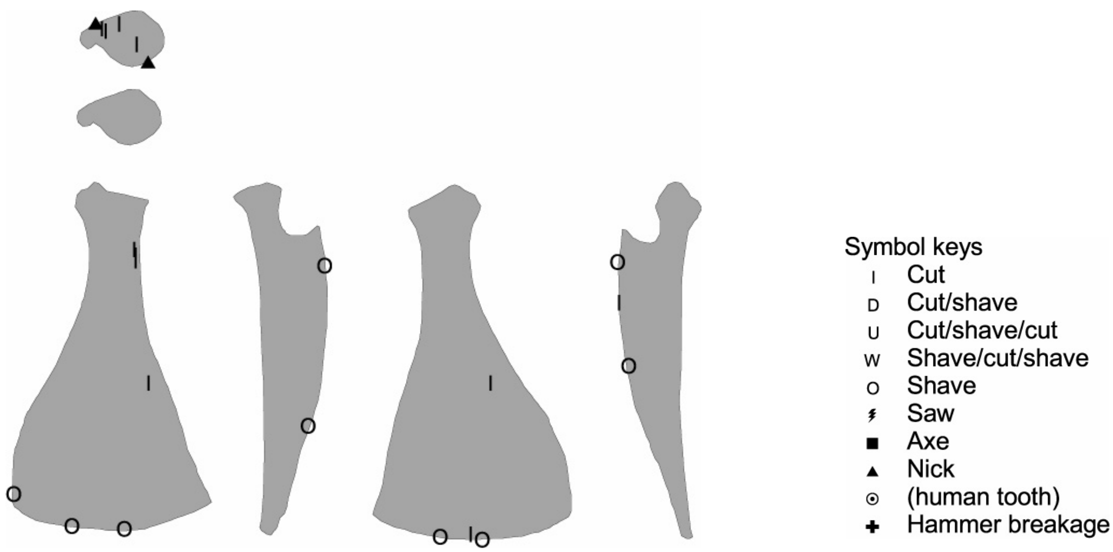


Ventral   Inferior   Dorsal   Superior

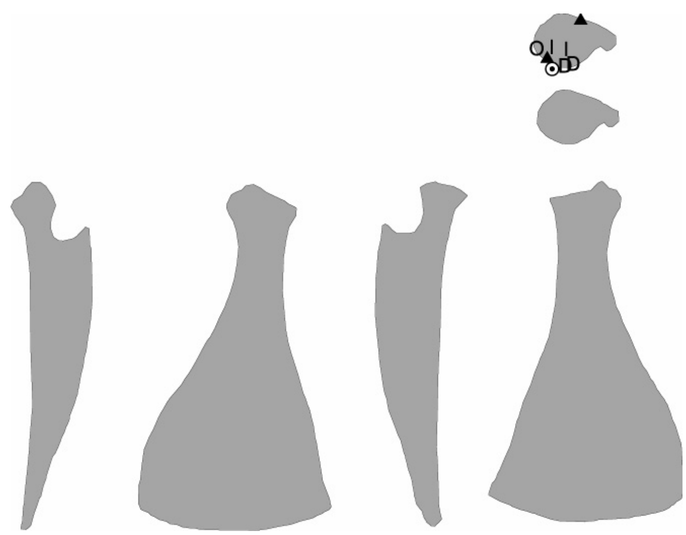
Superior   Dorsal   Inferior   Ventral

b) Distribution of all marks (symbol).

L



R



c) Zones.

L R

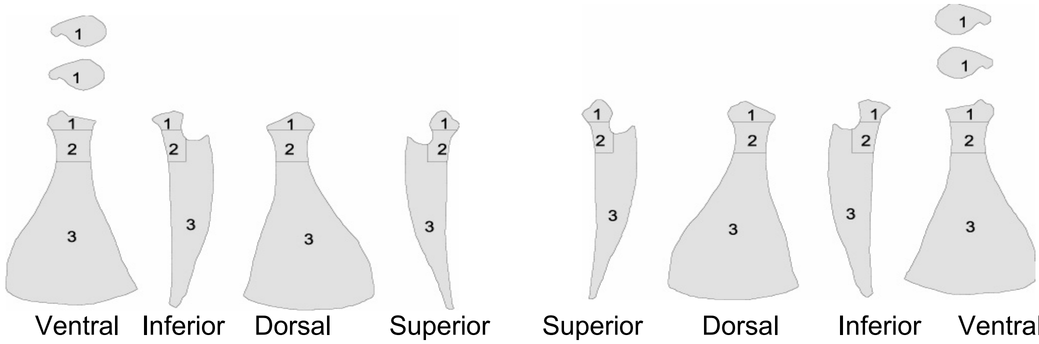


Table 7.18: Summary of *kabarga* scapula surface modification.

a) Cuts by animal, zone, and cutmark type.

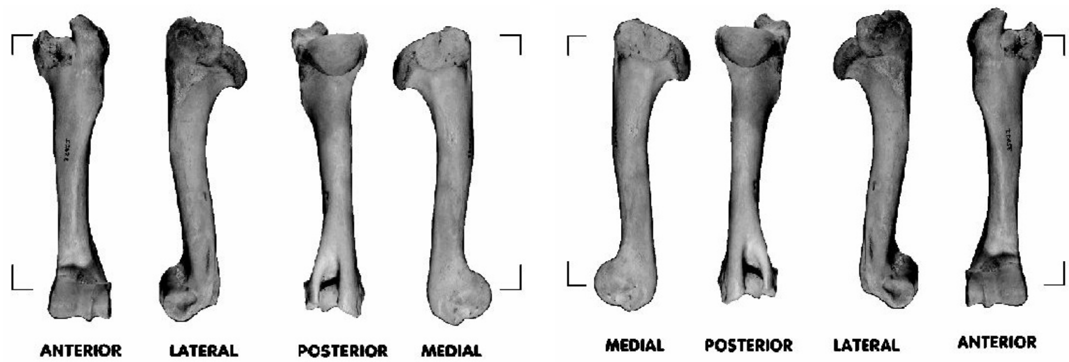
	Zone	cut 1	c/s 3	c/s/c 5	s/c/s 6	shave 7	saw 10	axe 11	nick 12	tooth 15	hammer 20	Total
L FK02	**3**	1				9						10
L FK03	**1**	1							1			2
	2	3										3
	3	1										1
	Total	*5*							*1*			*6*
L FK05	**1**	3										3
L SK15	**1**								1			1
	3	2										2
	Total	*2*							*1*			*3*
R FK03	**1**								2			2
R FK05	**1**	1										1
R FK10	**1**	1	1			1						3
R FK11	**1**		1							1		2

b) Summary of surface modification.
In addition to marks individually noted as eating marks, marks in zones 2 and 3 were also considered eating marks (i.e. for the removal of cooked meat), as these zones were not cut during parts butchery or cooking butchery.

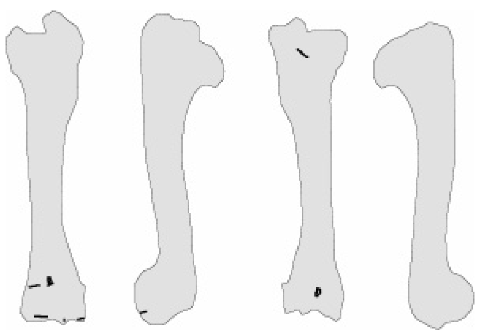
	Zone	cut 1	c/s 3	c/s/c 5	s/c/s 6	shave 7	saw 10	axe 11	nick 12	tooth 15	hammer 20	Total	% preserved	Corrected # cutmarks	Total eating	Corrected # cutmarks for disarticulation
SCL	**1**	4							2			6	500%	1.2	0	1.2
	2	3										3	500%	0.6	3	0.0
	3	4				9						13	585%	2.2	13	0.0
SCR	**1**	2	2			1			2	1		8	600%	1.3	2	1.0
	2												600%	0.0		0.0
	3												510%	0.0		0.0
SC	**1**													1.3		1.1
	2													0.3		0.0
	3													1.1		0.0

Figure 7.19: *Kabarga* humerus (L and R).
a) Template and individual specimens.
Templates.

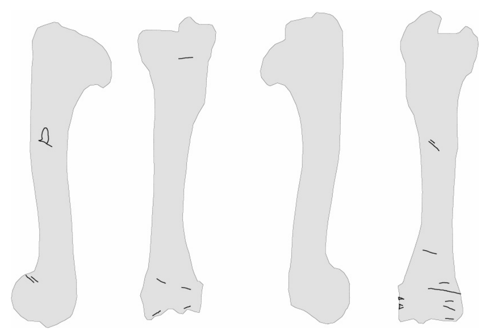
L | R



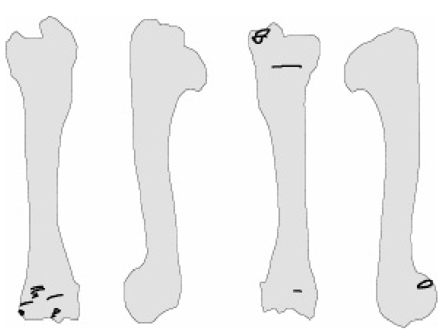
FK03 (cooking butchery: YA)
L (posterior distal mark from eating)



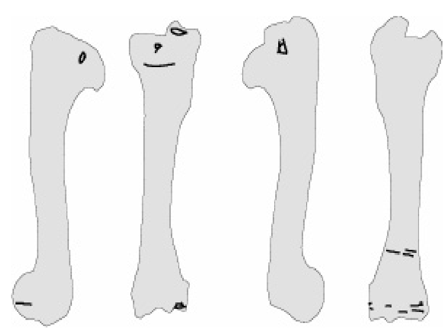
FK02
R



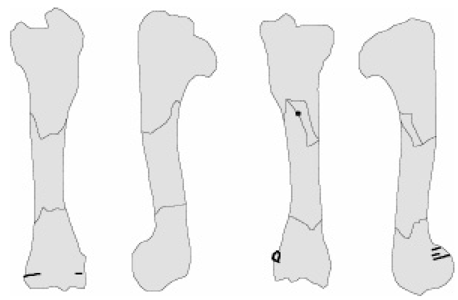
FK05 (cooking butchery: YA)
L



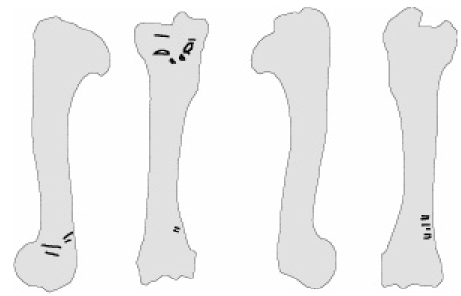
R (marks on mid- and distal shaft from eating)



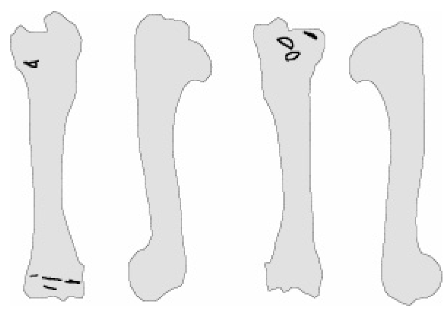
FK10 (cooking butchery: VS
L (Fragmentation at eating)



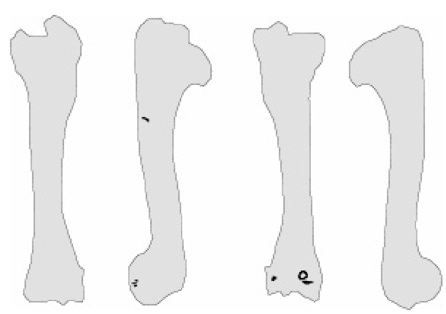
FK11 (cooking butchery: YA)
R



SK02 (cooking butchery: YU)
L

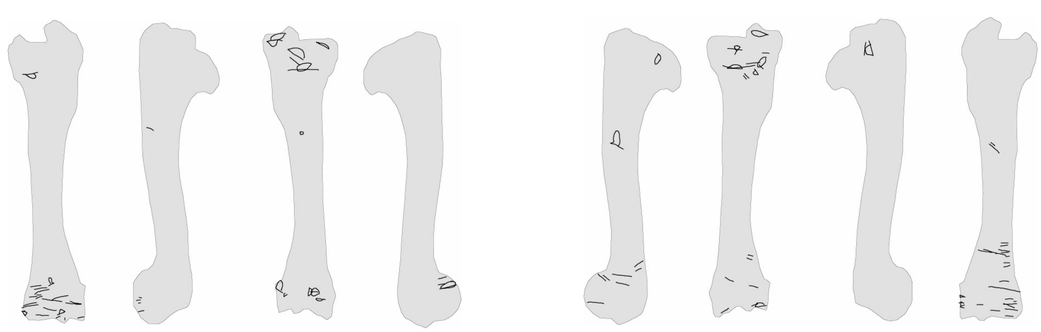


SK15
L



b) Distribution of all marks (drawing)

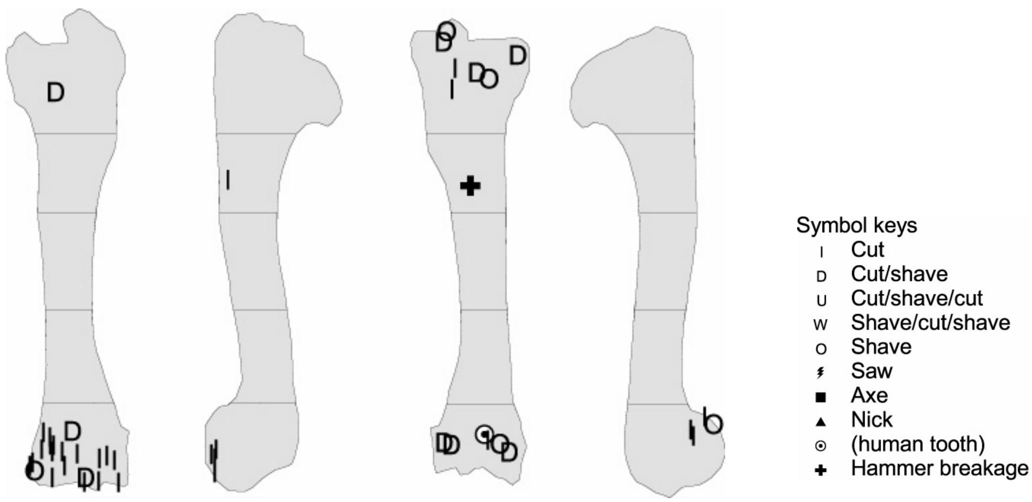
L R



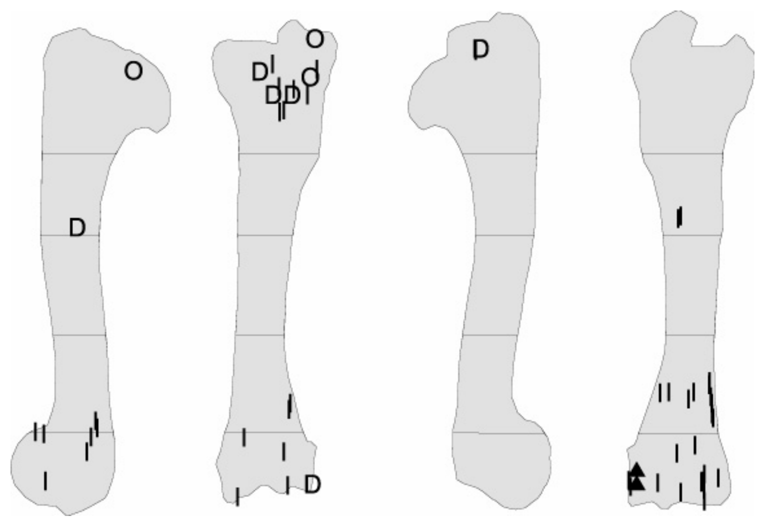
Anterior Lateral Posterior Medial Medial Posterior Lateral Anterior

c) Distribution of all marks (symbol).

L



R



d) Zones.

L R

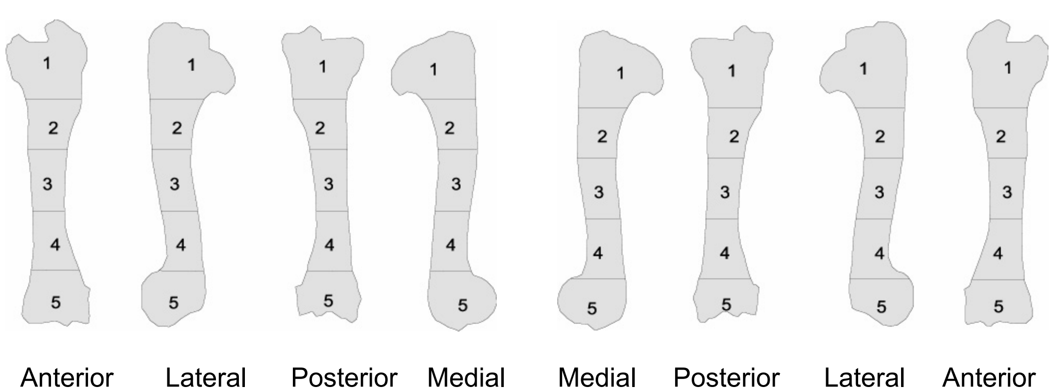


Table 7.20: Summary of *kabarga* humerus surface modification.
a) Cuts by animal, zone, and cutmark type.

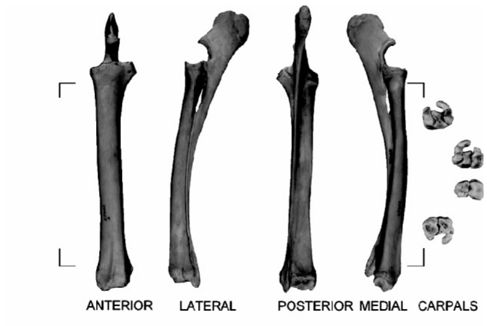
	Zone	cut 1	c/s 3	c/s/c 5	s/c/s 6	shave 7	saw 10	axe 11	nick 12	tooth 15	hammer 20	Total
L FK03	**1**	1										1
	5	5	1							1		7
	Total	*6*	*1*							*1*		*8*
L FK05	**1**	1	1	1								3
	5	8	1	2								11
	Total	9	2	3								14
L FK10	**2**										1	1
	5	5	1									6
	Total	*5*	*1*								*1*	*7*
L SK02	**1**		3	1								4
	5	5										5
	Total	*5*	*3*	*1*								*9*
L SK15	**2**	1										1
	5	3	2	1								6
	Total	*4*	*2*	*1*								*7*
R FK02	**1**	1										1
	2	2	1									3
	4	1										1
	5	11							2			13
	Total	*15*	*1*						*2*			*18*
R FK05	**1**	2	2			2						6
	4	3										3
	5	8	1									9
	Total	*13*	*3*			*2*						*18*
R FK11	**1**	5	2			1						8
	4	10										10
	5	2										2
	Total	*17*	*2*			*1*						*20*

b) Summary of surface modification.

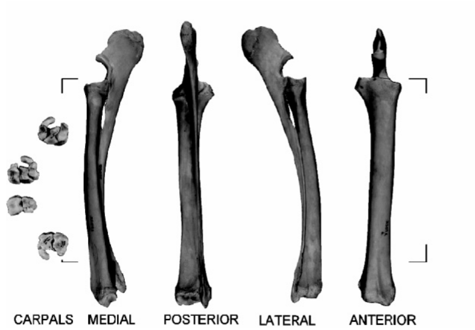
	Zone	cut 1	c/s 3	c/s/c 5	s/c/s 6	shave 7	saw 10	axe 11	nick 12	tooth 15	hammer 20	Total	% preserved	Corrected # cutmarks	Total eating	Corrected # cutmarks for disarticulation
HUL	**1**	2	4	2								8	500%	1.6	8	1.6
	2	1									1	2	500%	0.4	2	0.4
	3													0.0		0.0
	4													0.0		0.0
	5	26	5	3						1		35	500%	7.0	34	6.8
HUR	**1**	8	4			3						15	300%	5.0	15	5.0
	2	2	1									3	300%	1.0	3	1.0
	3													0.0		0.0
	4	14										14	300%	4.7	11	3.7
	5	21	1						2			24	300%	8.0	24	8.0
HU	**1**													3.3		3.3
	2													0.7		0.7
	3													0.0		0.0
	4													2.3		1.8
	5													7.5		7.4

Figure 7.21: *Kabarga* radioulna (L and R).
a) Template and individual specimens. Carpals are shown if they were attached to the radioulna at time of recording.
Templates.

L

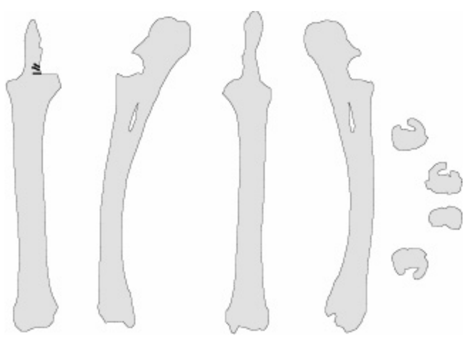


R



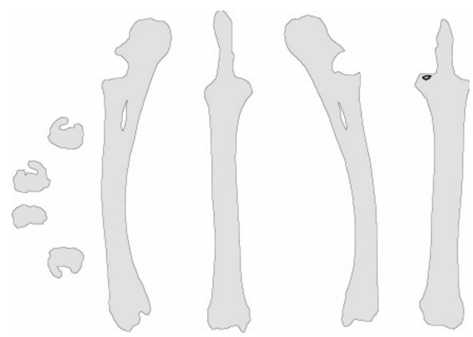
FK03 (cooking butchery: YA)

L



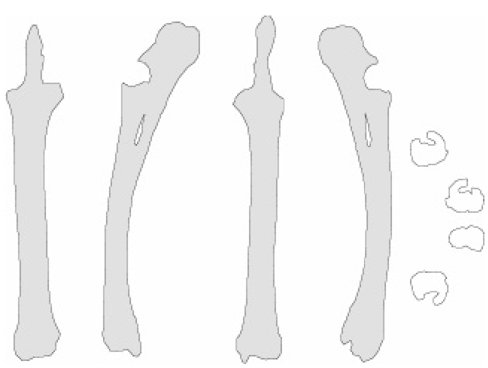
FK02

R

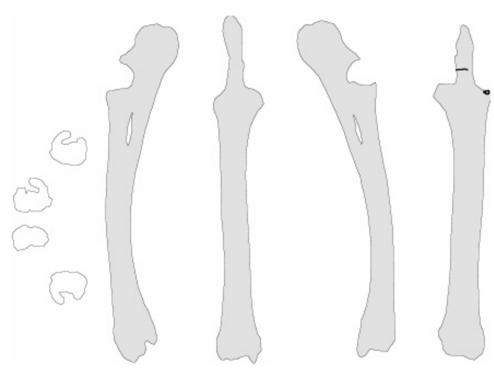


FK05 (cooking butchery: YA)

L

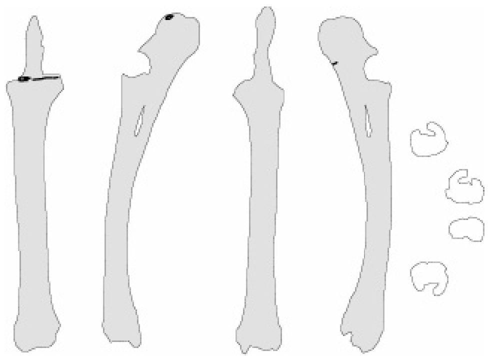


R



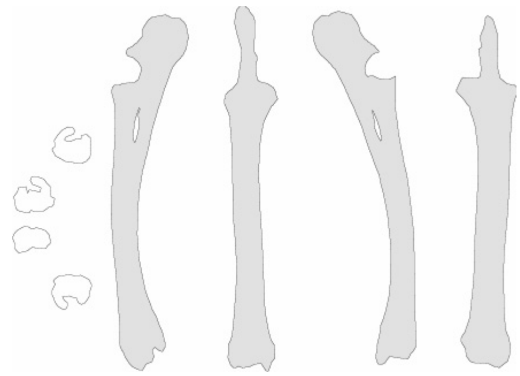
FK10 (cooking butchery: VS)

L



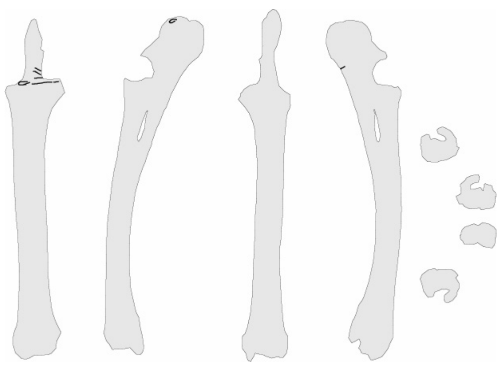
SK03

R



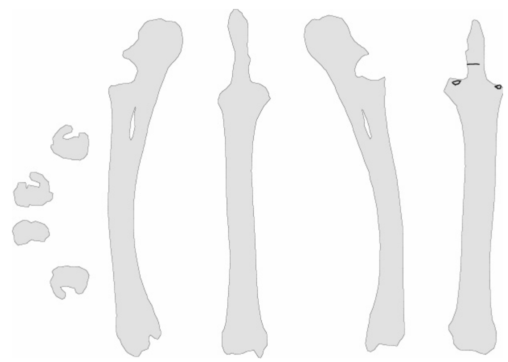
b) Distribution of all marks (drawing).

L



Anterior Lateral Posterior Medial

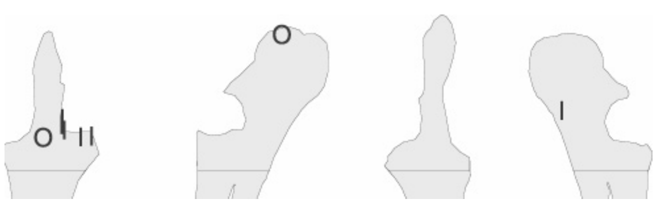
R



Medial Posterior Lateral Anterior

c) Distribution of all marks (symbol).

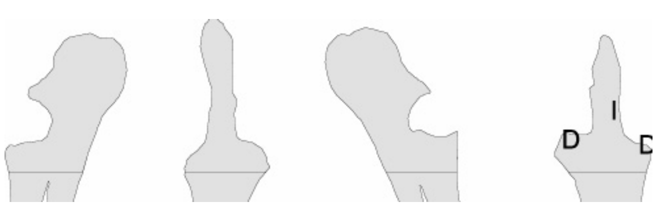
L



Symbol keys

- I Cut
- D Cut/shave
- U Cut/shave/cut
- W Shave/cut/shave
- O Shave
- Saw
- ■ Axe
- ▲ Nick
- ⊙ (human tooth)
- ✚ Hammer breakage

R



d) Zones.

L R

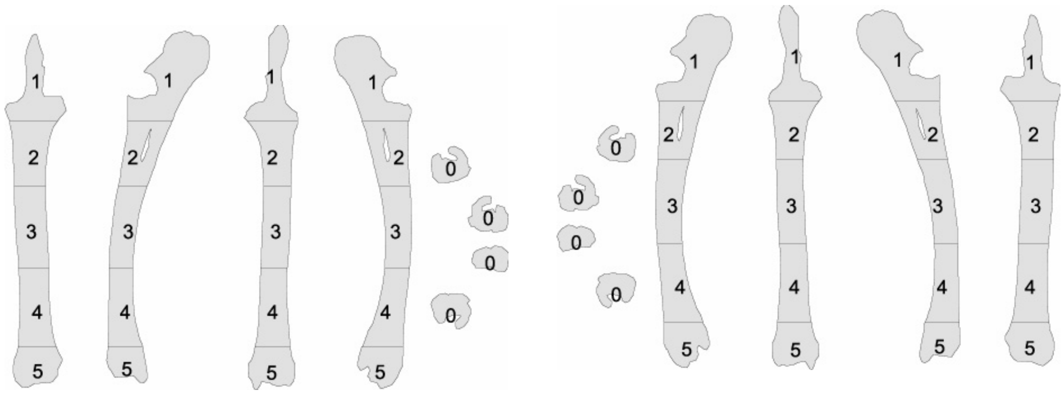


Table 7.22: Summary of *kabarga* radioulna surface modification.

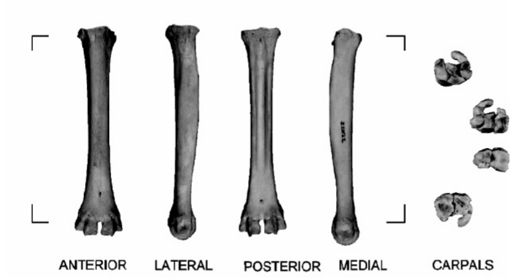
a) Cuts by animal, zone, and cutmark type.

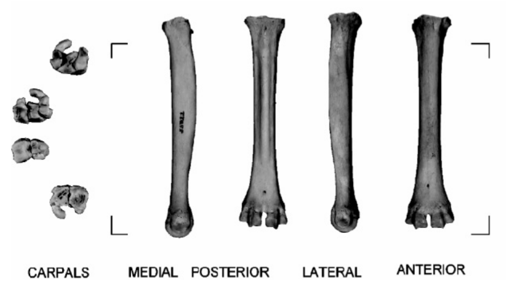
	Zone	cut 1	c/s 3	c/s/c 5	s/c/s 6	shave 7	saw 10	axe 11	nick 12	tooth 15	hammer 20	Total
L FK03	**1**	3										3
LFK10	**1**	3				2						5
R FK02	**1**		1									1
R FK05	**1**	1	1									2

b) Summary of surface modification.

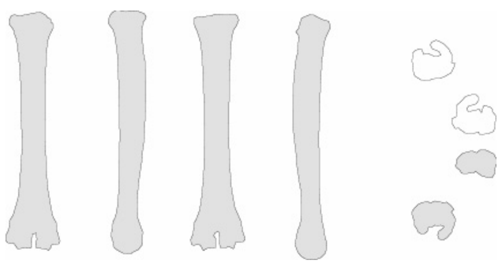
	Zone	cut 1	c/s 3	c/s/c 5	s/c/s 6	shave 7	saw 10	axe 11	nick 12	tooth 15	hammer 20	Total	% preserved	Corrected # cutmarks
RAULL	**1**	6				2						8	300%	2.7
	2													0.0
	3													0.0
	4													0.0
	5													0.0
RAULR	**1**	1	2									3	300%	1.0
	2													0.0
	3													0.0
	4													0.0
	5													0.0
RAUL	**1**													1.9
	2													0.0
	3													0.0
	4													0.0
	5													0.0

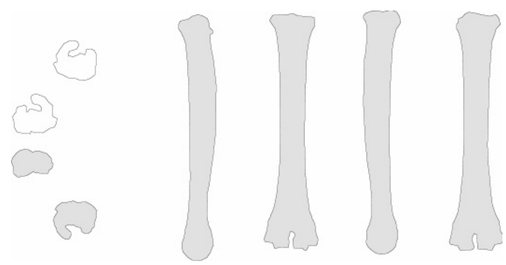
Figure 7.23: *Kabarga* metacarpal (L and R).
a) Templates and individual specimens. Carpals are shown if they were attached to the radioulna at time of recording.
Templates.
L R



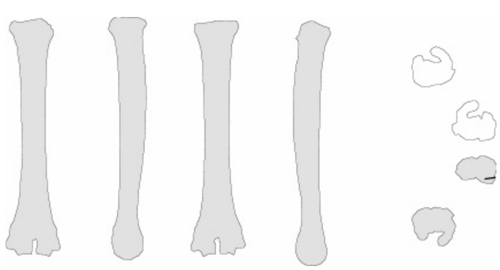


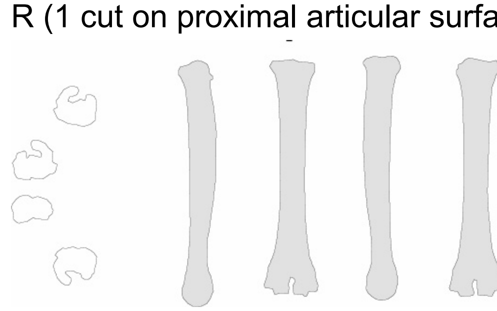
FK05? (Not eaten)
L R



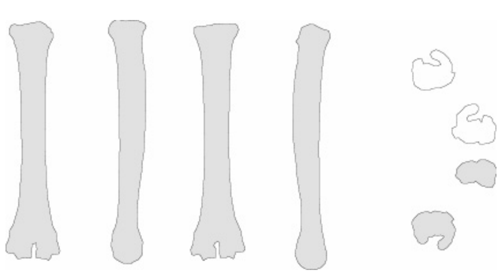


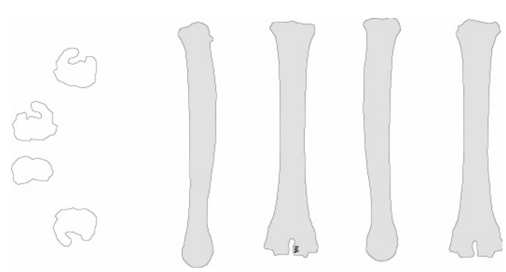
FK09 (cooking butchery: VS. Not eaten)
L R (1 cut on proximal articular surface)





FK11 (cooking butchery: YA. Not eaten)
L R



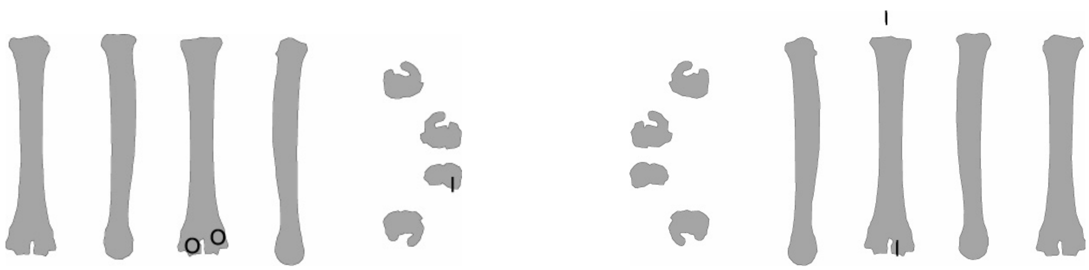


SK03 (Dog butchery by SA, eaten by SA?)

L R

b) Distribution of marks (symbol)

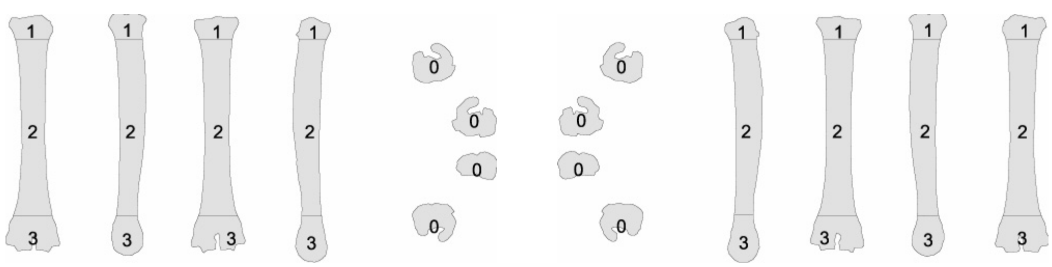
L R



Symbol keys
- I Cut
- D Cut/shave
- U Cut/shave/cut
- W Shave/cut/shave
- O Shave
- ⸗ Saw
- ■ Axe
- ▲ Nick
- ⊙ (human tooth)
- ✚ Hammer breakage

c) Zones.

L R



Anterior Lateral Posterior Medial Medial Posterior Lateral Anterior

Table 7.24: Summary of *kabarga* metacarpal surface modification.

a) Cuts by animal, zone, and cutmark type.

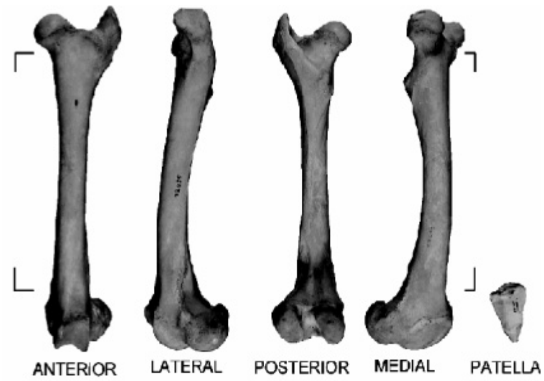
	Zone	cut 1	c/s 3	c/s/c 5	s/c/s 6	shave 7	saw 10	axe 11	nick 12	tooth 15	hammer 20	Total
L FK09	**0**	1										1
L SK03	**3**					2						2
R FK09	**1**	2										2
R FK11	**3**	3										3

b) Summary of surface modification.

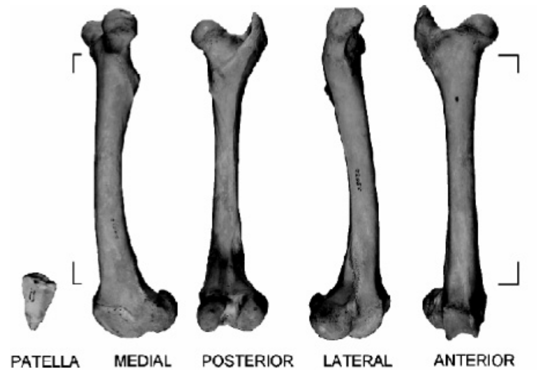
	Zone	cut 1	c/s 3	c/s/c 5	s/c/s 6	shave 7	saw 10	axe 11	nick 12	tooth 15	hammer 20	Total	% preserved	Corrected # cutmarks
MCL	**1**													0.0
	2													0.0
	3					2						2	400%	0.5
MCR	**1**	2										2	400%	0.5
	2													0.0
	3	3										3	400%	0.8
MC	**1**													0.3
	2													0.0
	3													0.7

Figure 7.25: *Kabarga* femur (L and R).
a) Template and individual specimens. The patella is shown if it was attached to the femur at time of recording.
Templates.

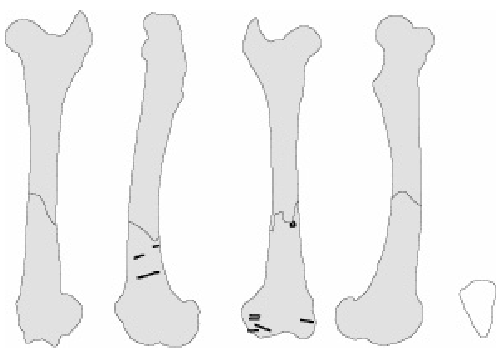
L



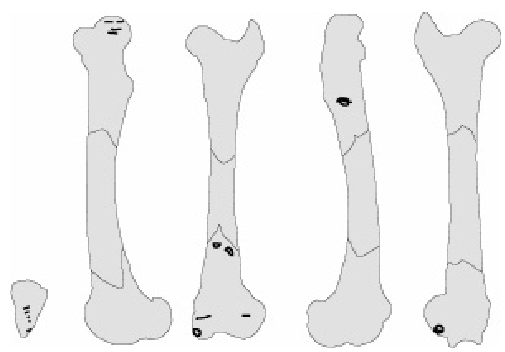
R



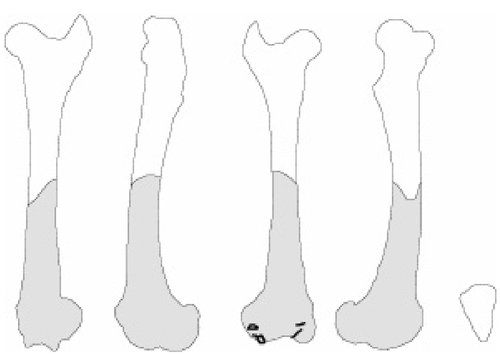
FK02 (parts butchery: YA)
L



FK10 (parts butchery: VS)
R

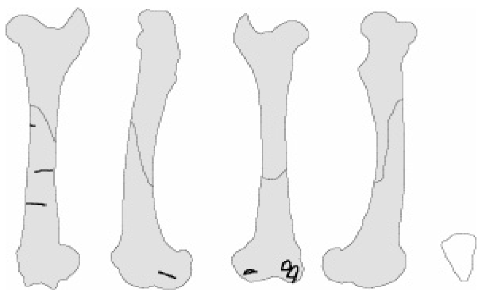


FK03 (parts butchery: VS/VD)
L

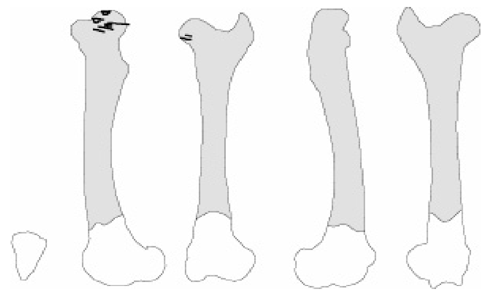


FK11 (parts butchery: YA)

L

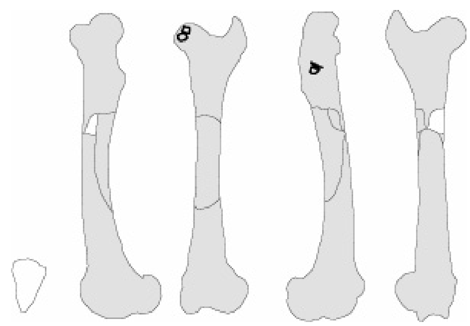


R



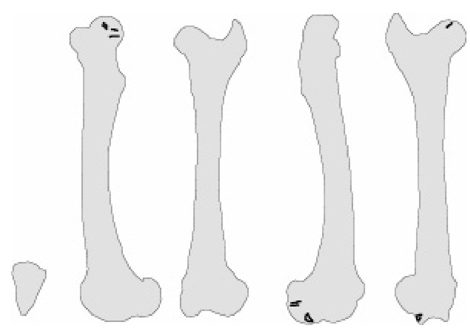
SK02 (parts butchery: YU)

R



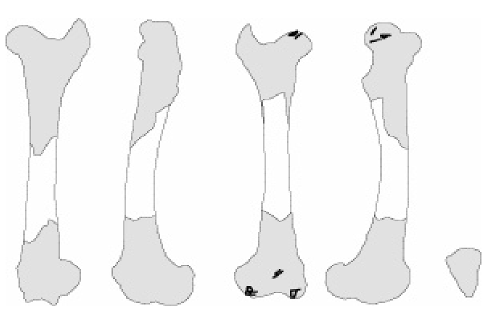
SK03 (parts butchery: SA)

R

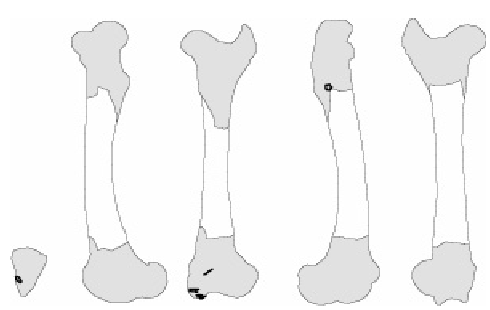


SK05 (parts butchery: VS)

L



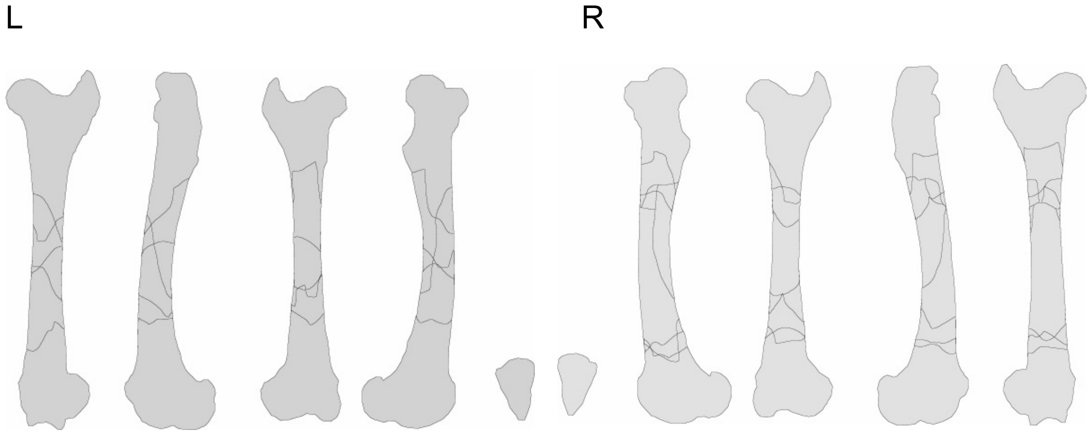
R (Mark on patella at eating)



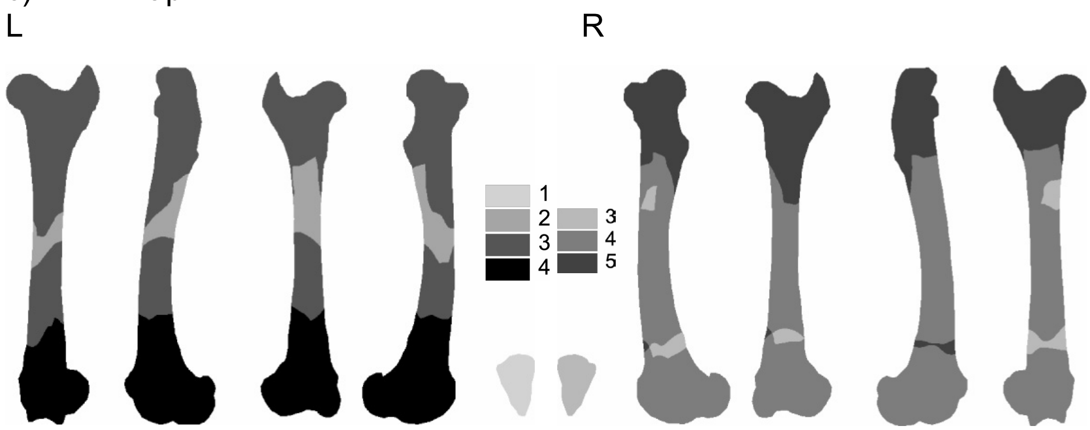
Anterior Lateral Posterior Medial

Medial Posterior Lateral Anterior

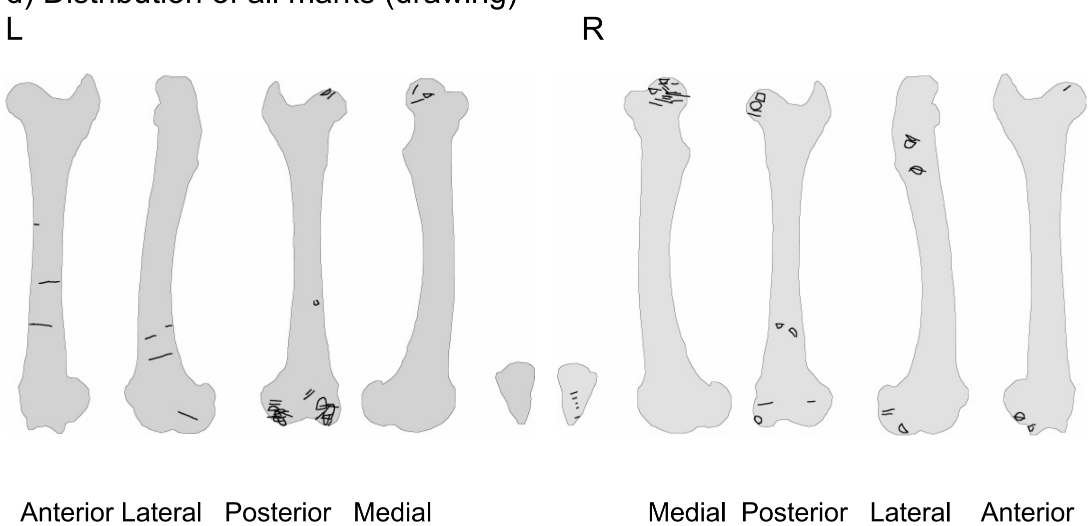
b) Fracture pattern.



c) MNE map.

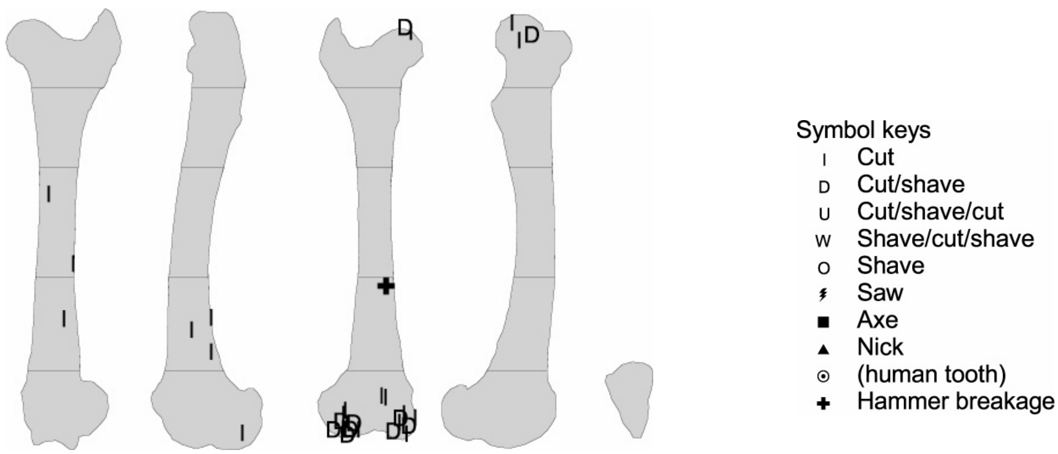


d) Distribution of all marks (drawing)

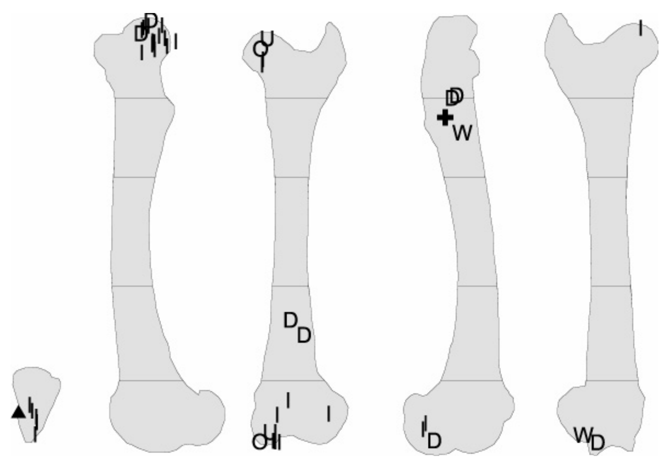


e) Distribution of all marks (symbol)

L

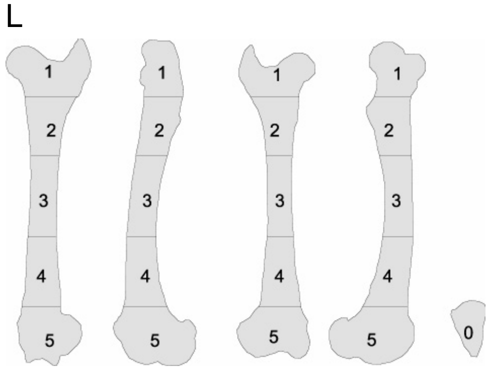


R

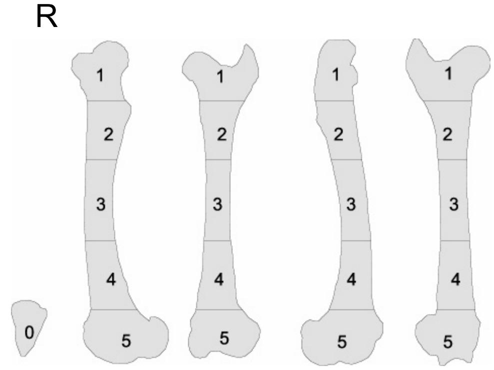


f) Zones.

L



R



Anterior Lateral Posterior Medial

Medial Posterior Lateral Anterior

Table 7.26: Summary of *kabarga* femur surface modification.

a) Cuts by animal, zone, and cutmark type.

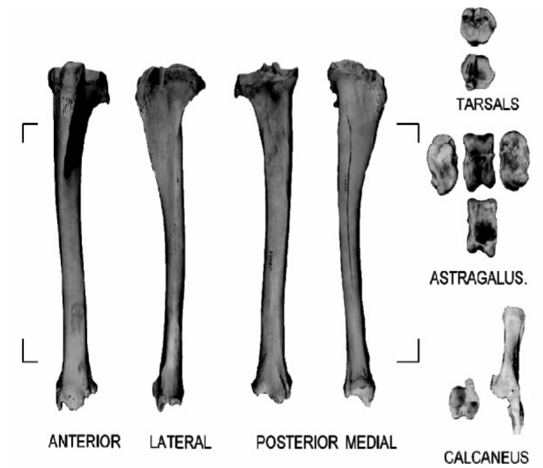
	Zone	cut 1	c/s 3	c/s/c 5	s/c/s 6	shave 7	saw 10	axe 11	nick 12	tooth 15	hammer 20	Total
L FK02	4	3									1	4
	5	5										5
	Total	*8*									*1*	*9*
L FK03	5	2	2									4
L FK11	3	2										2
	4	1										1
	5	2	3									5
	Total	*5*	*3*									*8*
L SK05	1	3	2									5
	5	2	3									5
	Total	*5*	*5*									*10*
R FK10	**0**	5										5
	1	4										4
	2				1							1
	4		2									2
	5	2			1	1						4
	Total	*11*	*2*		*2*	*1*						*16*
R FK11	**1**	7	2									9
R SK02	**1**		1	1		1						3
	2		1									1
	Total		*2*	*1*		*1*						*4*
R SK03	**1**	5										5
	5	2	2									4
	Total	*7*	*2*									*9*
R SK05	**0**								1			1
	2										1	1
	5	4		1								5
	Total	*4*		*1*					*1*		*1*	*7*

b) Summary of surface modification.

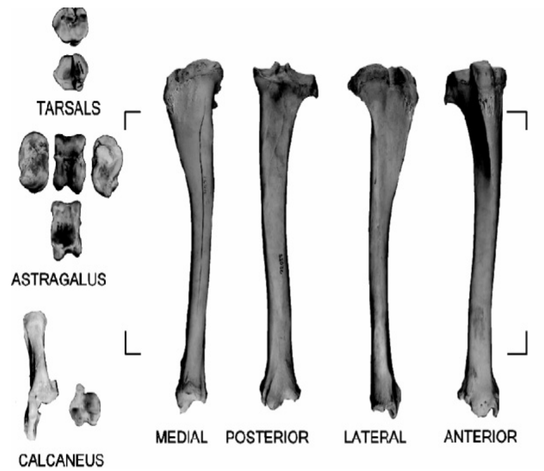
	Zone	cut 1	c/s 3	c/s/c 5	s/c/s 6	shave 7	saw 10	axe 11	nick 12	tooth 15	hammer 20	Total	% preserved	Corrected # cutmarks
FEL	**1**	3	2									5	300%	1.7
	2	2										2	287%	0.7
	3												260%	0.0
	4	4									1	5	258%	1.9
	5	11	8									19	400%	4.8
FER	**1**	16	3	1		1						21	500%	4.2
	2		1		1						1	3	391%	0.8
	3												391%	0.0
	4		2									2	398%	0.5
	5	8	2	1	1	1						13	400%	3.3
	patella	5							1			*6*		
FE	**1**													2.9
	2													0.7
	3													0.0
	4													1.2
	5													4.0

Figure 7.27: *Kabarga* tibia (L and R).
a) Template and individual specimens. The tarsals are shown if they were attached to the tibia at time of recording.
Templates.

L

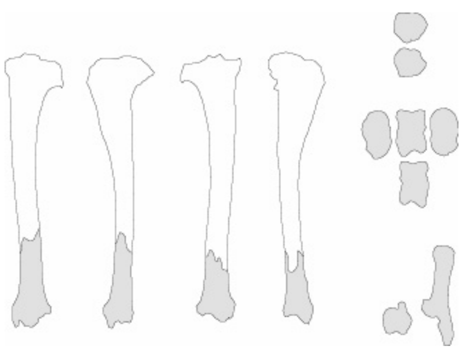


R

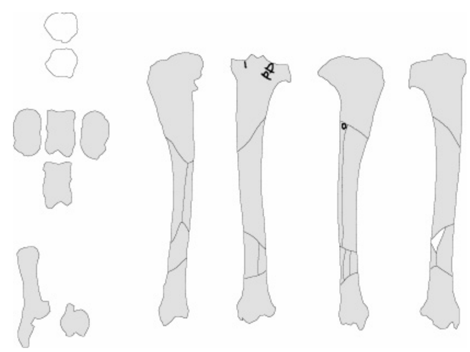


FK03 (marrow cracking: YA)

L

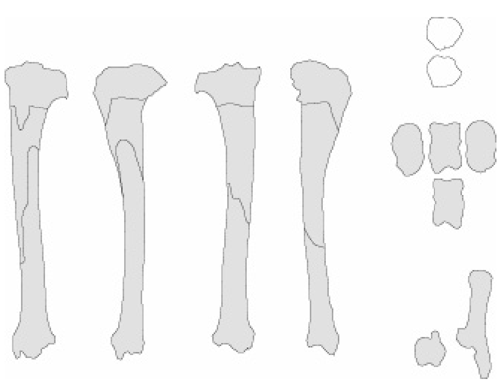


R



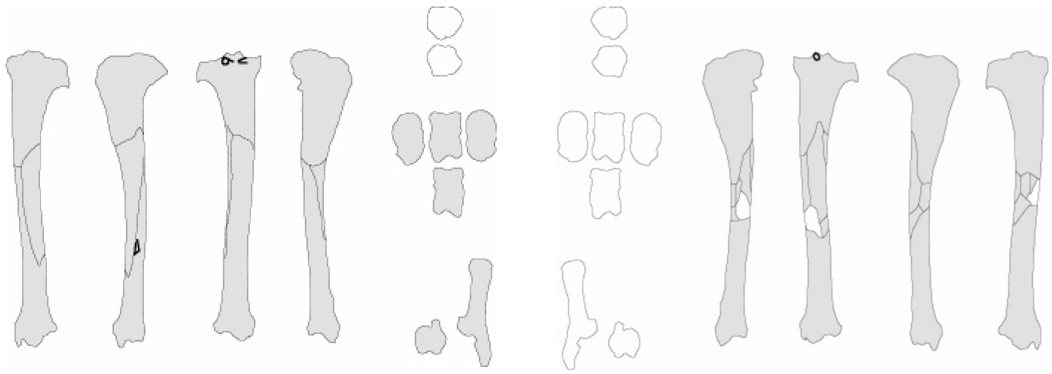
FK04

L



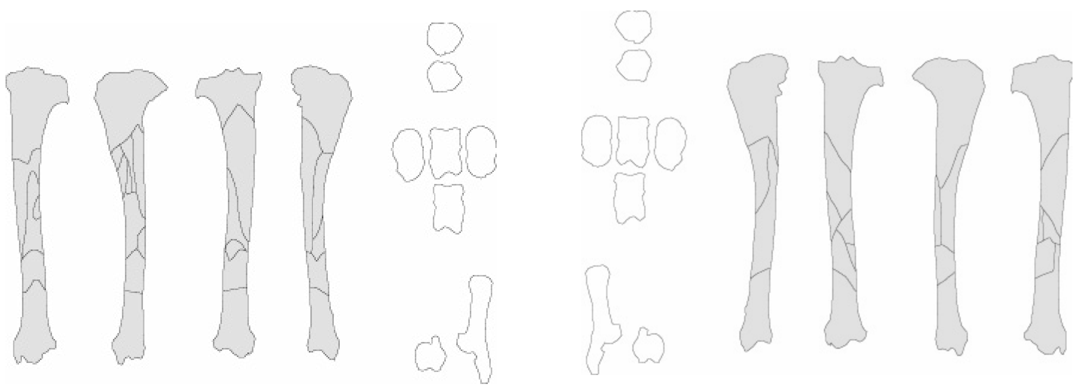
FK05 (marrow cracking: VS)

L R



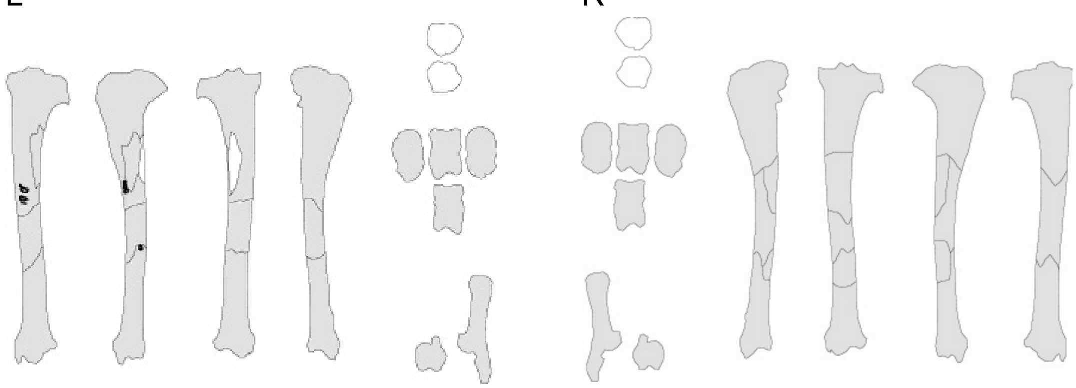
FK06

L R



SK03 (marrow cracking: SA)

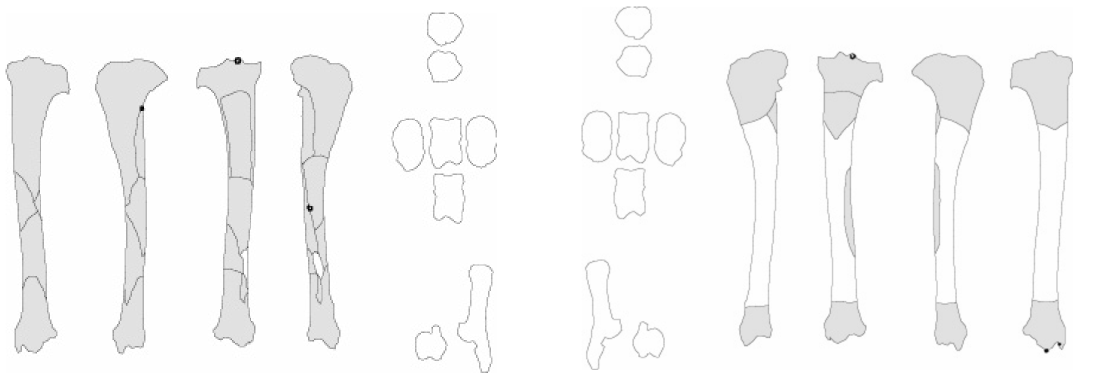
L R



Anterior Lateral Posterior Medial   Medial Posterior Lateral Anterior

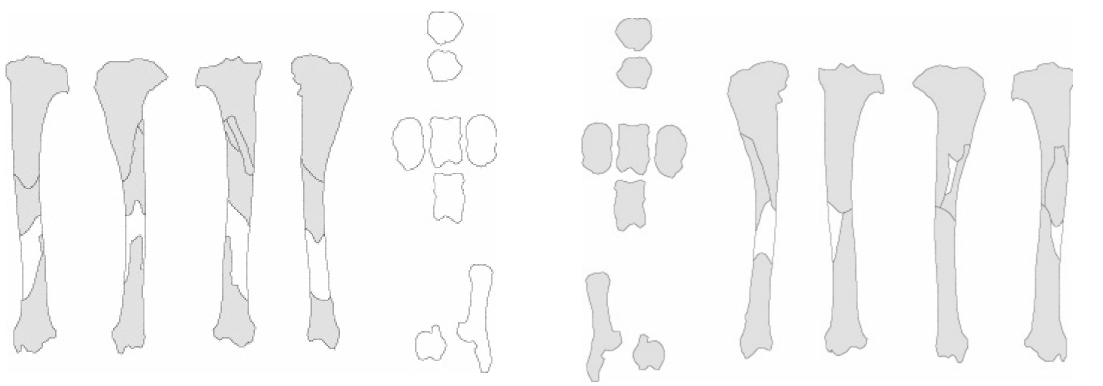
SK05

L R (2 marks on distal articular surface)



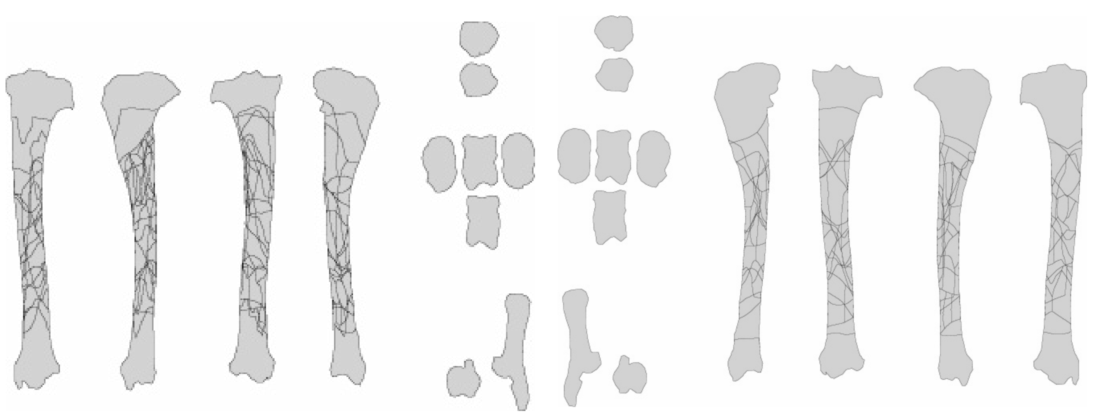
SK08

L R



b) Fracture pattern.

L R



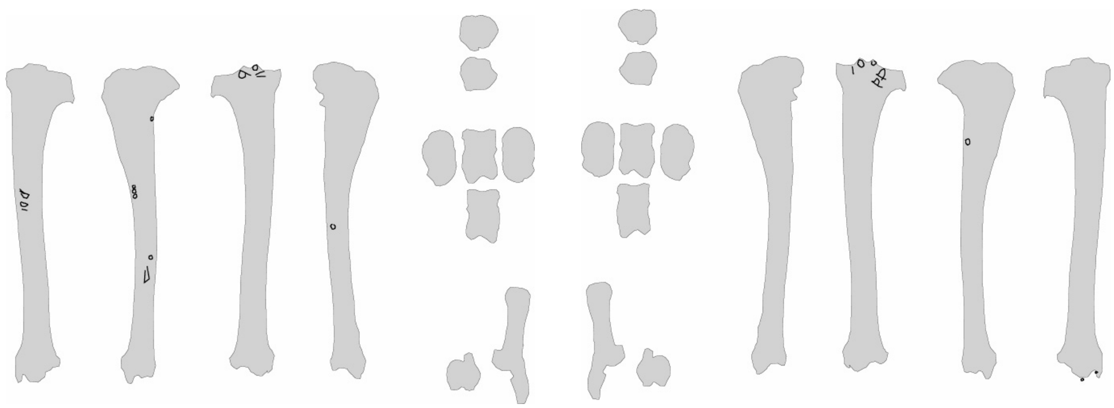
Anterior Lateral Posterior Medial Medial Posterior Lateral Anterior

c) MNE map, showing preservation at time of recording.

L R

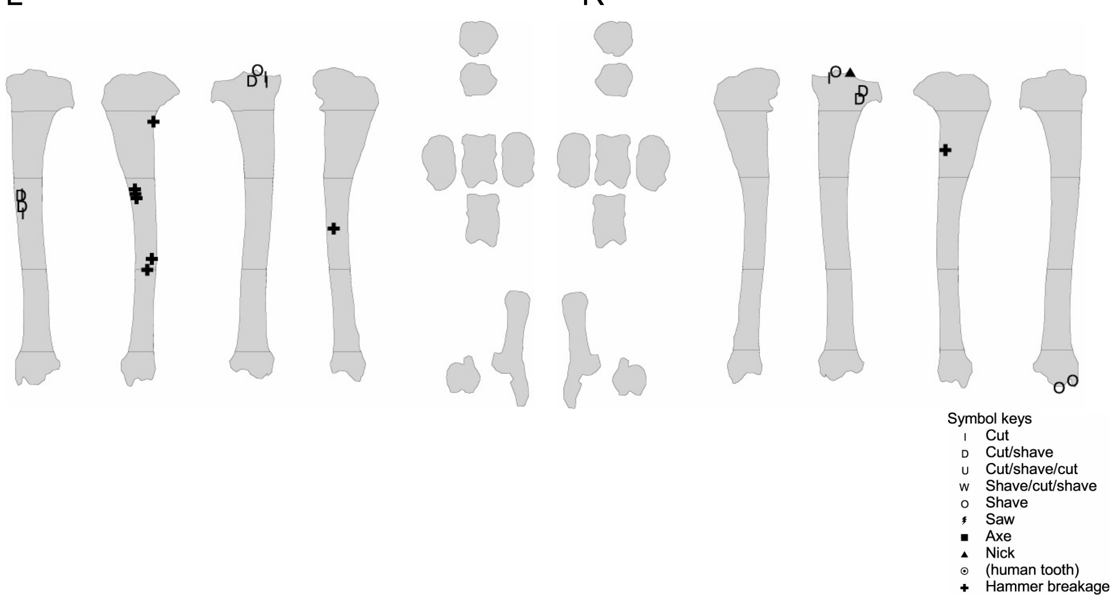
d) Distribution of all marks (drawing).

L R



e) Distribution of all marks (symbol).

L R



Anterior Lateral Posterior Medial Medial Posterior Lateral Anterior

f) Zones.

L R

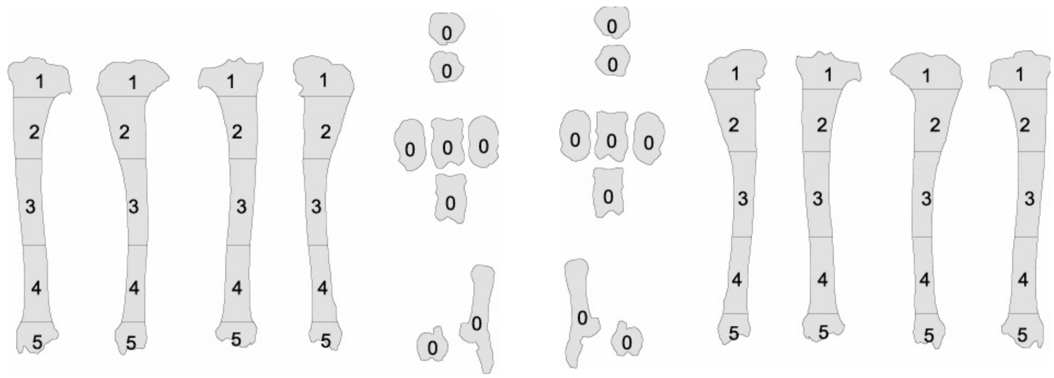


Table 7.28: Summary of *kabarga* tibia surface modification.

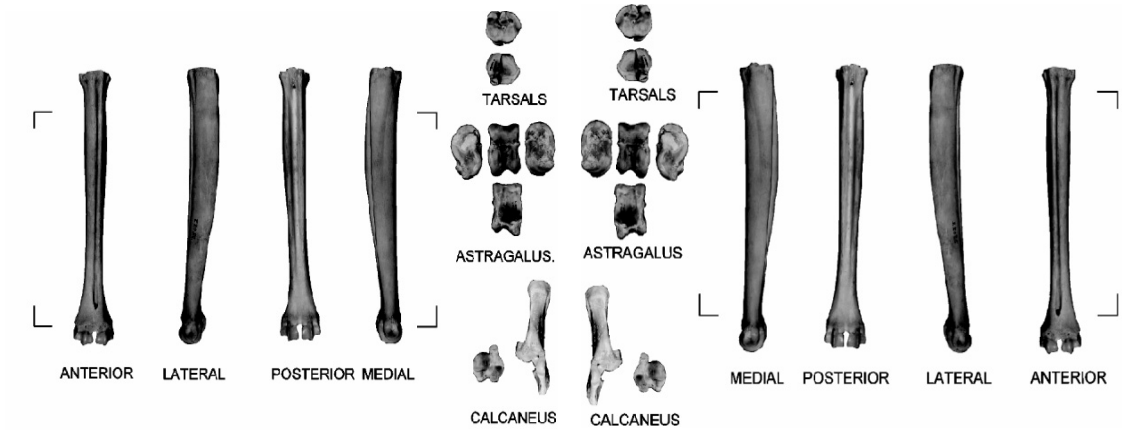
a) Cuts by animal, zone, and cutmark type.

	Zone	cut 1	c/s 3	c/s/c 5	s/c/s 6	shave 7	saw 10	axe 11	nick 12	tooth 15	hammer 20	Total	% preserved	Corrected # cutmarks	Total periosteum cleaning/ hammer	Corrected # cutmarks for disarticulation
TIL	**1**	2	1			1						4	600%	0.7		0.7
	2										1	1	594%	0.2	1	0.0
	3	2	2								5	9	573%	1.6	9	0.0
	4										1	1	623%	0.2	1	0.0
	5												700%	0.0		0.0
TIR	**1**	1	2			1			1			5	600%	0.8		0.8
	2										1	1	561%	0.2	1	0.0
	3												478%	0.0		0.0
	4												514%	0.0		0.0
	5					2						2	600%	0.3		0.3
TI	**1**													0.8		0.8
	2													0.2		0.0
	3													0.8		0.0
	4													0.1		0.0
	5													0.2		0.2

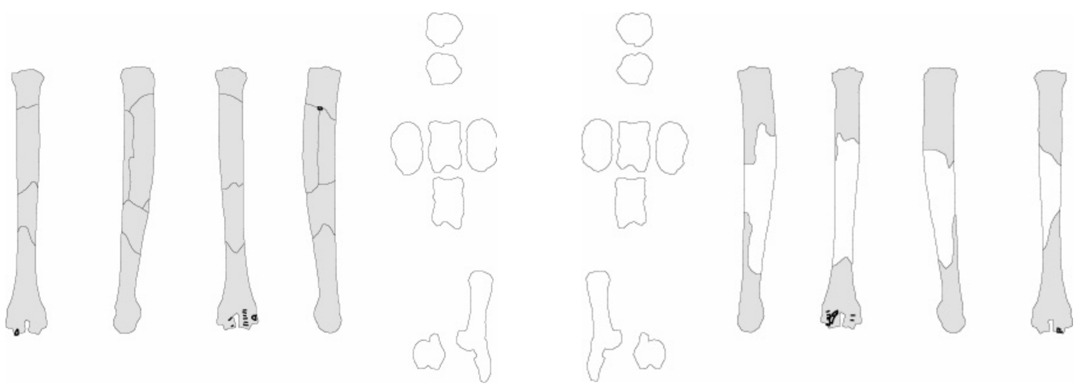
b) Summary of surface modification.

	Zone	cut 1	c/s 3	c/s/c 5	s/c/s 6	shave 7	saw 10	axe 11	nick 12	tooth 15	hammer 20	Total
L FK05	**1**	2	1									3
	4										1	1
	Total	2	1								1	4
L SK03	**3**	2	2								4	8
L SK05	**1**					1						1
	2										1	1
	3										1	1
	Total					1					2	3
R FK03	**1**	1	2									3
	2										1	1
	Total	1	2								1	4
R FK05	**1**					1						1
R SK05	**1**								1			1
	5					2						2
	Total					2			1			3

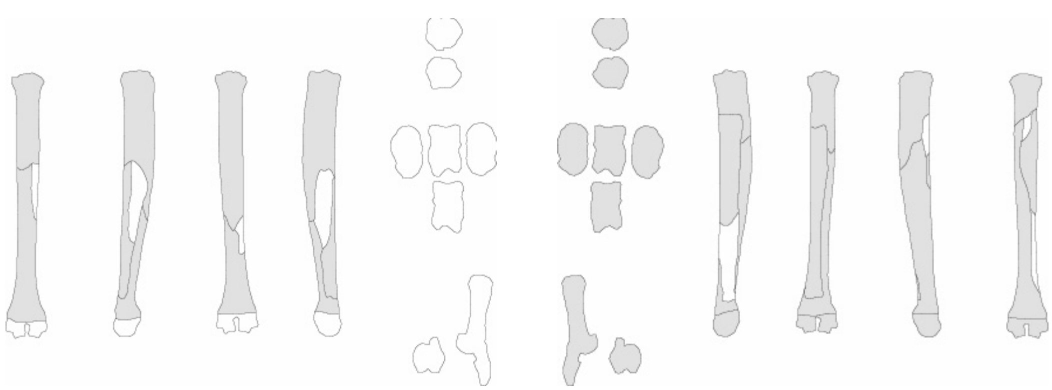
Figure 7.29: *Kabarga* metatarsal (L and R).
a) Template and individual specimens. The tarsals are shown if they were attached to the metatarsal at time of recording.
Templates.
L R



FK03 (marrow cracking: YA)
L R

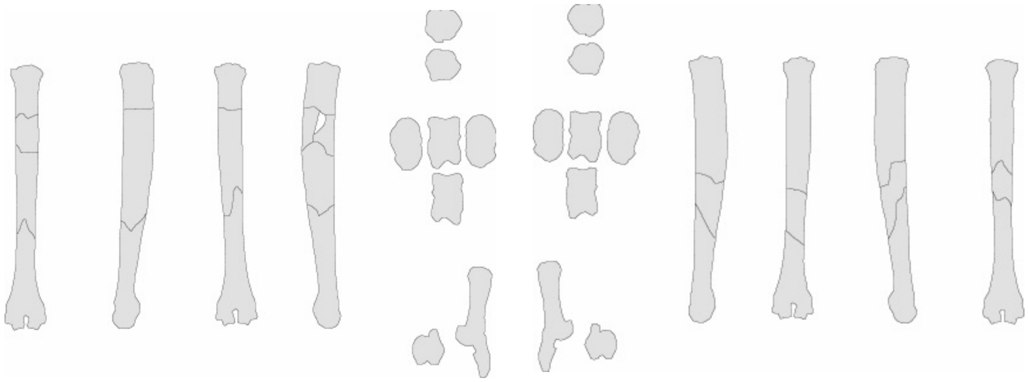


FK05 (marrow cracking: VS)
L R



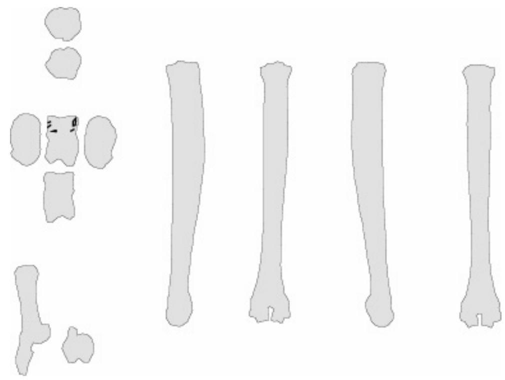
FK06

L R



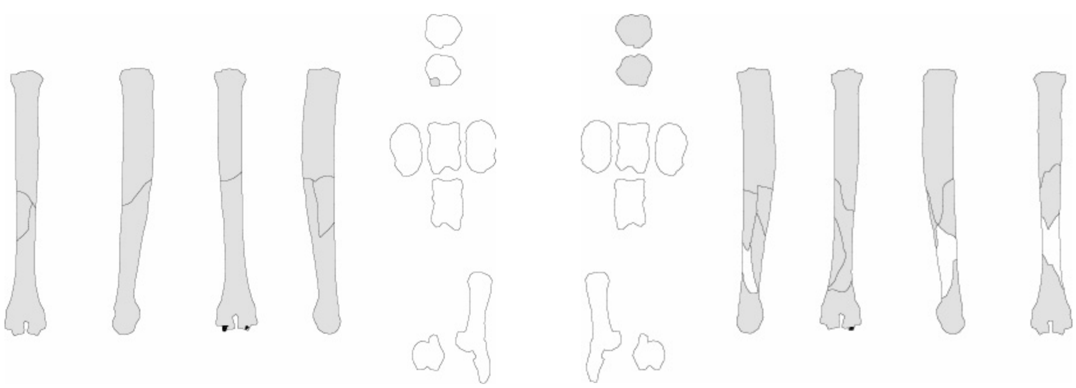
FK09 (marrow cracking: VS)

R



SK03 (marrow cracking: SA)

L R

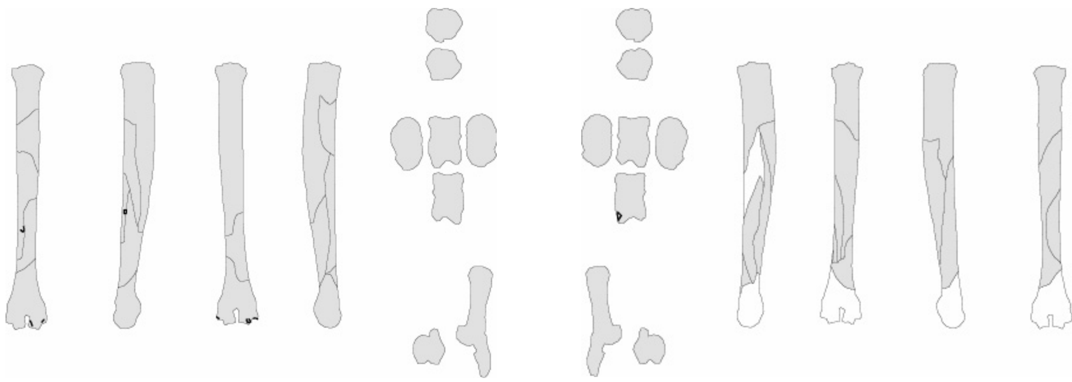


Anterior Lateral Posterior Medial

Medial Posterior Lateral Anterior

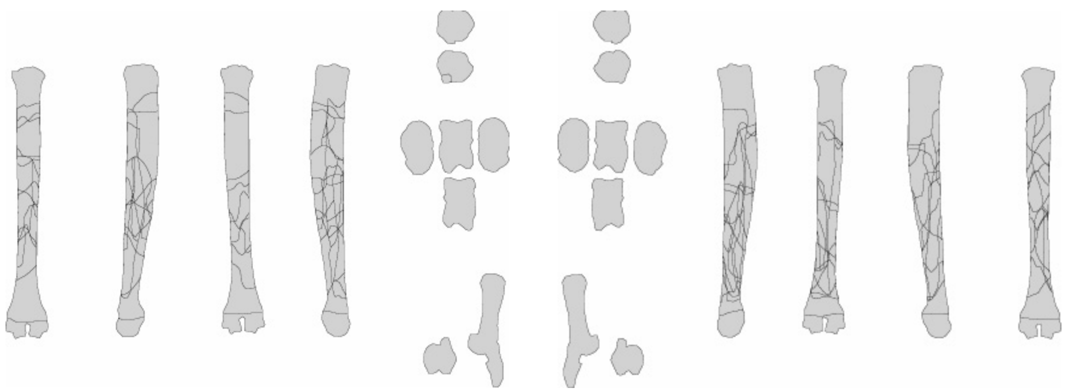
SK05

L R



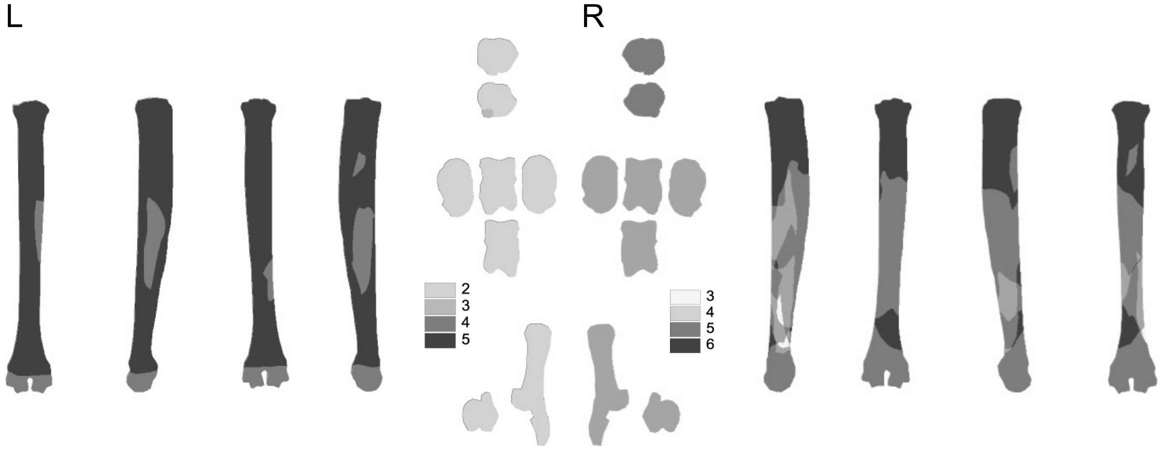
b) Fracture pattern.

L R



c) MNE map, showing preservation at time of recording.

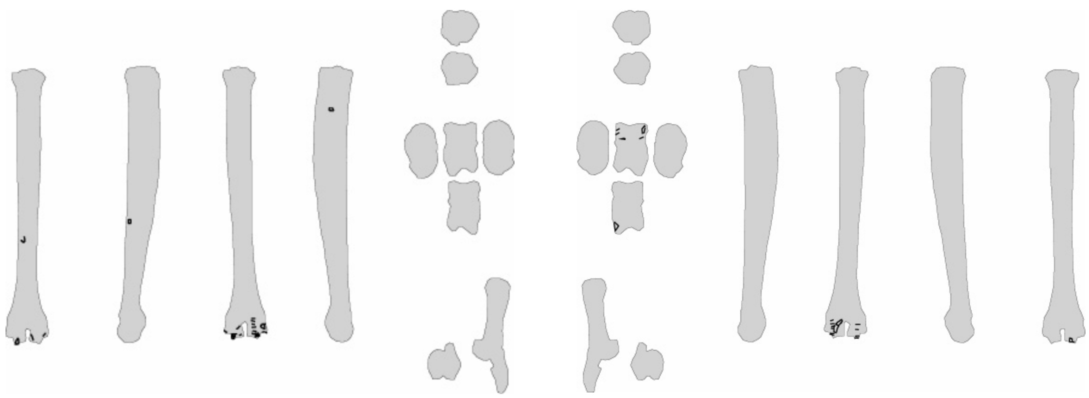
L R



Anterior Lateral Posterior Medial Medial Posterior Lateral Anterior

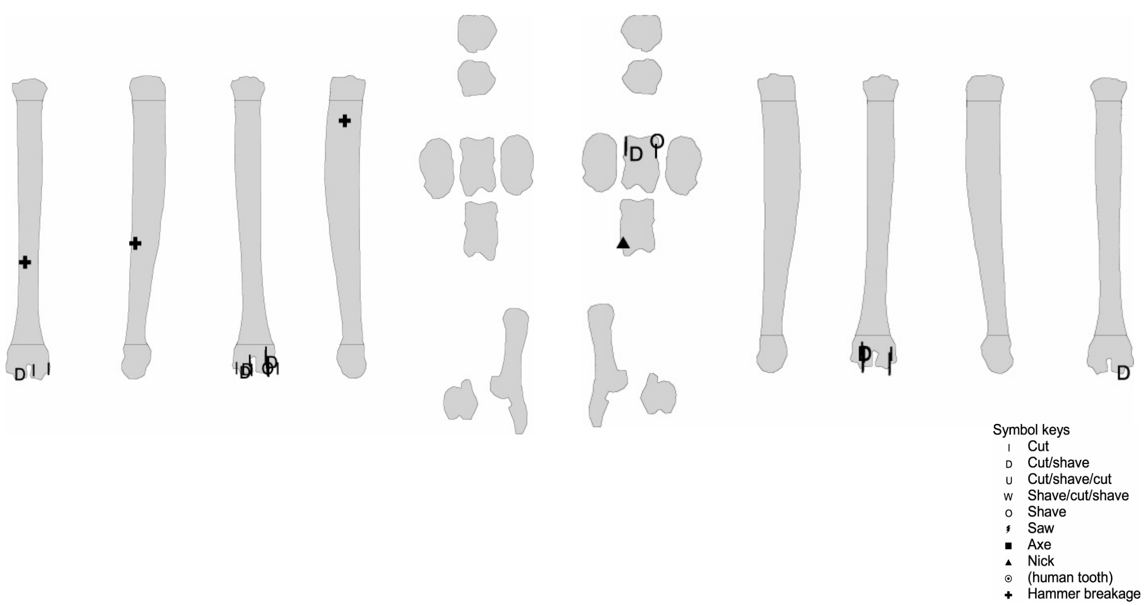
d) Distribution of all marks (drawing).

L R



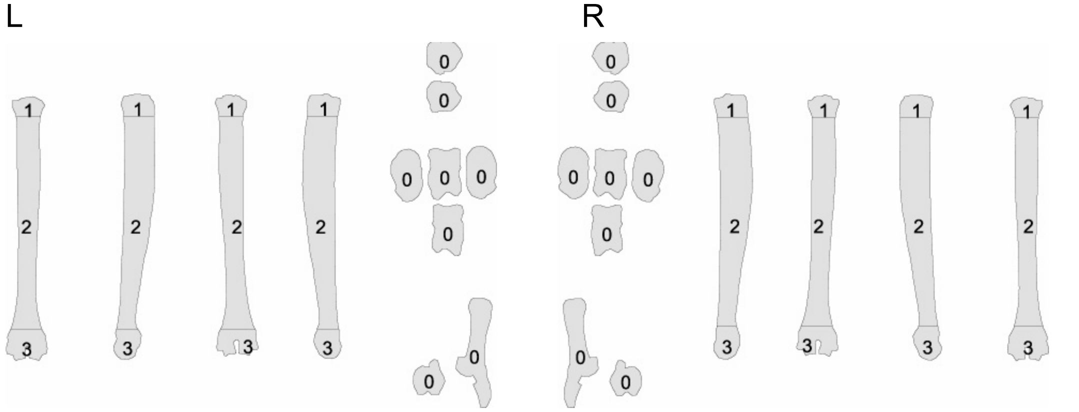
e) Distribution of all marks (symbol).

L R



f) Zones.

L R



Anterior Lateral Posterior Medial Medial Posterior Lateral Anterior

Table 7.30: Summary of *kabarga* metatarsal surface modification.

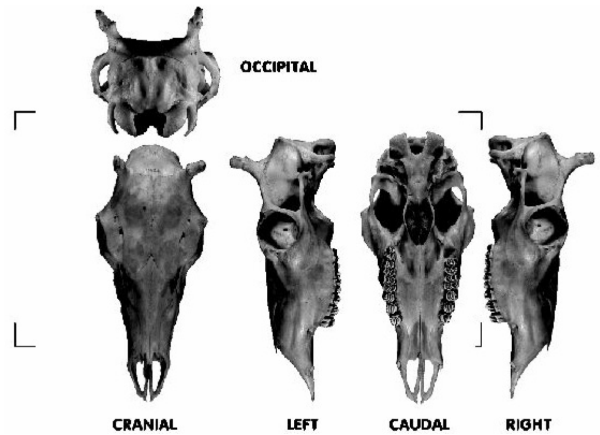
a) Cuts by animal, zone, and cutmark type.

	Zone	cut 1	c/s 3	c/s/c 5	s/c/s 6	shave 7	saw 10	axe 11	nick 12	tooth 15	hammer 20	Total
L FK03	**2**										1	1
	3	8	2									10
	Total	8	2								1	11
L SK03	**3**	2	2									4
L SK05	**2**										2	2
	3	4				1						5
	Total	4				1					2	7
R FK03	**3**	8	3									11
R FK09	**0**	3	1			1						5
R SK03	**3**	2										2
R SK05	**0**								1			1

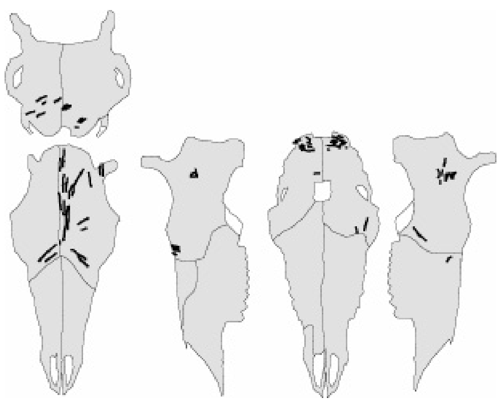
b) Summary of surface modification.

	Zone	cut 1	c/s 3	c/s/c 5	s/c/s 6	shave 7	saw 10	axe 11	nick 12	tooth 15	hammer 20	Total	% preserved	Corrected # cutmarks
MTL	**1**												500%	0.0
	2										3	3	487%	0.0
	3	14	4			1						19	439%	4.3
MTR	**1**												600%	0.0
	2												519%	0.0
	3	10	3									13	500%	2.6
	tarsal	3	1			1			1			6		
MT	**1**													0.0
	2													0.0
	3													3.5

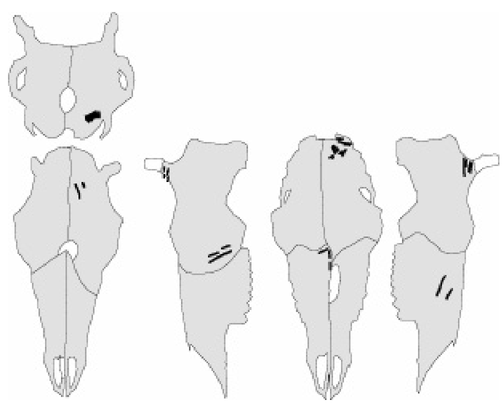
Figure 7.31: Reindeer cranium.
a) Template and individual specimens.
Template.



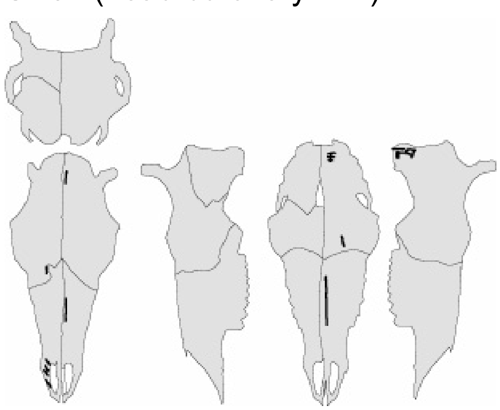
FR01 (head butchery: VS)



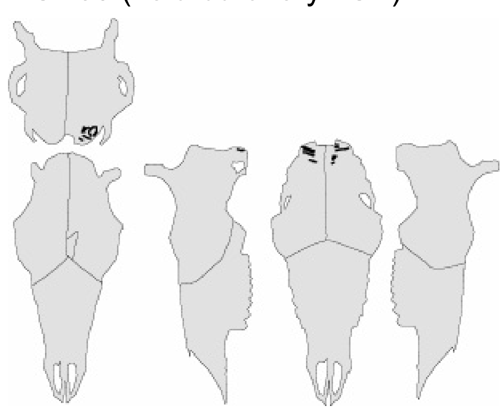
SR01 (head butchery: VS)



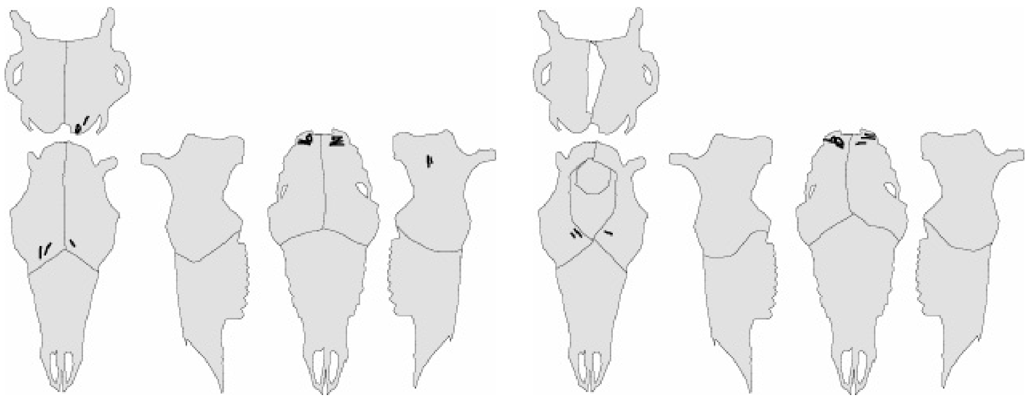
SR02 (head butchery: VD)



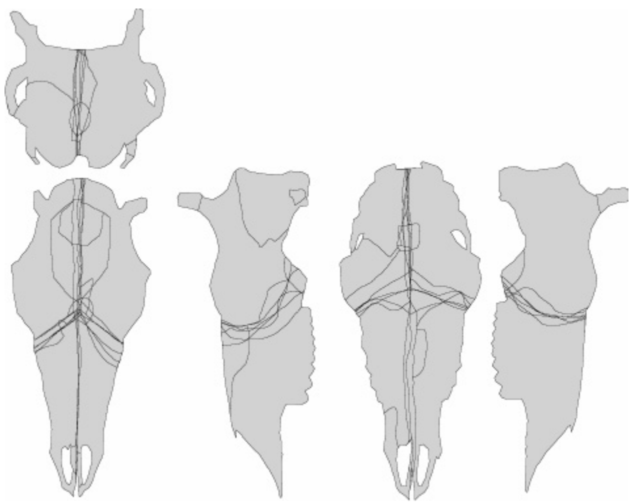
SR03 (field butchery: SA)



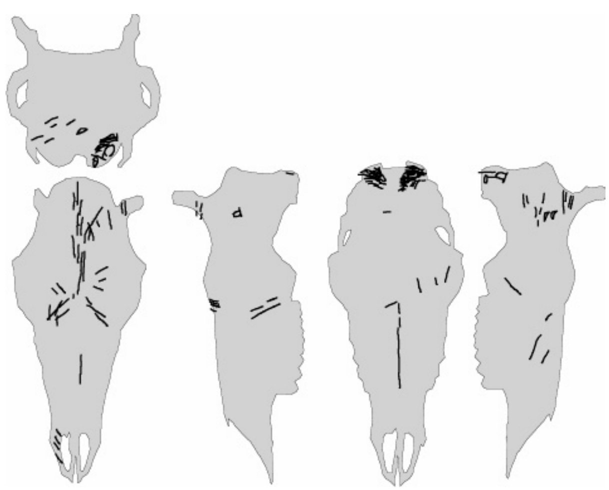
SR04 (head butchery: VS) SR05 (head butchery: VS)



b) Fracture pattern.

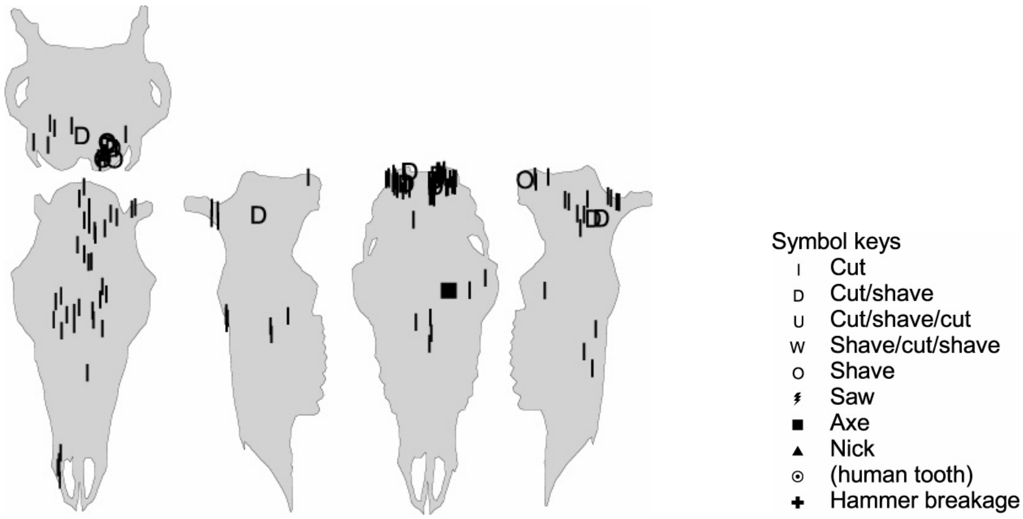


c) Distribution of marks (drawing).

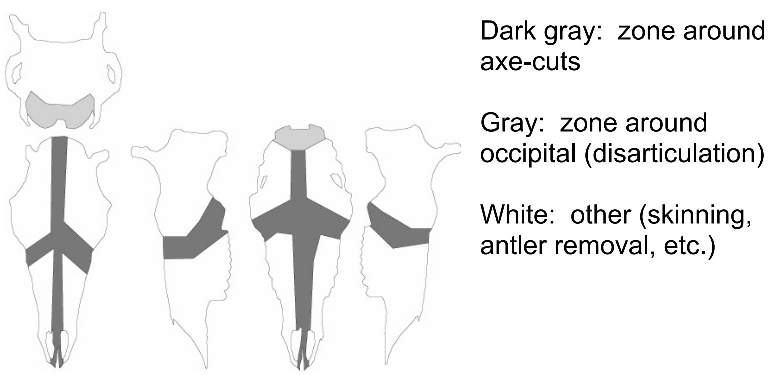


Cranial Left Caudal Right

d) Distribution of marks (symbol).



e) Spatial separation of activities.



f) Marks by activity.

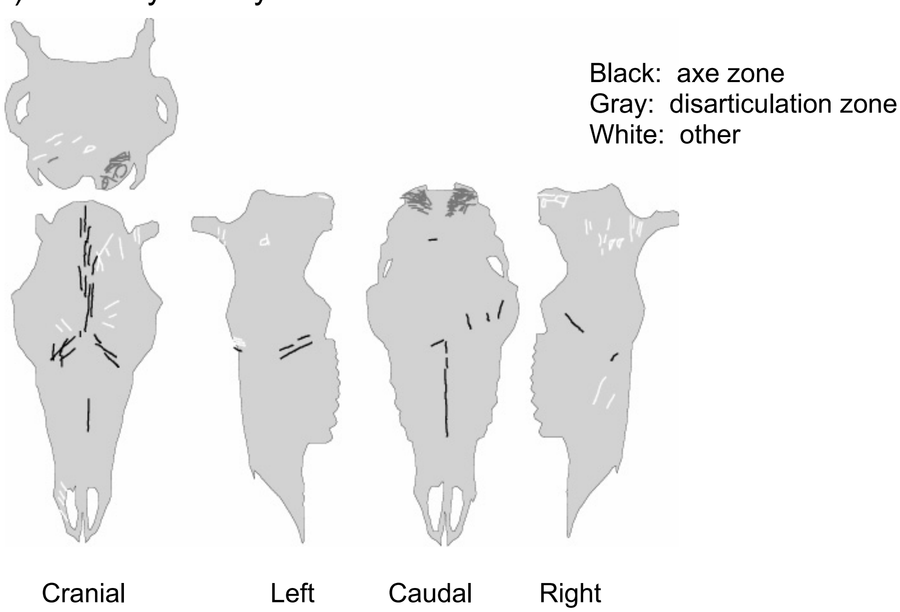


Table 7.32: Summary of reindeer cranium surface modification.

a) Marks by type.
Skinning = marks in white, axe = black, occipital = gray in Figure 7.31f.

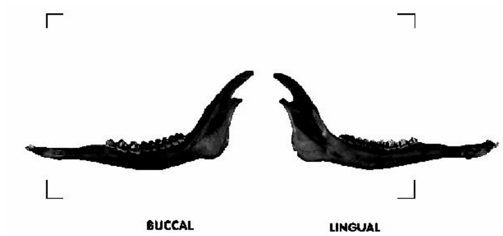
	Zone	cut 1	c/s 3	c/s/c 5	s/c/s 6	shave 7	saw 10	axe 11	nick 12	tooth 15	hammer 20	Total
FR01	**skinning**	17	4									21
	axe	20										20
	occipital	25										25
	Total	*62*	*4*									*66*
SR01	**skinning**	12										12
	axe	6										6
	occipital	11	2			2						15
	Total	*29*	*2*			*2*						*33*
SR02	**skinning**	7				1						8
	axe	4						1				5
	occipital	4										4
	Total	*15*				*1*		*1*				*17*
SR03	**skinning**	1										1
	axe											
	occipital	10	2			1						13
	Total	*11*	*2*			*1*						*14*
SR04	**skinning**	2										2
	axe	3										3
	occipital	5	2			1						8
	Total	*10*	*2*			*1*						*13*
SR05	**skinning**	3										3
	axe											
	occipital	5	2									7
	Total	*8*	*2*									*10*

b) Summary of surface modification.

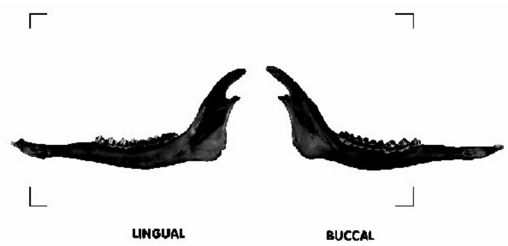
Zone	cut 1	c/s 3	c/s/c 5	s/c/s 6	shave 7	saw 10	axe 11	nick 12	tooth 15	hammer 20	Total	% preserved	Corrected # cutmarks
skinning	42	4			1						47	600%	7.8
axe	33						1				34	600%	5.7
occipital	60	8			4						72	600%	12.0
Total	135	12			5		1				153	600%	25.5

Figure 7.33: Reindeer mandibles (L, R).
a) Template and individual specimens.
Template.

L

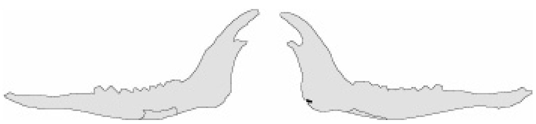


R

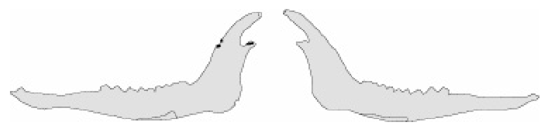


FR01 (VS)

L

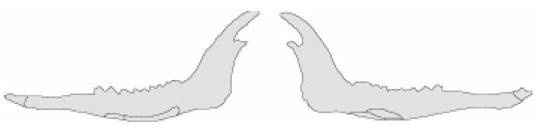


R

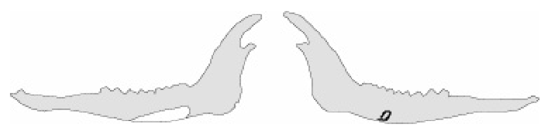


SR01 (VS)

L

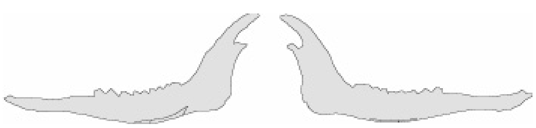


R

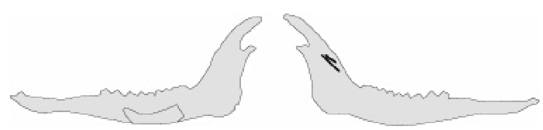


SR02 (VD)

L

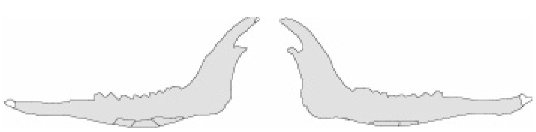


R

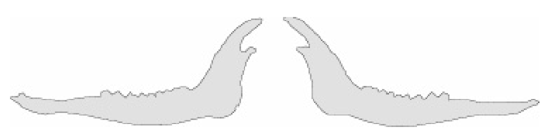


SR03 (VS)

L

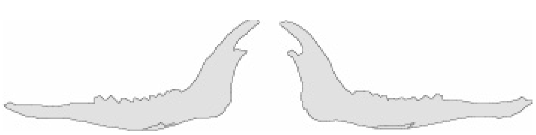


R

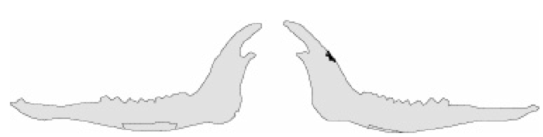


SR04 (VS)

L

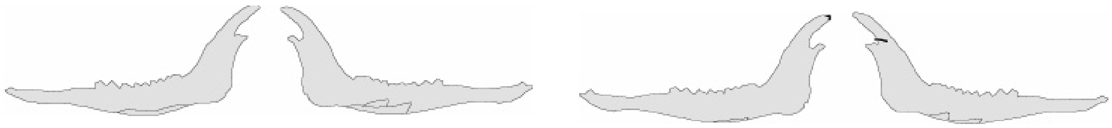


R



SR05 (VS VD)

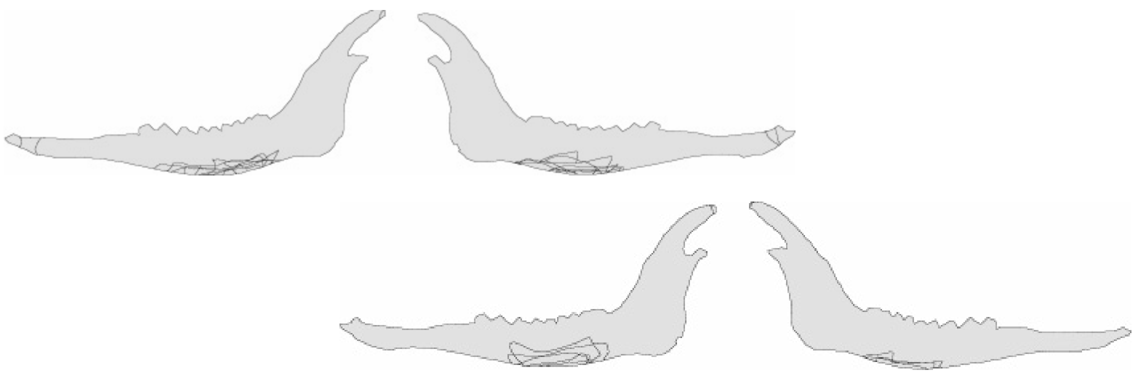
L R



Buccal Lingual Lingual Buccal

b) Fragmentation pattern.

L R



d) Distribution of marks (symbol).

L R

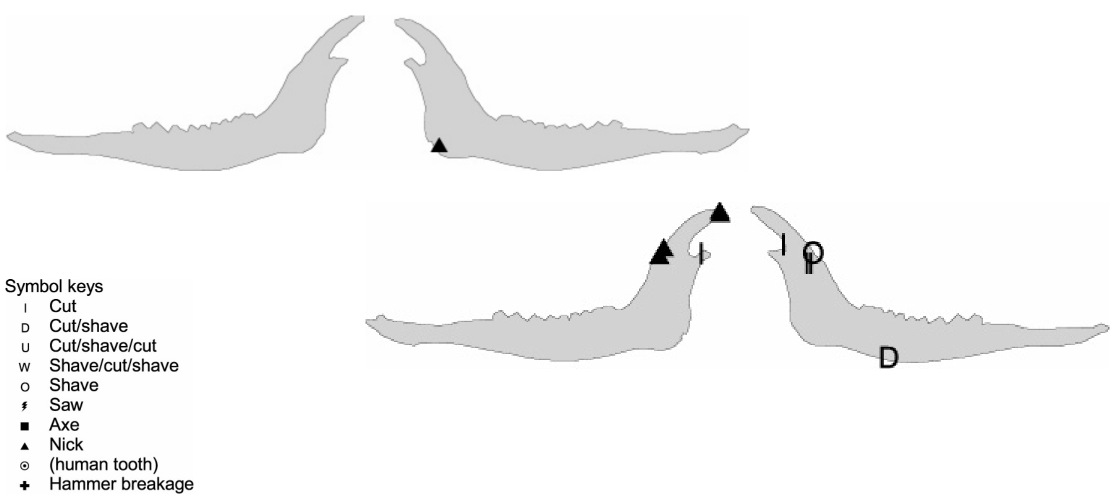


Table 7.34: Summary of reindeer mandible surface modification.

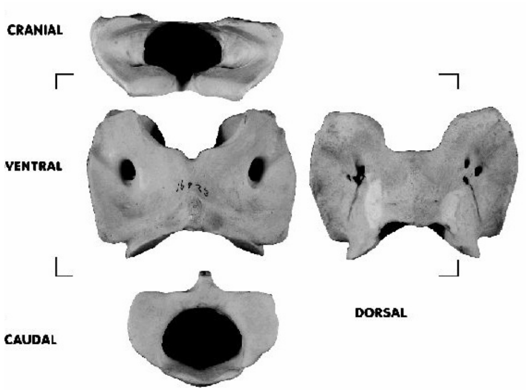
a) Marks by type.

Zone	cut 1	c/s 3	c/s/c 5	s/c/s 6	shave 7	saw 10	axe 11	nick 12	tooth 15	hammer 20	Total
L FR01								1			1
R FR01	1							2			3
R SR01		1									1
R SR02	2										2
R SR04					1						1
R SR05	1							2			3

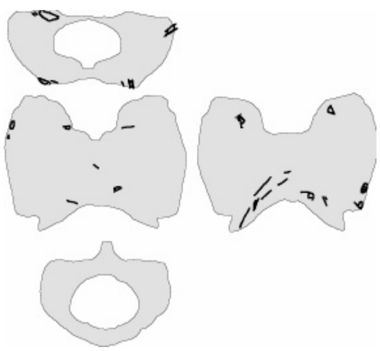
b) Summary of surface modification.

Zone	cut 1	c/s 3	c/s/c 5	s/c/s 6	shave 7	saw 10	axe 11	nick 12	tooth 15	hammer 20	Total	% preserved	Corrected # cutmarks
MD L								1			1	600%	0.2
MD R	4	1			1			4			10	600%	1.7
MD													1.0

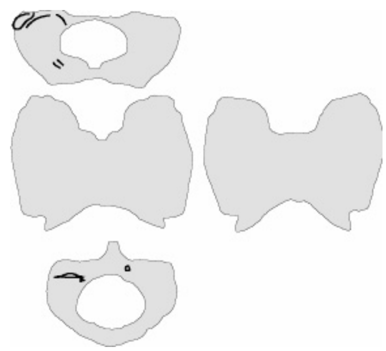
Figure 7.35: Reindeer atlas.
a) Template and individual specimens.
Template.



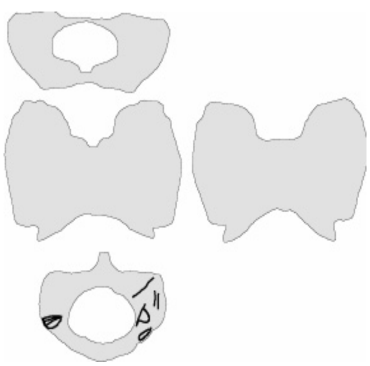
FR01 (AT off VS)



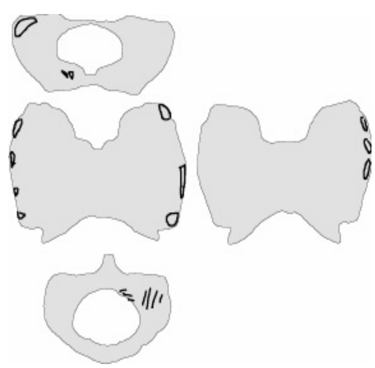
SR01 (head off VS, AT off VS)



SR02 (head off VD, AT off VD)



SR04 (AT off VS)



b) Distribution of marks (symbol).

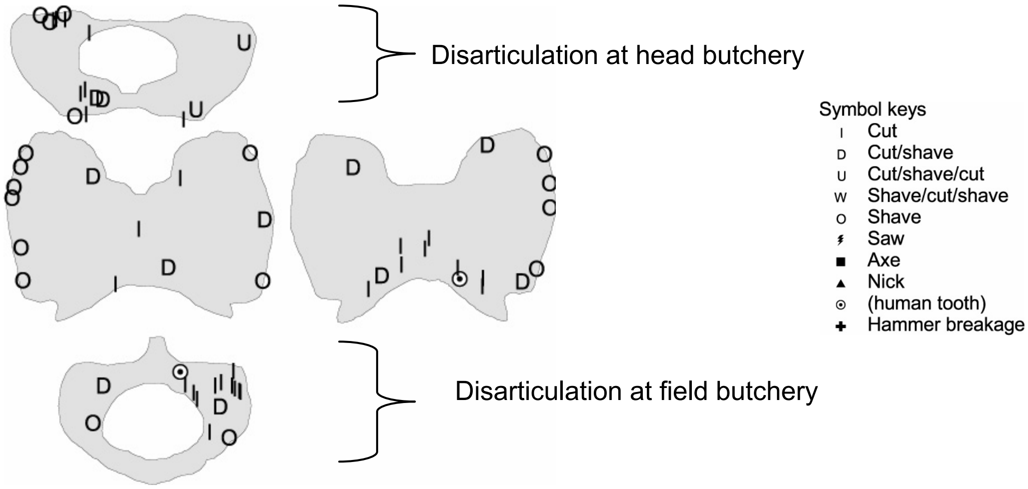


Table 7.36: Summary of reindeer atlas surface modification.

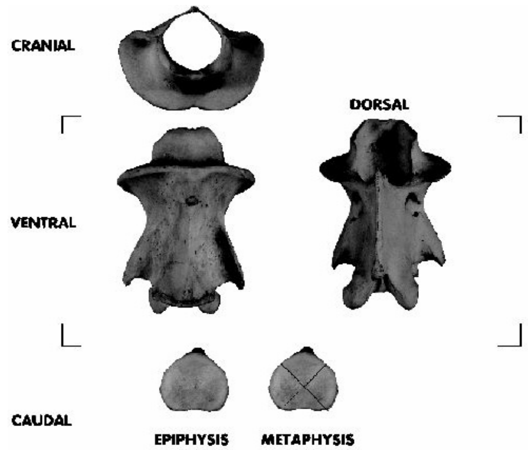
a) Marks by type.
'Cranial' marks are those recorded in cranial view, and are disarticulation marks from head butchery. 'Caudal' marks are those recorded in the caudal view, and are disarticulation marks from parts butchery.

	Zone	cut 1	c/s 3	c/s/c 5	s/c/s 6	shave 7	saw 10	axe 11	nick 12	tooth 15	hammer 20	Total
FR01	**cranial**	4		2		2						8
	-	11	6			3				1		21
	Total	15	6	2		5				1		29
SR01	**cranial**	4				1						5
	caudal		1							1		2
	Total	4	1			1				1		7
SR02	**caudal**	3	1			2						6
	Total	3	1			2						6
SR04	**cranial**		2			1						3
	-		1			9						10
	caudal	8										8
	Total	8	3			10						21

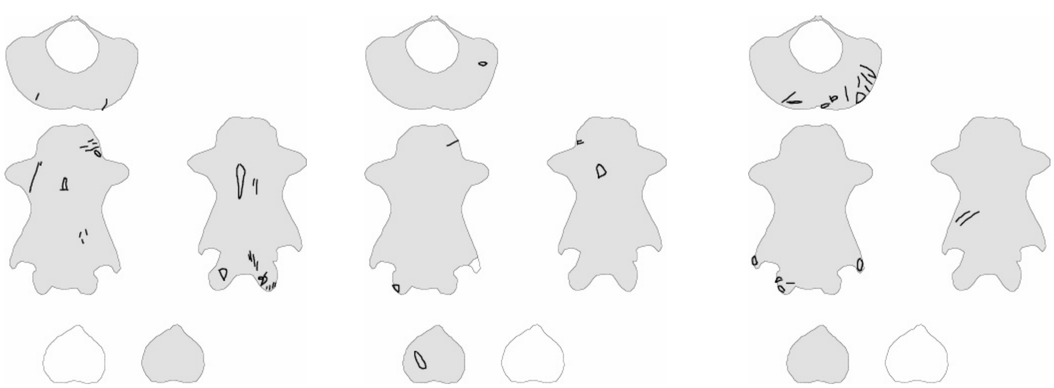
b) Summary of surface modification.

Zone	cut 1	c/s 3	c/s/c 5	s/c/s 6	shave 7	saw 10	axe 11	nick 12	tooth 15	hammer 20	Total	% preserved	Corrected # cutmarks	Total eating	Corrected # cutmarks for disarticulation
cranial	8	2	2		4						16	400%	4.0	3	3.3
-	11	7			12				1		31	400%	7.8	11	5.0
caudal	11	2			2				1		16	400%	4.0	8	2.0

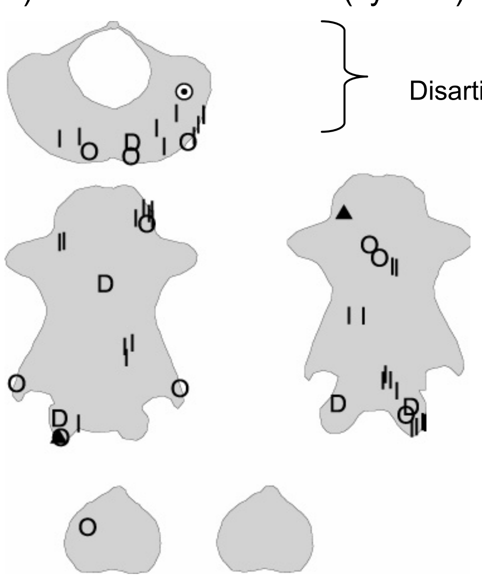
Figure 7.37: Reindeer axis.
a) Template and individual specimens.
Template.



FR01 SR01 (VS) SR02 (VD)



b) Distribution of marks (symbol).



Disarticulation at parts butchery

Symbol keys
- I Cut
- D Cut/shave
- U Cut/shave/cut
- W Shave/cut/shave
- O Shave
- Saw
- Axe
- Nick
- (human tooth)
- Hammer breakage

Table 7.38: Summary of reindeer axis surface modification.

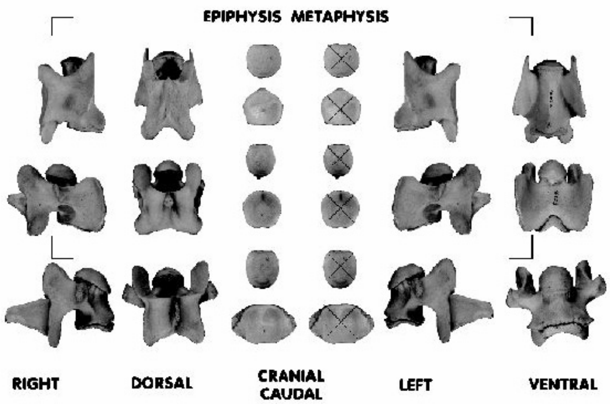
a) Marks by type.
'Cranial' marks from the cranial view are disarticulation marks from parts butchery.

	Zone	cut 1	c/s 3	c/s/c 5	s/c/s 6	shave 7	saw 10	axe 11	nick 12	tooth 15	hammer 20	Total
FR01	**cranial**	2										2
	-	19	3			3						25
	Total	21	3			3						27
SR01	**cranial**									1		1
	-	1				2			2			5
	Total	1				2			2	1		6
SR02	**cranial**	7	1			3						11
	-	3	1			3						7
	Total	10	2			6						18

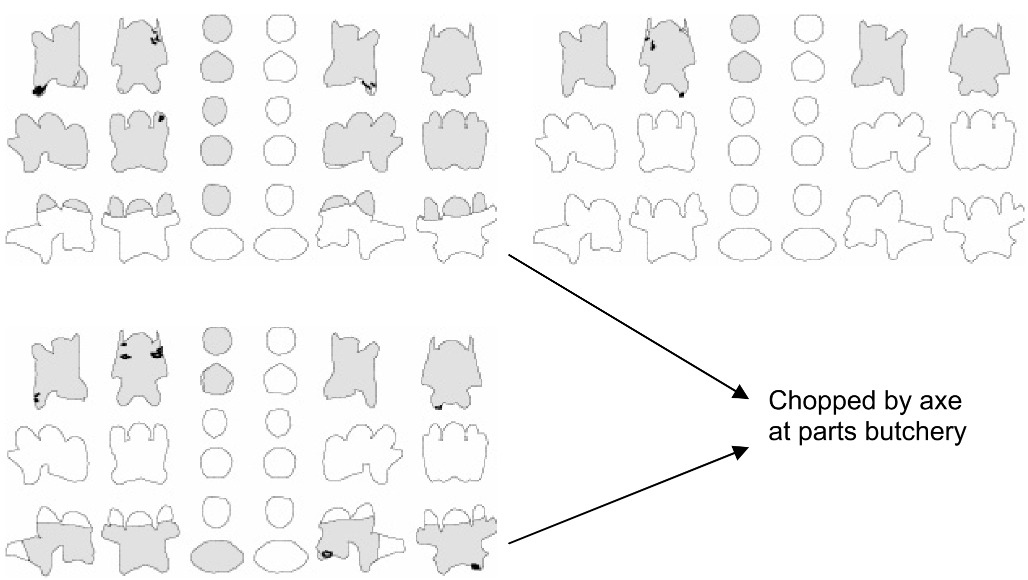
b) Summary of surface modification.

Zone	cut 1	c/s 3	c/s/c 5	s/c/s 6	shave 7	saw 10	axe 11	nick 12	tooth 15	hammer 20	Total	% preserved	Corrected # cutmarks
cranial	23	4			8			2			37	300%	12.3
-	9	1			3				1		14	300%	4.7

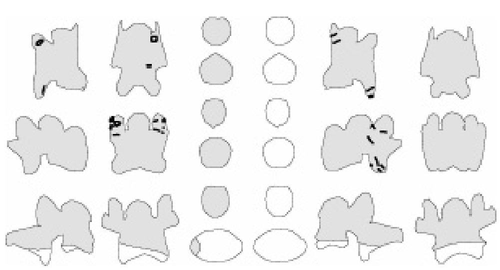
Figure 7.39: Reindeer cervical.
a) Template and individual specimens.
Template.



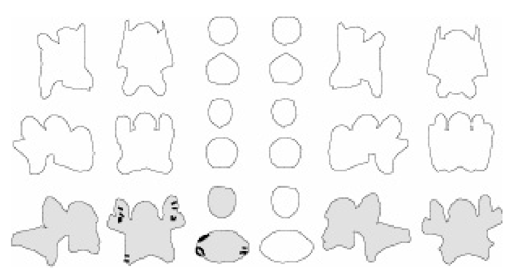
SR01 (6 CE: 5 CE from neck unit, 1 CE (left bottom) from *dramah* unit, knife butchery by VS)



SR02 (3 CE from neck unit, knife butchery by YU)



SR03 (1 CE from *dramah* unit)



b) Distribution of marks (symbol).

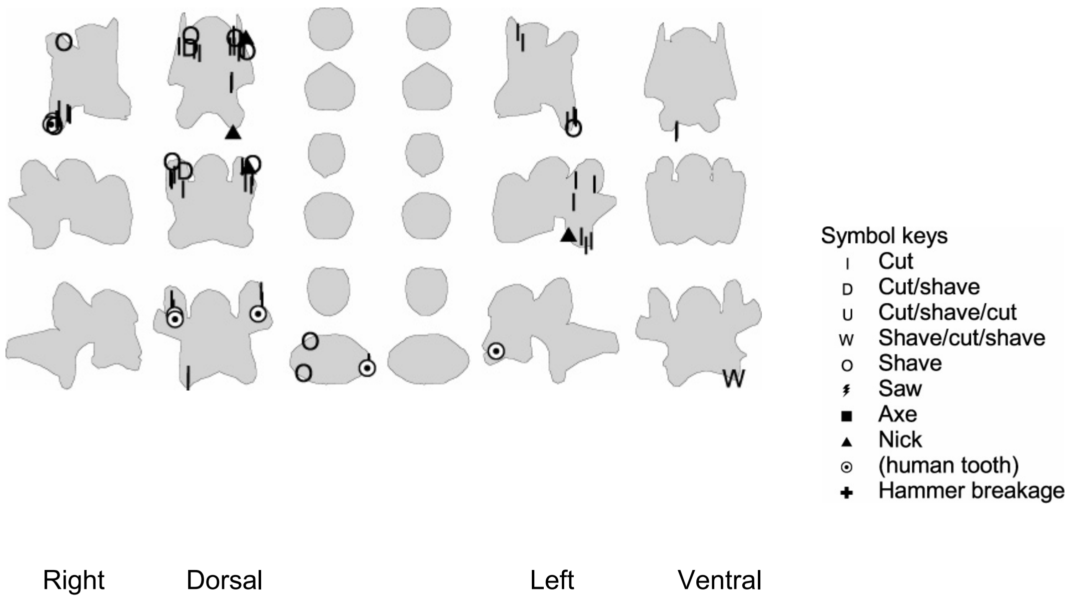


Table 7.40: Summary of reindeer cervical surface modification.

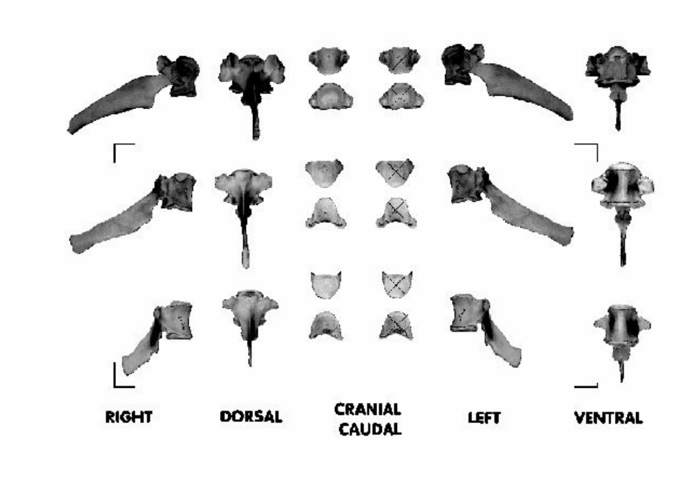
a) Marks by type.
Each row is an individual vertebrae from that animal, ordered by mark frequency (i.e. do not match the order in above figure).

Zone	cut 1	c/s 3	c/s/c 5	s/c/s 6	shave 7	saw 10	axe 11	nick 12	tooth 15	hammer 20	Total
SR01								1			1
				1					1		2
	1	1						1			3
	8				2			1			11
	8				1			1	2		12
SR02	6				3						9
	14	1			2			1			18
SR03	8				2				4		14

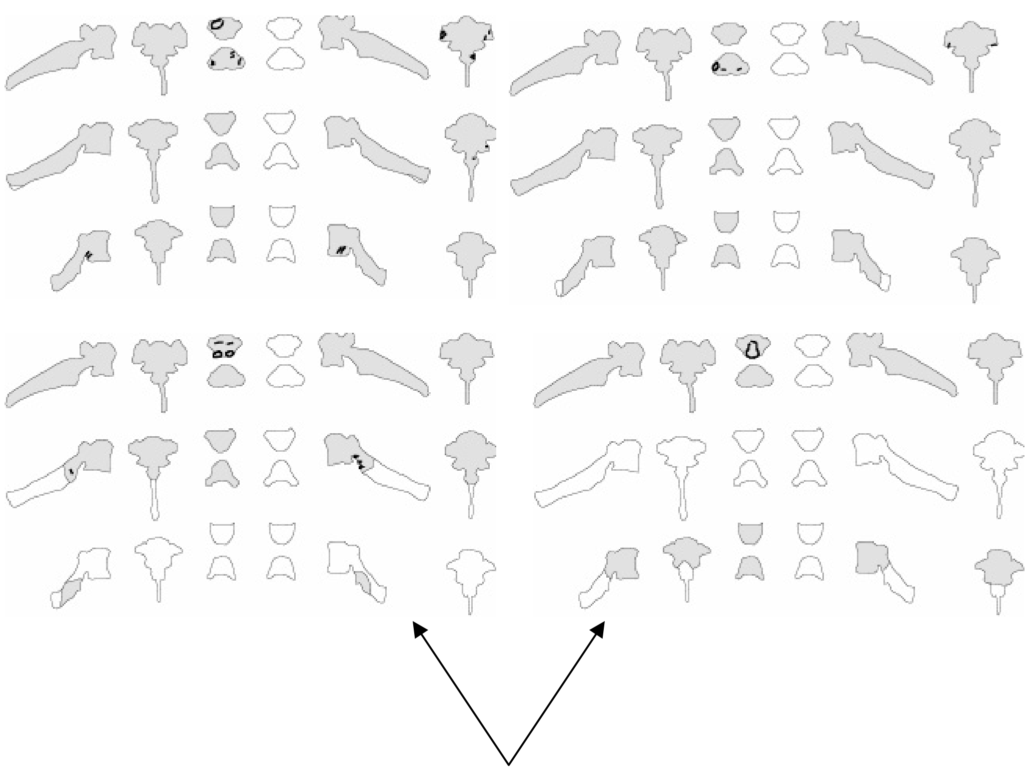
b) Summary of surface modification.

	cut 1	c/s 3	c/s/c 5	s/c/s 6	shave 7	saw 10	axe 11	nick 12	tooth 15	hammer 20	Total	% preserved	Corrected # cutmarks
CE	45	2		1	10			5	7		70	800%	8.8

Figure 7.41: Reindeer thoracic.
a) Template and individual specimens.
Template.

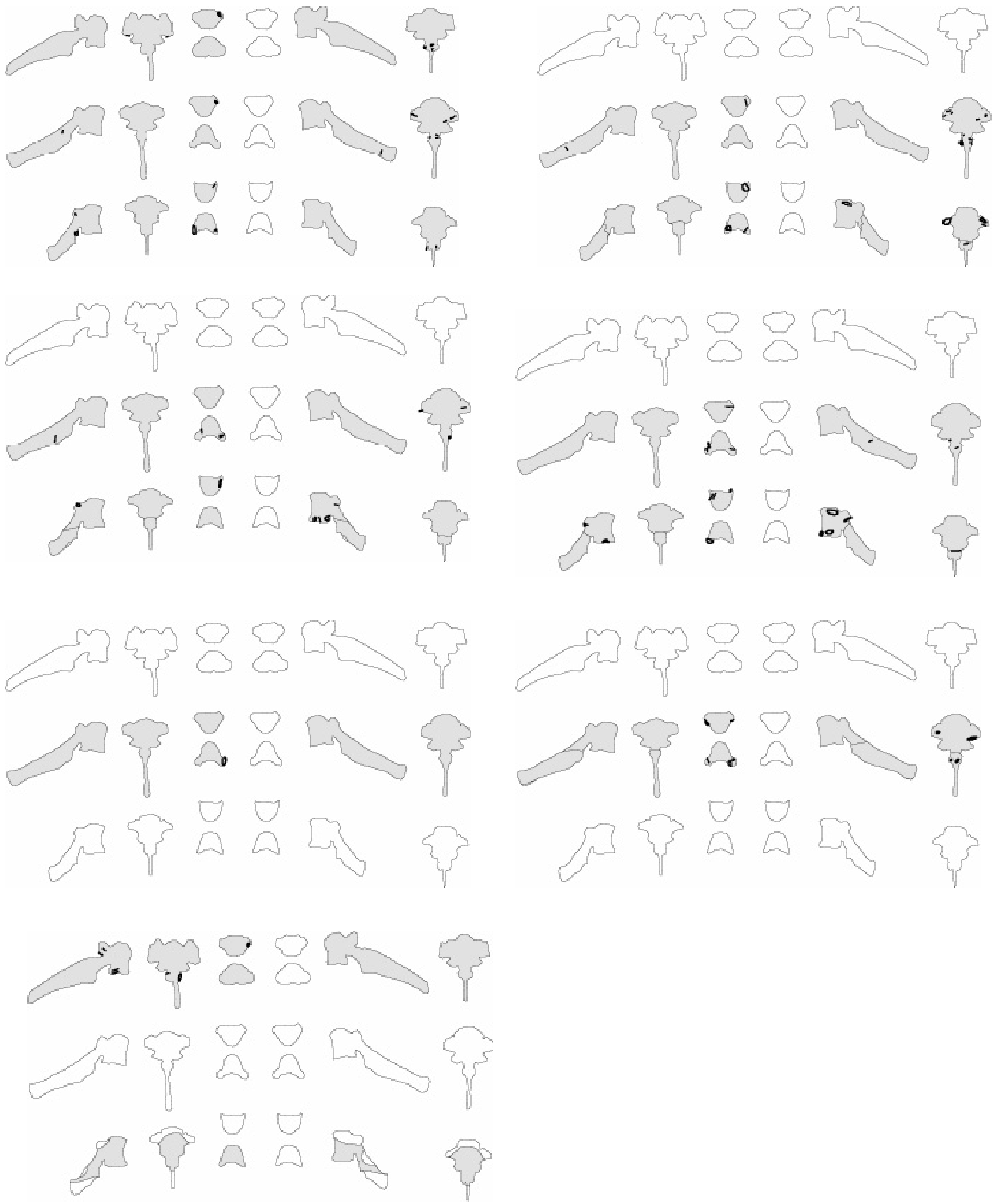


FR01 (10-11 TH)



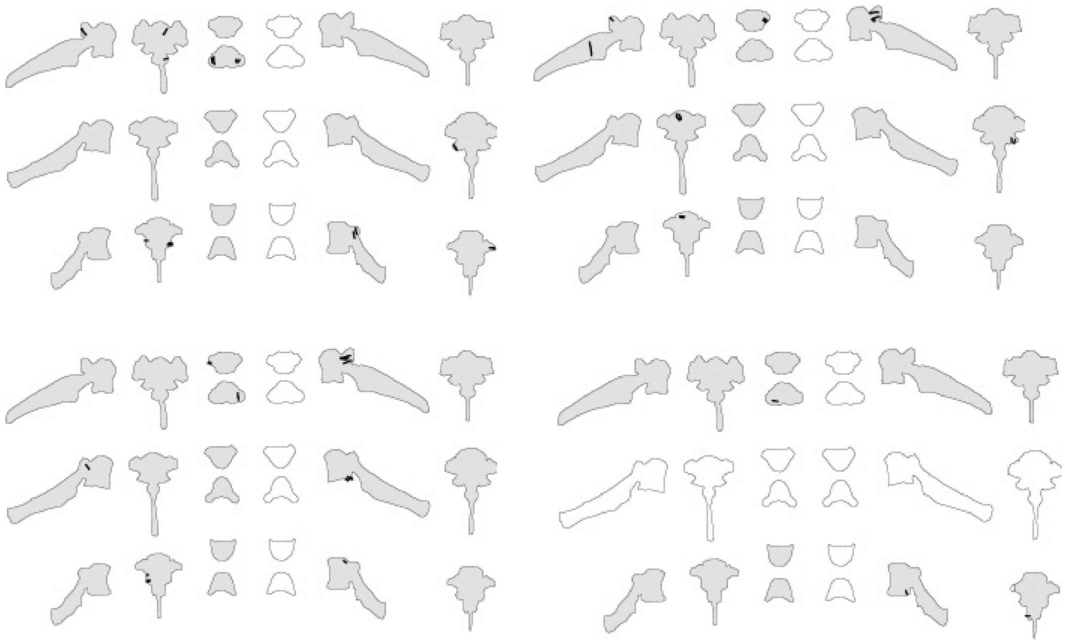
Probable match, but drawn on different days.

SR01 (13 TH, from upper *dramah* unit and TH unit)

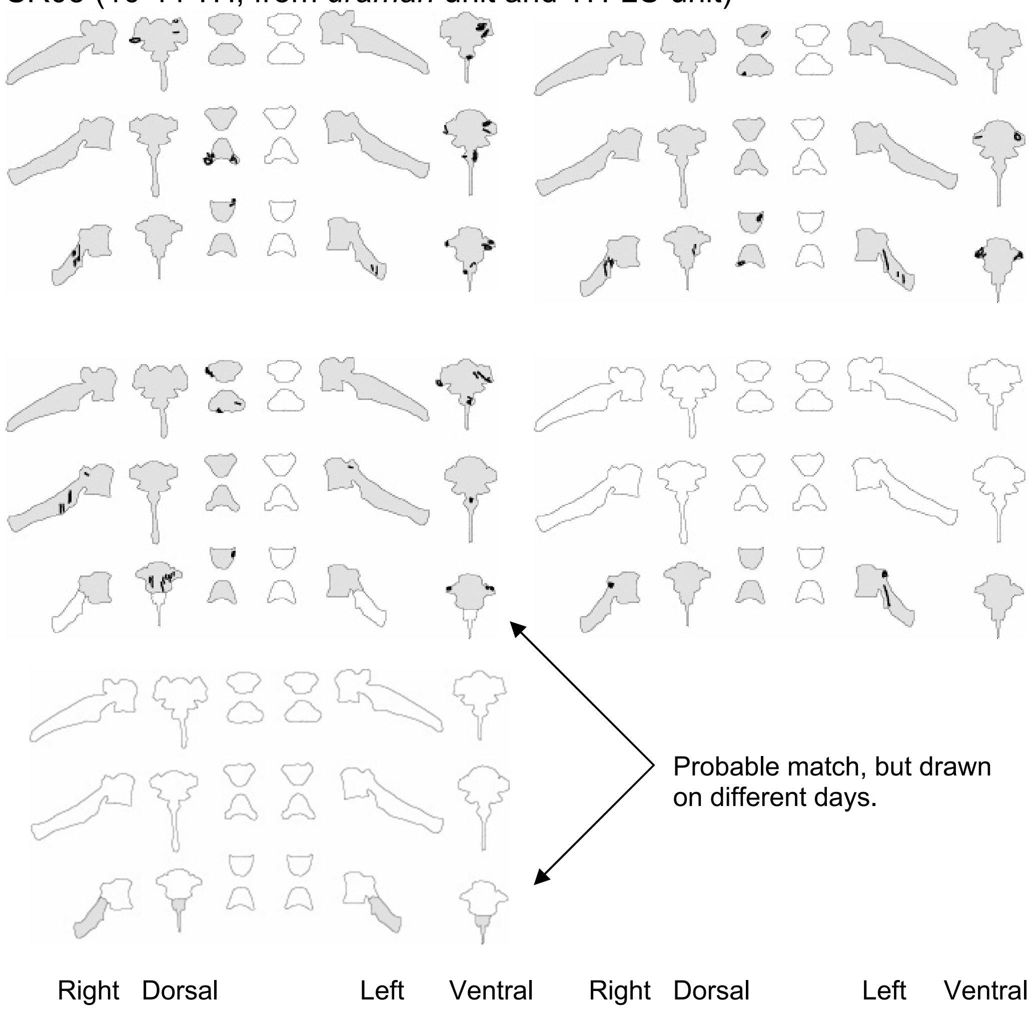


Right Dorsal Left Ventral Right Dorsal Left Ventral

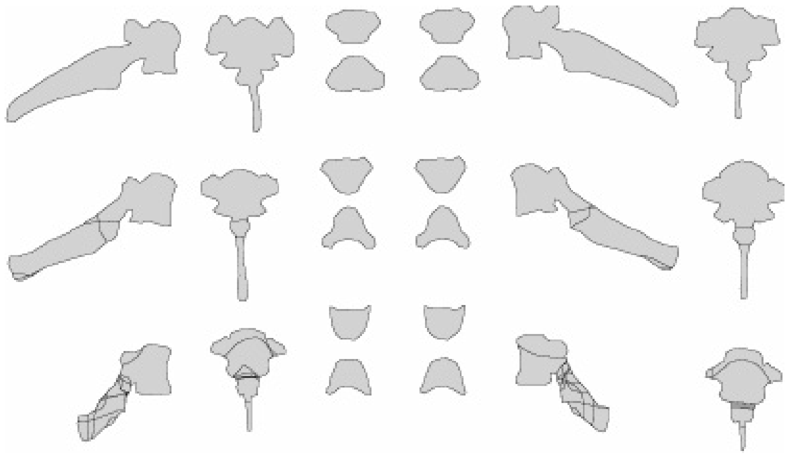
SR02 (11 TH, from *dramah* unit and TH-LU unit)



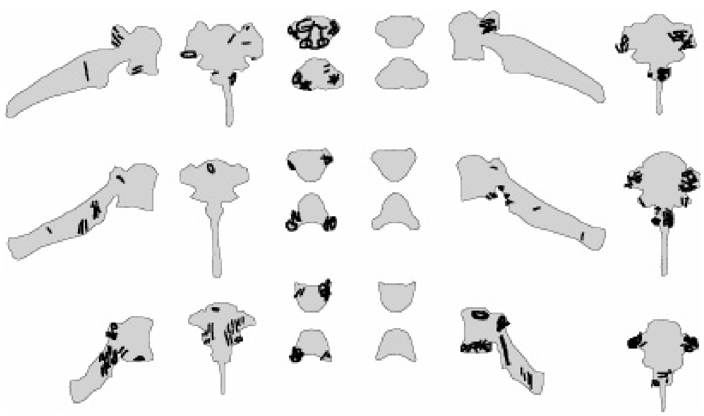
SR03 (10-11 TH, from *dramah* unit and TH-LU unit)



Fragmentation pattern.



b) Distribution of marks (drawing).
Second figure shows MNE map of TH for comparison with distribution of marks.



Right Dorsal Left Ventral

c) Distribution of marks (symbol)

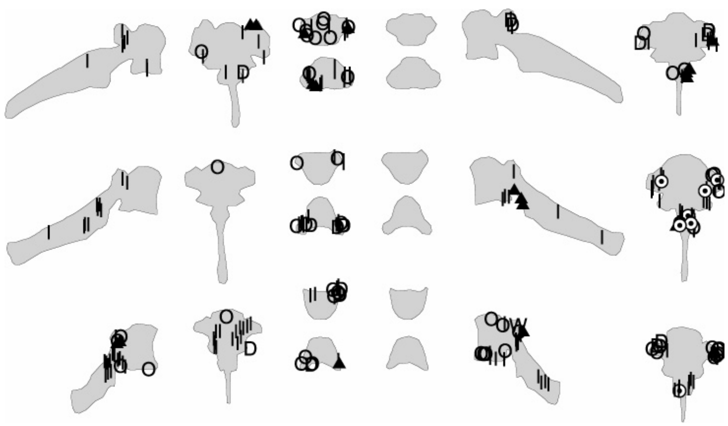
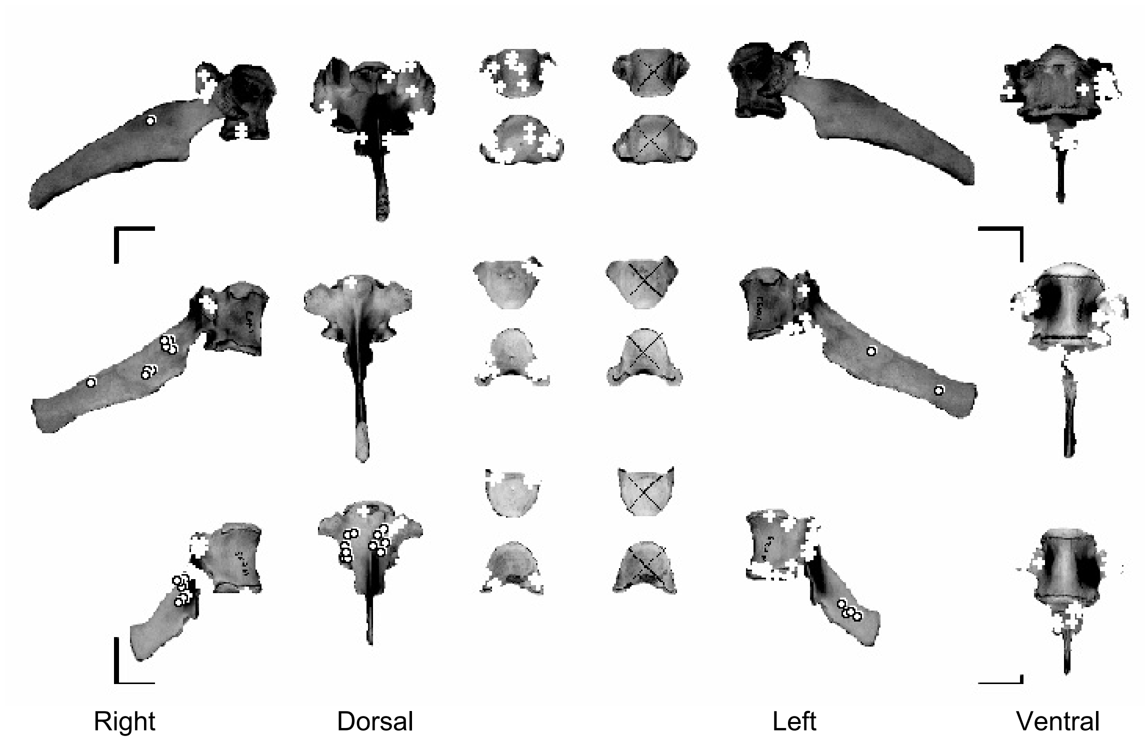


Table 7.42: Summary of reindeer thoracic surface modification.
a) Marks by type. Each row represents an individual vertebra from that animal, ordered by frequency.

	cut 1	c/s 3	c/s/c 5	s/c/s 6	shave 7	saw 10	axe 11	nick 12	tooth 15	hammer 20	Total
FR01					1						1
	2										2
	1							3			4
	4										4
	2				2						4
	4				1						5
	7				2			1			10
SR01					1						1
	4	1			1						6
	2				4						6
	4				3						7
	4				2			1			7
	7				1						8
	3	1			3			1			8
	7				1				1		9
	2	2			2				3		9
	10							1	1		12
	5				6			2			13
SR02	1										1
					1						1
	1										1
	2										2
	2				1						3
	4										4
	4										4
	2	1						1			4
	4	1									5
	5				1						6
	5	1									6
	5	1						1			7
SR03	1							1			2
	1				1						2
	1			1	1			1			4
	6								1		7
	3	2			1			3			9
	4	1			3			3			11
	8	1			3						12
	12	1			3				1		17
	14	1			3						18
	11	1			6						18

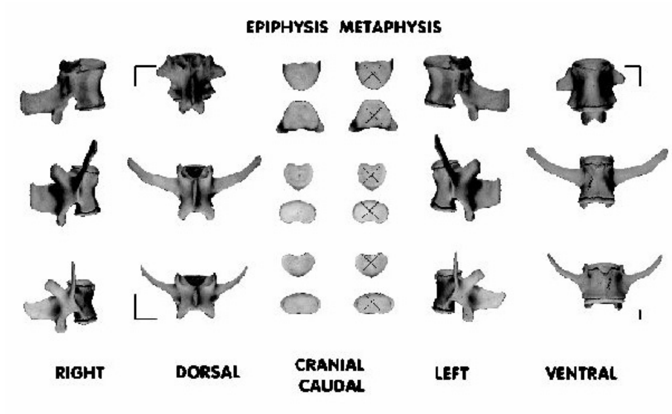
b) Summary of surface modification.
O = marks spatially determined as not from disarticulation (most likely from eating; + = all other marks (most likely from disarticulation).



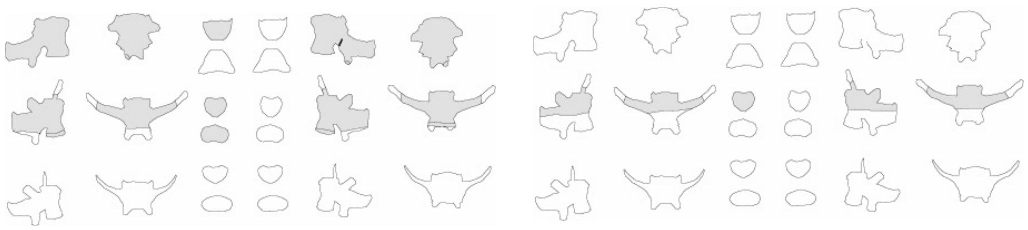
The corrected number of cutmarks (CNC) for disarticulation excludes eating marks as determined above (X), tooth marks, and a mark (1 shave) noted as made during eating.

Zone	cut 1	c/s 3	c/s/c 5	s/c/s 6	shave 7	saw 10	axe 11	nick 12	tooth 15	hammer 20	Total	% preserved	Corrected # cutmarks	Corrected # cutmarks for disarticulation
total	164	15		1	54			19	7		260	3825%	6.8	5.8
eating (spatial: x)	32													
eating (other)					1				7					

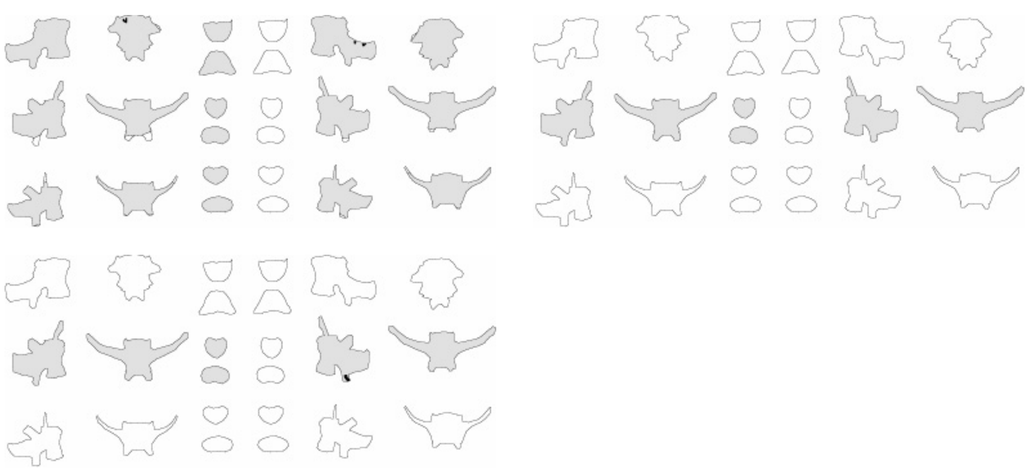
Figure 7.43: Reindeer lumbar.
a) Template and individual specimens.
Template.



FR01 (3 LU)

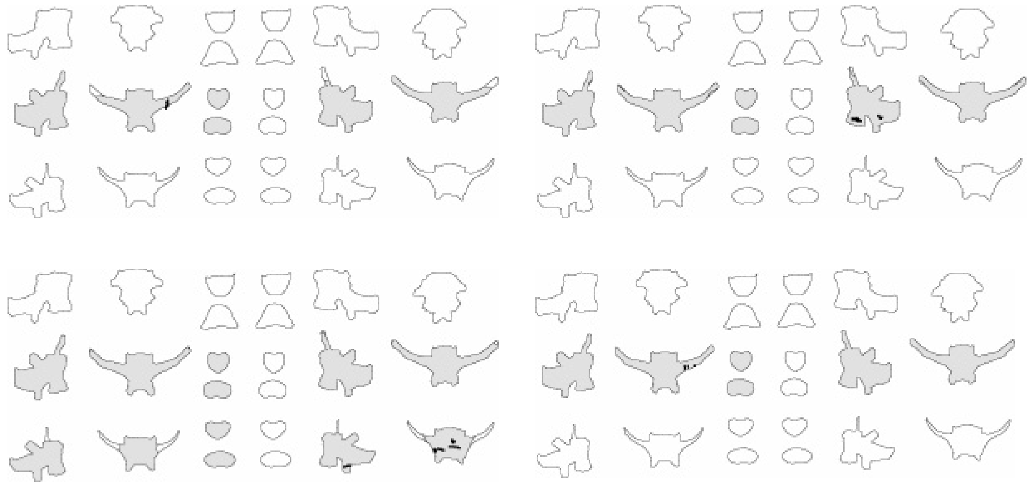


SR01 (5 LU from LU unit)

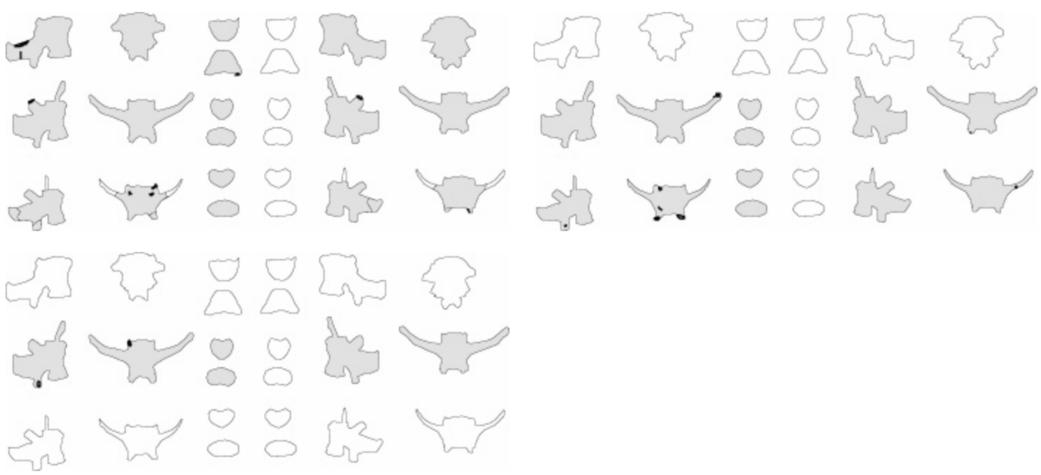


Right Dorsal Left Ventral Right Dorsal Left Ventral

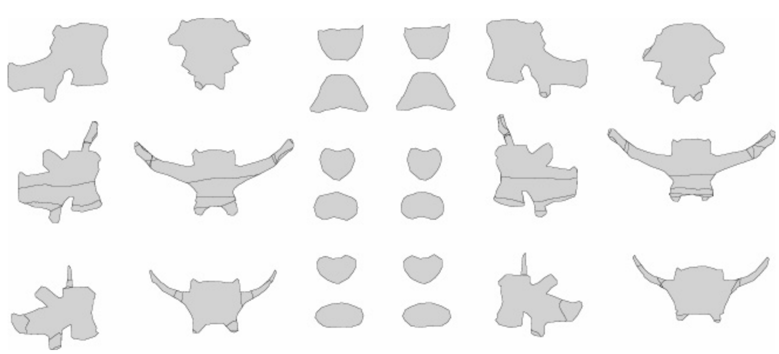
SR02 (5 LU, 4 from TH-LU unit, one (left bottom) from sacrum unit)



SR03 (6 LU from TH-LU unit. One (probably top left) recorded LU but actually TH)

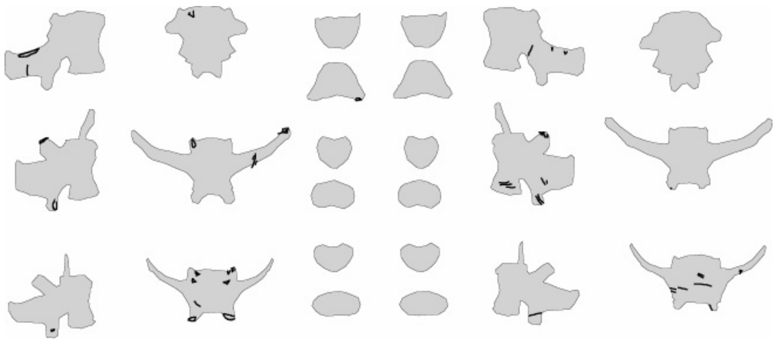


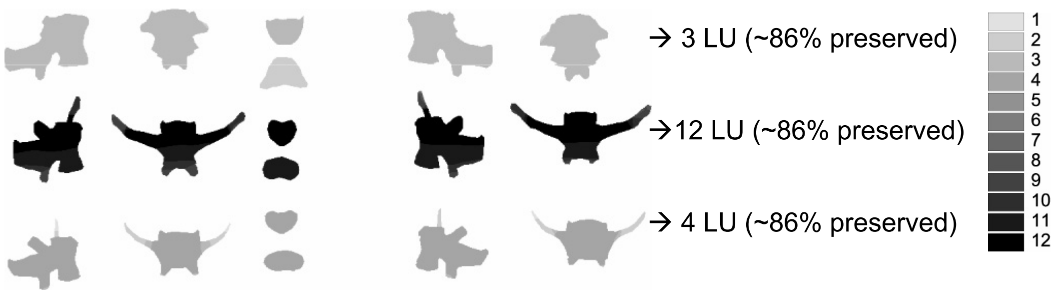
b) Fragmentation pattern.



Right Dorsal Left Ventral

c) Distribution of marks (drawing).
Second figure shows MNE map of LU for comparison with distribution of marks.
Note loss of transverse processes in the more caudal vertebrae.





d) Distribution of marks (symbol).

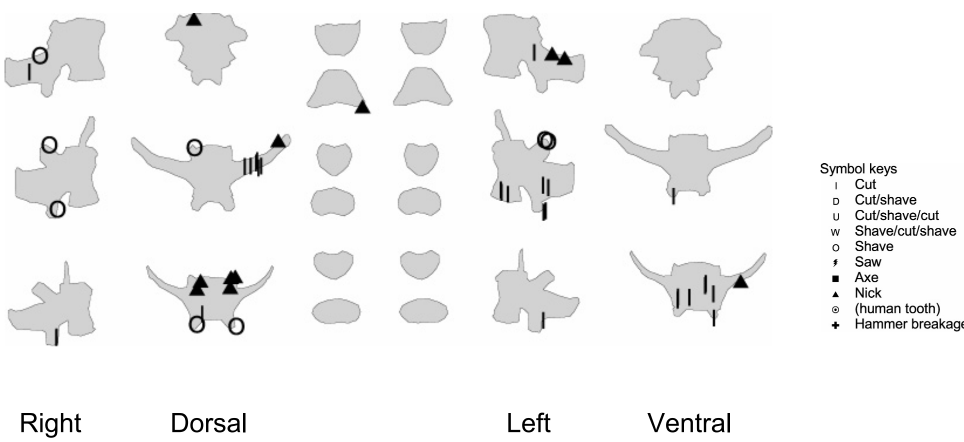


Table 7.44: Summary of reindeer lumbar surface modification.

a) Marks by type. Each row represents an individual vertebra from that animal, ordered by frequency.

Zone	cut 1	c/s 3	c/s/c 5	s/c/s 6	shave 7	saw 10	axe 11	nick 12	tooth 15	hammer 20	Total
FR01	1										1
SR01	2										2
								3			3
SR02	3										3
	3										3
	5										5
	7										7
SR03	1							1			2
					2						2
	1				1			1			3
					3						3
	1							4			5
	3				2			2			7

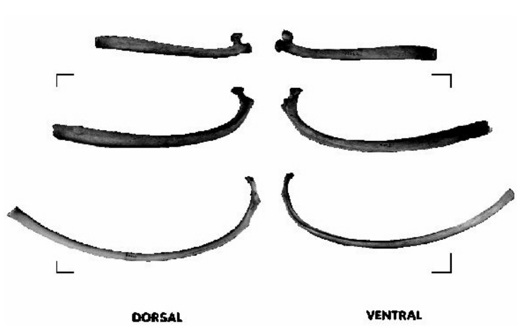
b) Summary of surface modification.

	cut 1	c/s 3	c/s/c 5	s/c/s 6	shave 7	saw 10	axe 11	nick 12	tooth 15	hammer 20	Total	% preserved	Corrected # cutmarks
LU	27				8			11			46	1634%	2.8

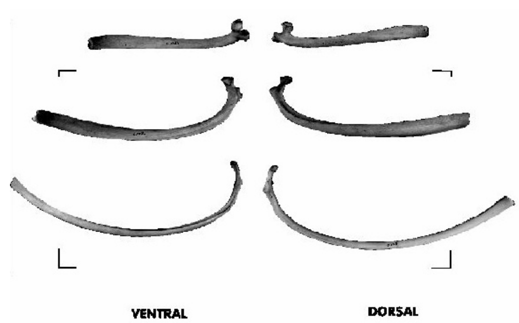
Figure 7.45: Reindeer ribs (L and R).
a) Template and individual specimens. Some fragments were crushed when chopping with the axe; if they could not be matched, they were drawn separately.

Templates.

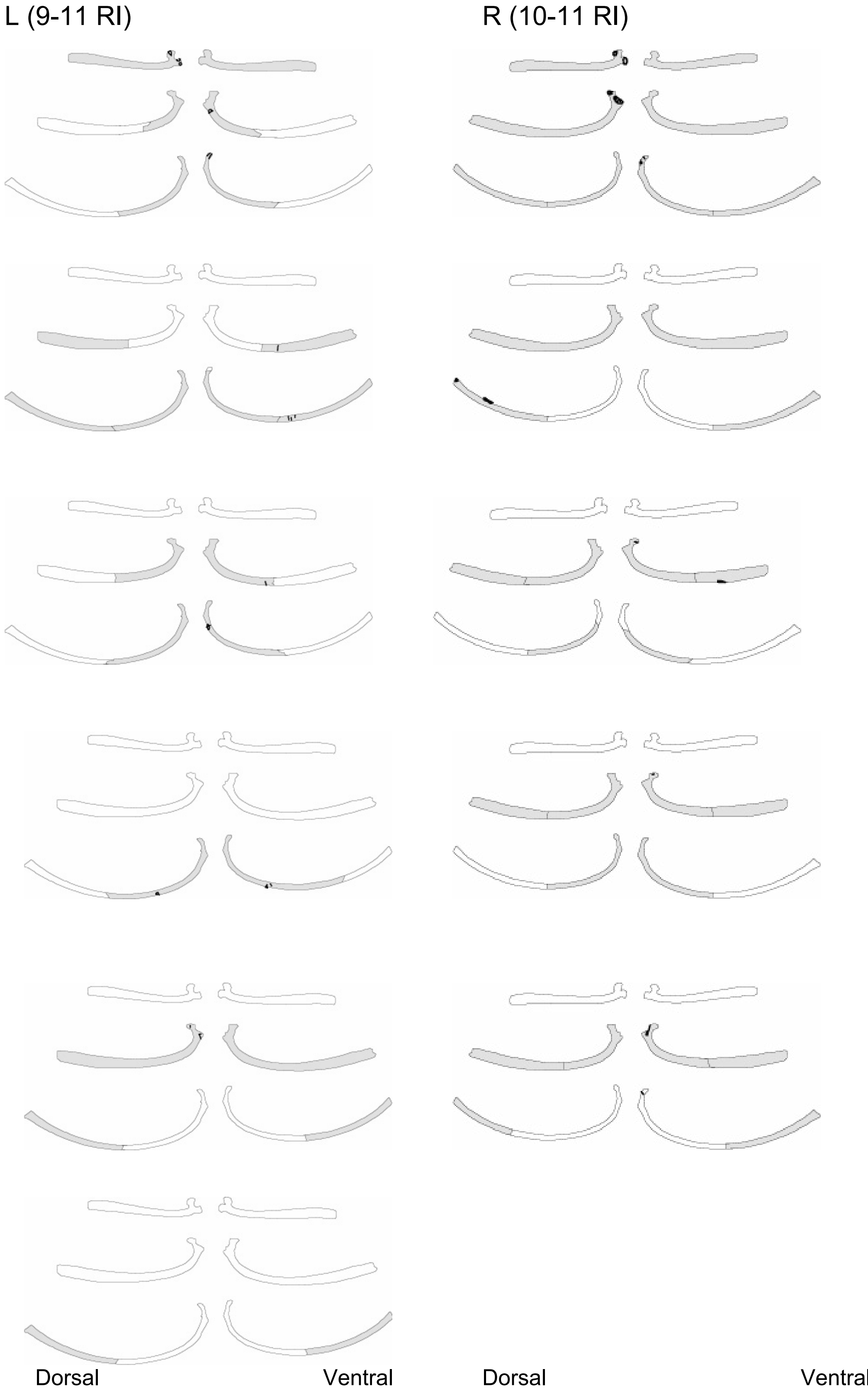
L



R

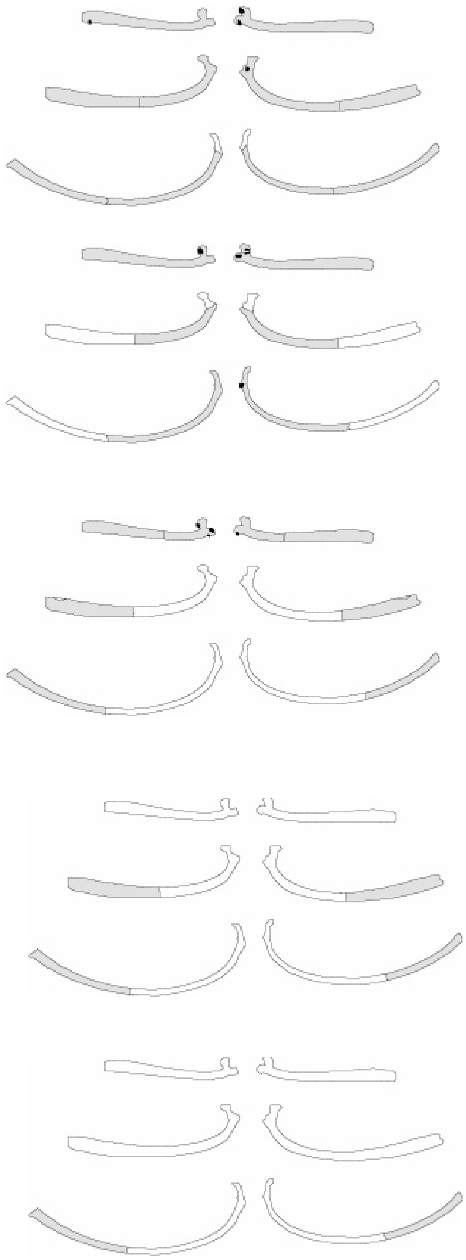


FR01

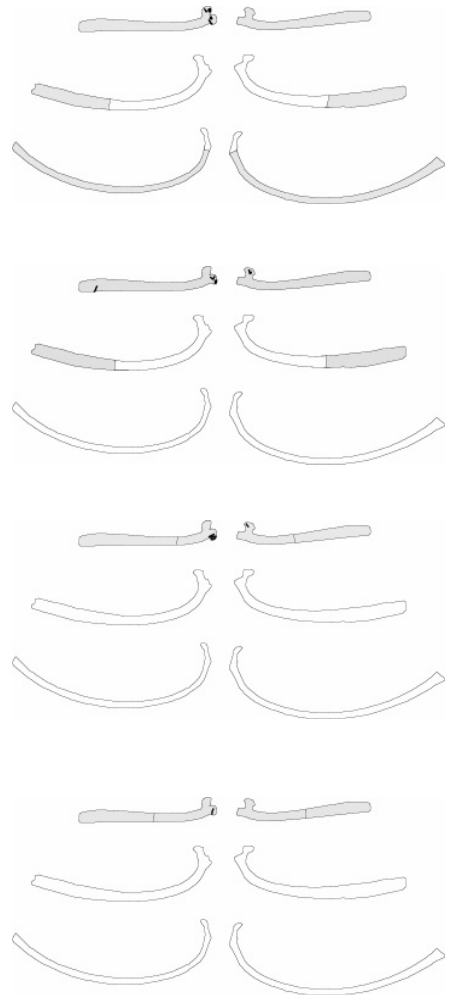

L (9-11 RI)
R (10-11 RI)
Dorsal
Ventral
Dorsal
Ventral

SR01

L (10-12 RI)

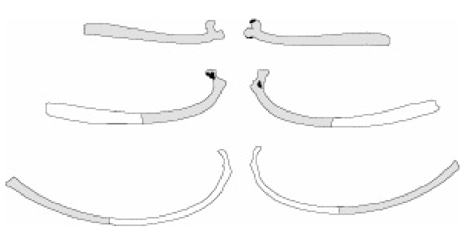


R (7 RI)

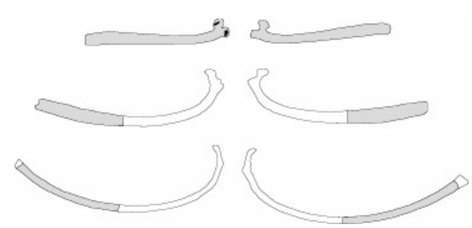


SR02

L (8-12 RI)

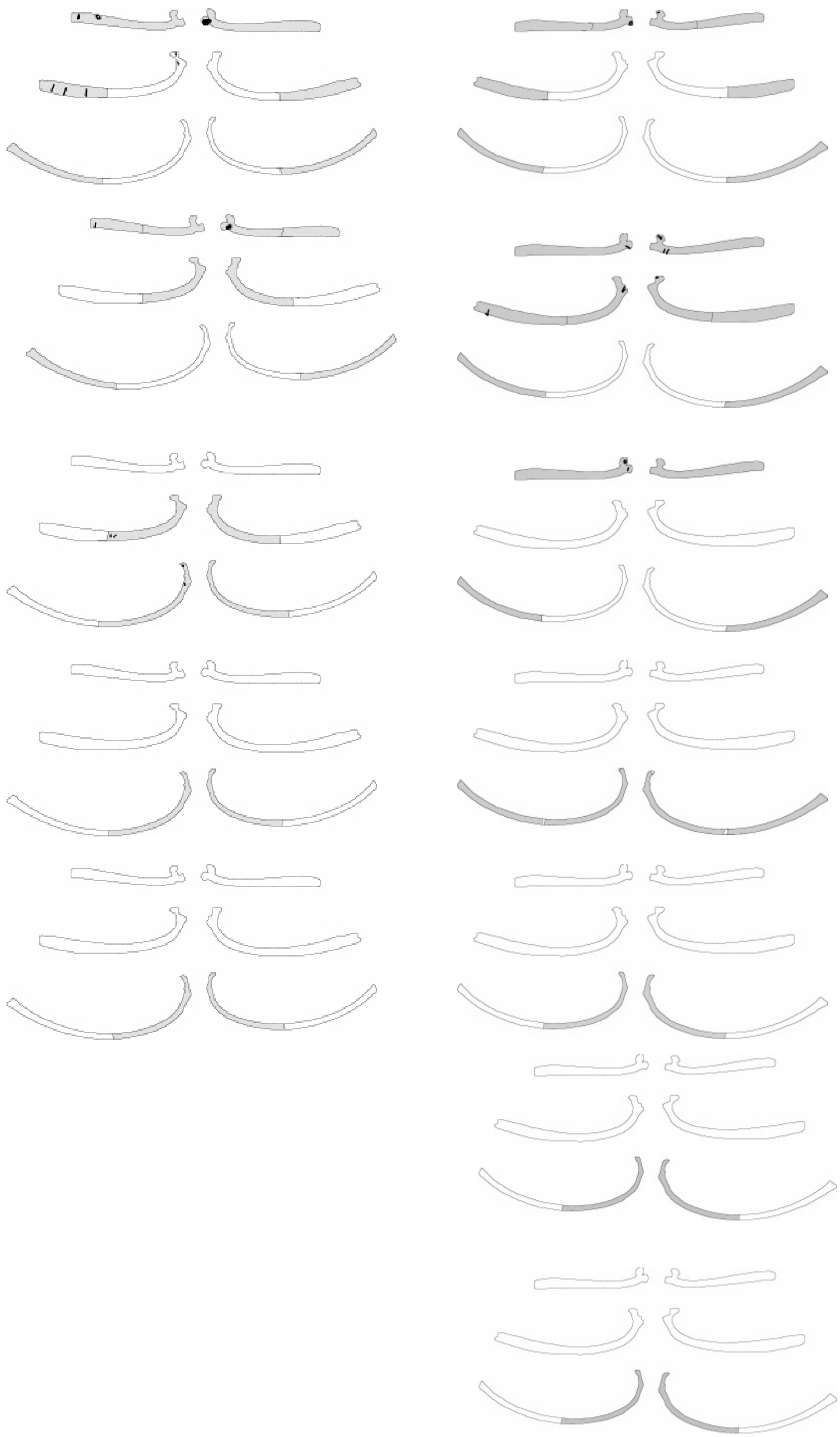


R (12-17 RI)



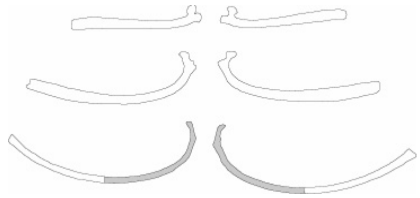
Dorsal Ventral Ventral Dorsal

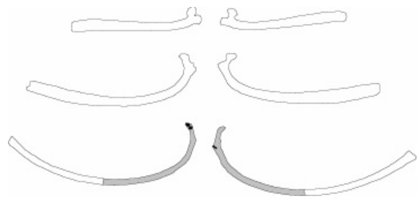
(SR02 cont.)



Dorsal Ventral Ventral Dorsal

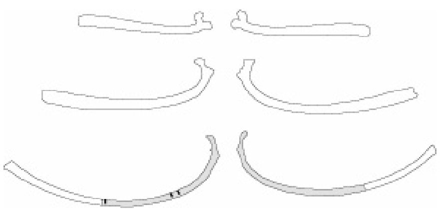
(SR02 cont.)

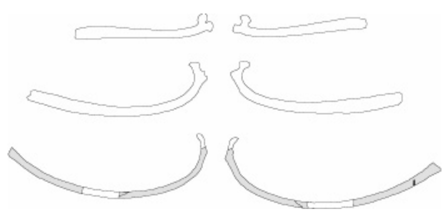


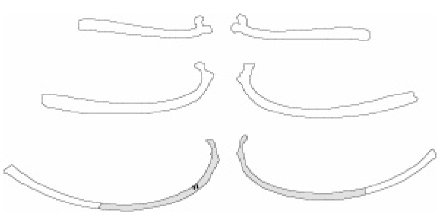


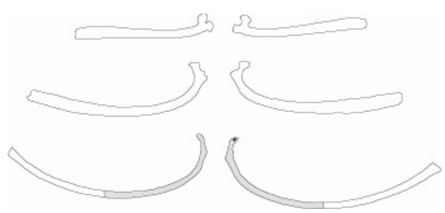
SR03

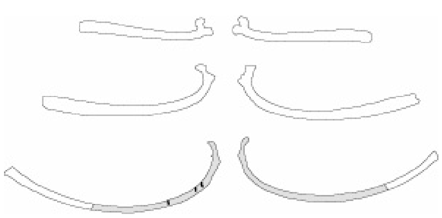
L (6-7 RI) R (7 RI)

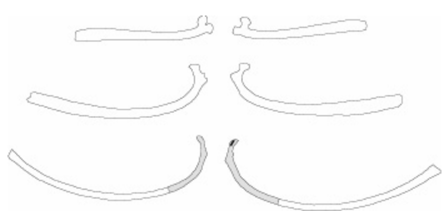


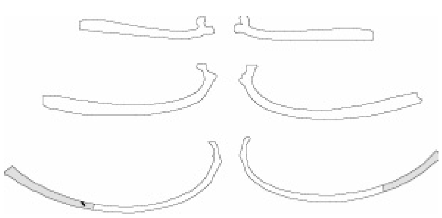


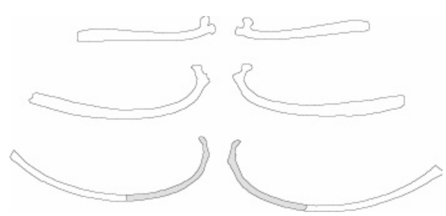






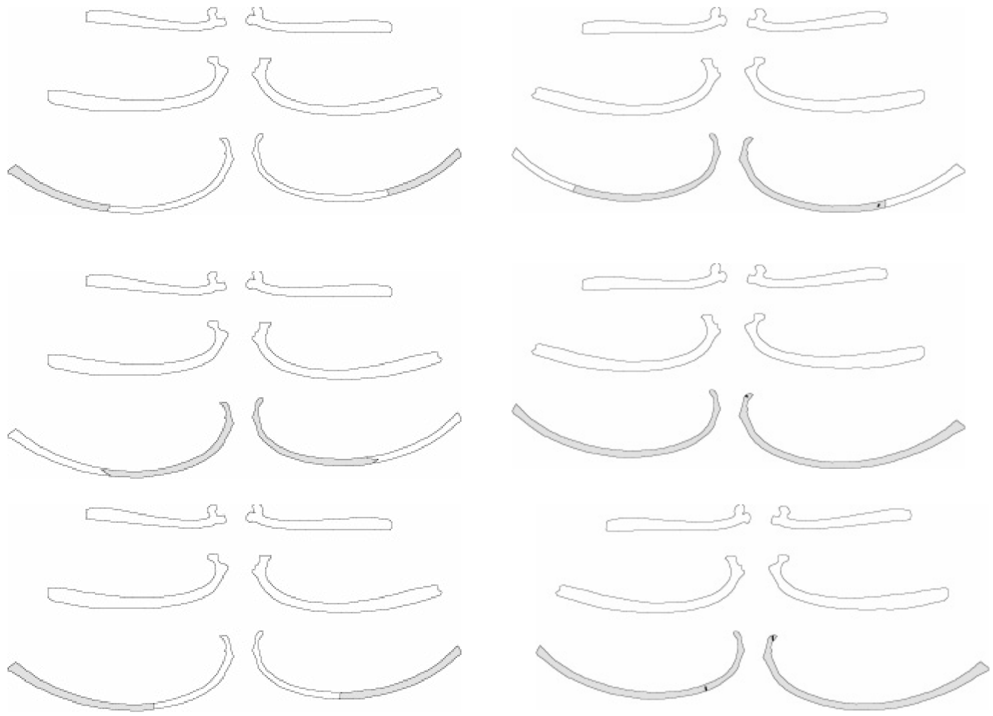






Dorsal Ventral Ventral Dorsal

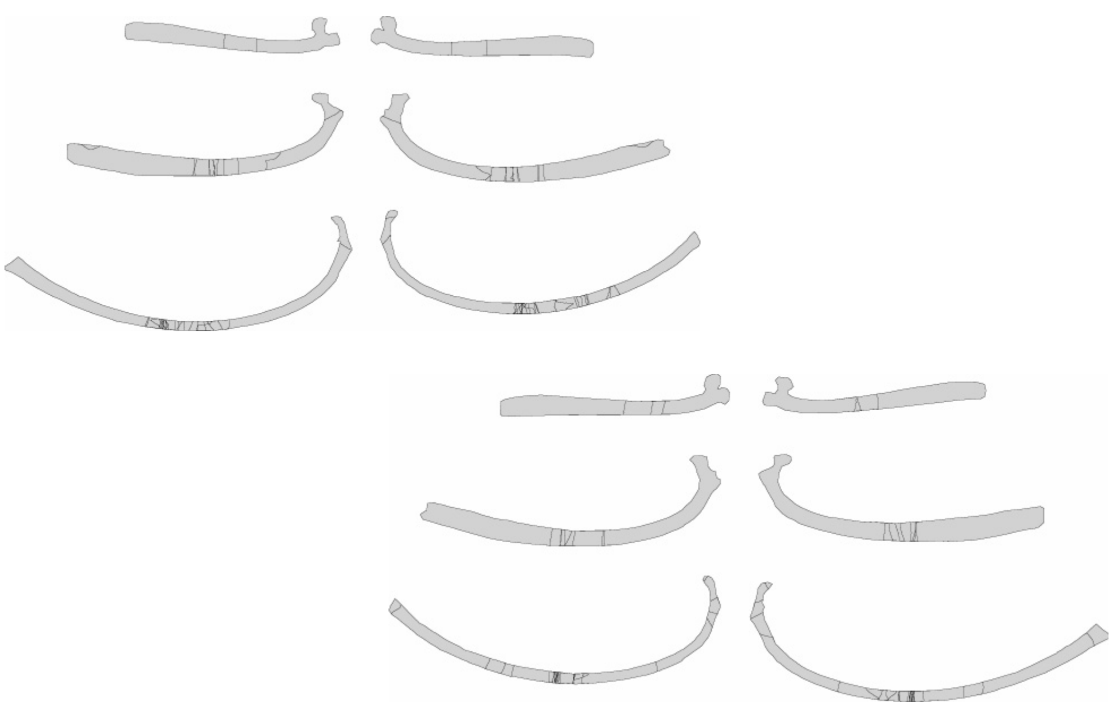
(SR03 cont.)



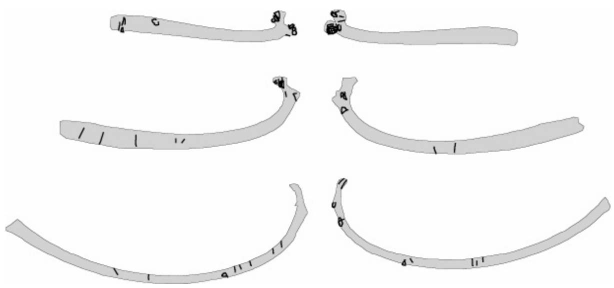
Dorsal Ventral Ventral Dorsal

b) Fracture pattern.

L R



c) Distribution of marks (drawing).
Second sets of figures show tally of recorded RI for comparison with distribution of marks.
L: 30 out of 56 anatomically possible RI recorded

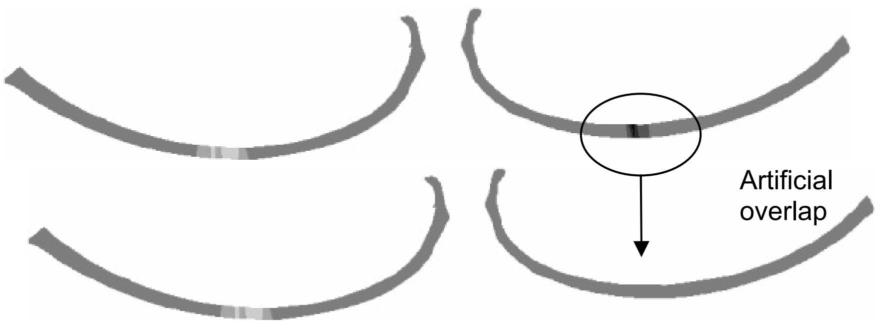


R: 36 out of 56 possible RI recorded.

Dorsal Ventral Ventral Dorsal

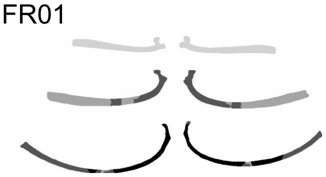
d) Example of MNE map manipulation.
Most proximal and distal RI fragments were drawn separately, due to the crushed nature of the fracture and also because they were eaten at different meals. Artificial overlaps that came from not drawing refitting fragments on the same template were detected and corrected during the MNE calculation. The steps were 1) to make a MNE map for each animal and reclassifying the pixels with artificially high MNE to the correct MNE, and 2) adding the MNE maps of each animal together to get a MNE map of all reindeer RI.

1) For each animal, check for artificial overlaps (e.g. distal L RI of SR02). Dark area (MNE>14) was corrected to anatomical maximum MNE (14).

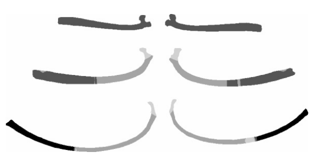


2) Add up MNE maps of each animal for total MNE map.

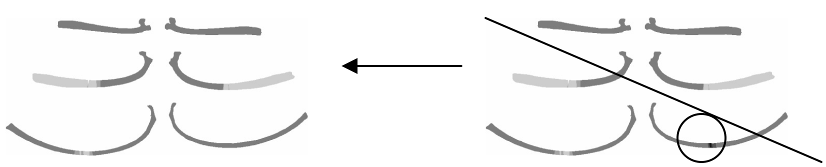
L FR01



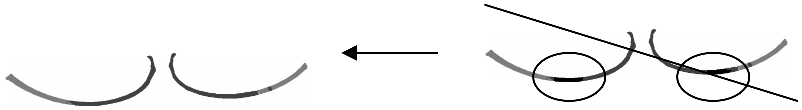
+ L SR01



+ L SR02

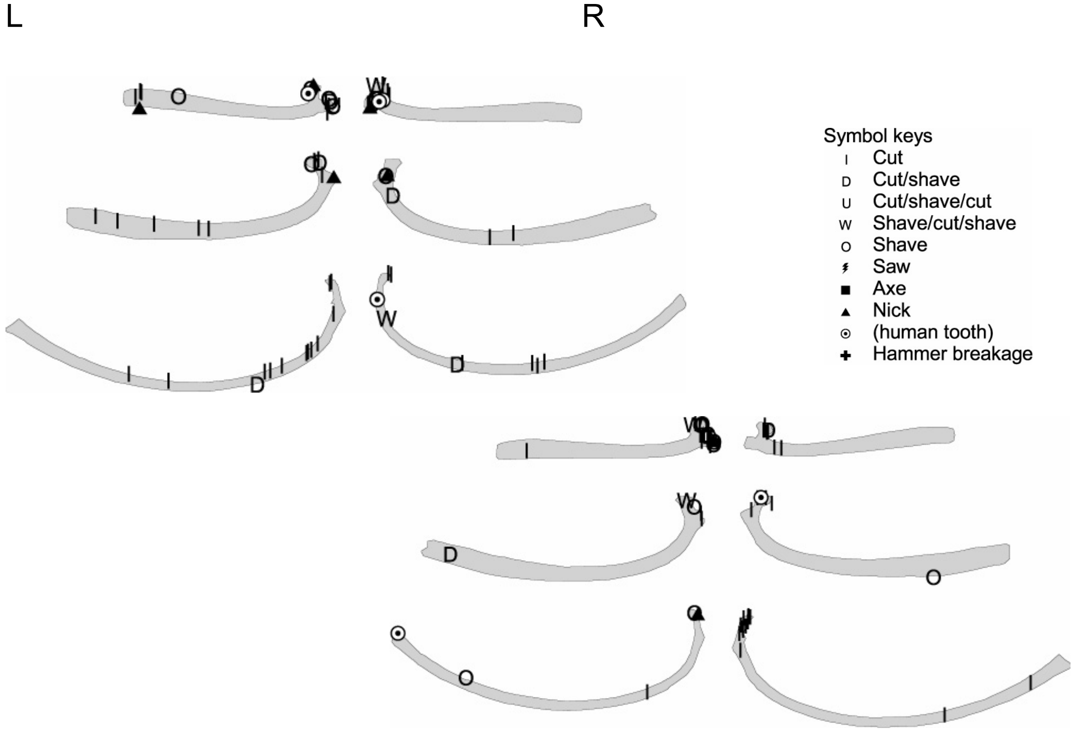


+ L SR03



= L RI MNE map

e) Distribution of marks (symbol).



f) Disassociation of marks and axe-chopping.
Gray = disarticulation marks at rib head, black = other marks.

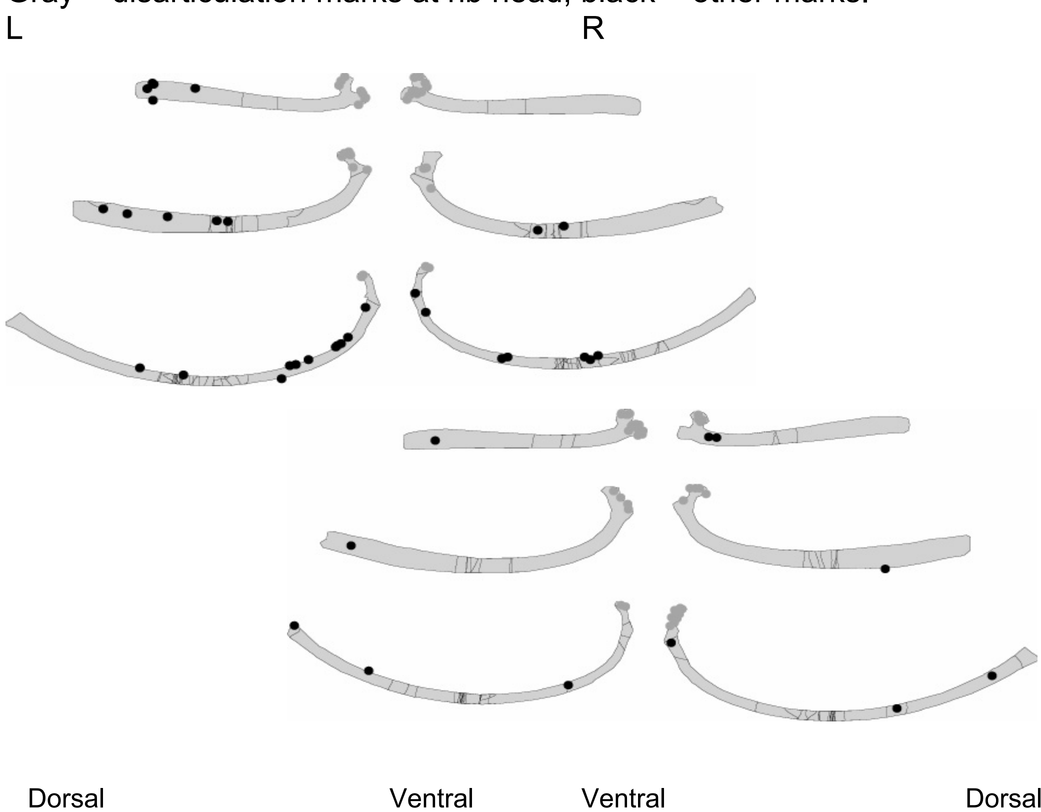


Table 7.46: Summary of reindeer rib surface modification.

a) Marks by type. Each row represents an individual rib from that animal, ordered by frequency.

	cut 1	c/s 3	c/s/c 5	s/c/s 6	shave 7	saw 10	axe 11	nick 12	tooth 15	hammer 20	Total
L FR01		1									1
	1										1
				1							1
	1										1
	2										2
	1							1			2
	3										3
	1	2									3
					2			1			3
L SR01					1						1
									1		1
		1		1				1			3
	2				2						4
	1	1	1					1	1		5
L SR02	1										1
	2										2
	1								2		3
		1			1			1			3
	3										3
	2				2						4
	5										5
L SR03	1										1
	2										2
	3										3
	3										3

	cut 1	c/s 3	c/s/c 5	s/c/s 6	shave 7	saw 10	axe 11	nick 12	tooth 15	hammer 20	Total
R FR01	1										1
	1										1
				1	1						2
				1	1						2
	1				1						2
	2										2
					1				1		2
	5										5
R SR01	1										1
	2				1						3
	2	1			1						4
	5							1			6
R SR02	1								1		2
	1				1						2
	1				1						2
	1				1			1			3
	3	1									4
	2	1							1		4
R SR03	1										1
	1										1
	1										1
	1										1
	1										1
	2										2

b) Summary of surface modification.
'head' = marks on ribheads that were spatially classified spatially (Figure 7.45f, gray dots). Marks on ribheads that were not eating marks were counted as disarticulation marks (and used to calculate disarticulation CNC).

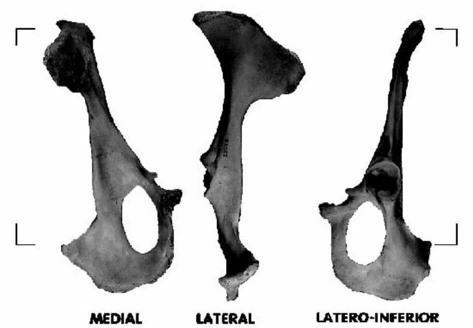
		cut 1	c/s 3	c/s/c 5	s/c/s 6	shave 7	saw 10	axe 11	nick 12	tooth 15	hammer 20	Total	% preserved	Corrected # cutmarks	Total eating	Corrected # cutmarks for disarticulation
RI L	**head**	24	2		1	1			1	1		30	2746%	1.1	6	0.9
	-	11	4	1	1	7			4	3		31	2746%	1.1	5	0.0
	Total	35	6	1	2	8			5	4		61	2746%	2.2	11	0.0
RIR	**head**	29	2		2	7			2	2		44	3070%	1.4	6	1.2
	-	7	1			2				1		11	3070%	0.4	4	0.0
	Total	36	3		2	9			2	3		55	3070%	1.8	10	0.0
RI	**head**													1.3		1.1
	-													0.7		0.0
	Total													2.0		0.0

c) Cutmark frequency across different zones:

	rib head	ventral	dorsal	overall
L	31	21	9	61
R	44	5	6	55
Total	75	26	15	116

Figure 7.47: Reindeer innominate (L and R).
a) Template and individual specimens.
Template.

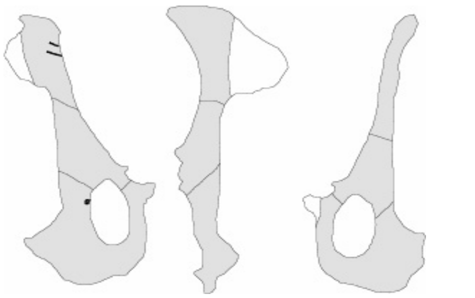
L



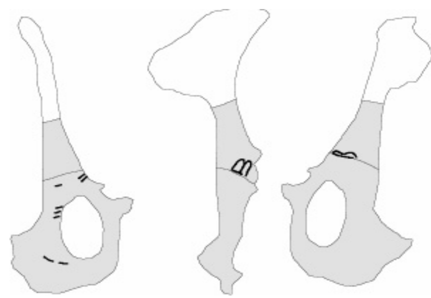
R

FR01

L

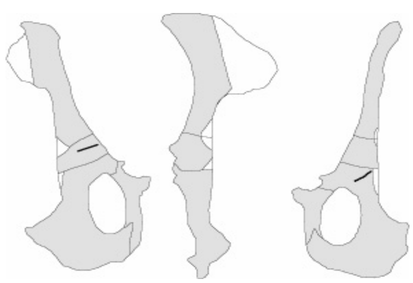


R

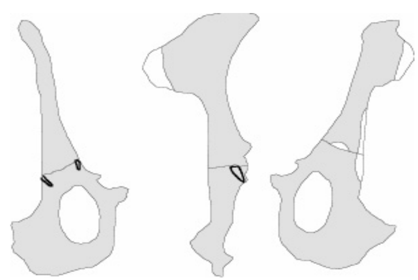


SR01 (parts butchery: VD, cooking butchery YA)

L

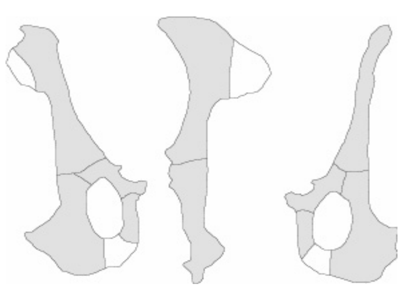


R

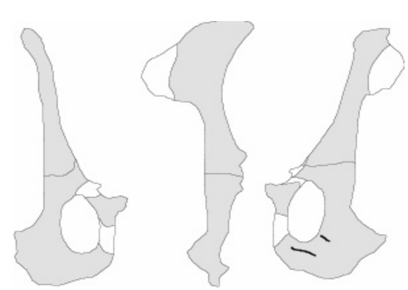


SR02 (parts butchery: VS, cooking butchery R: VS, L: YA)

L

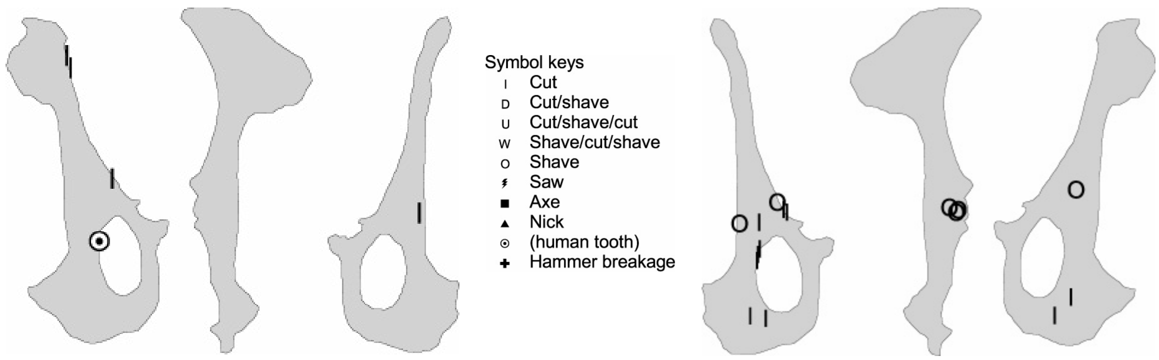


R



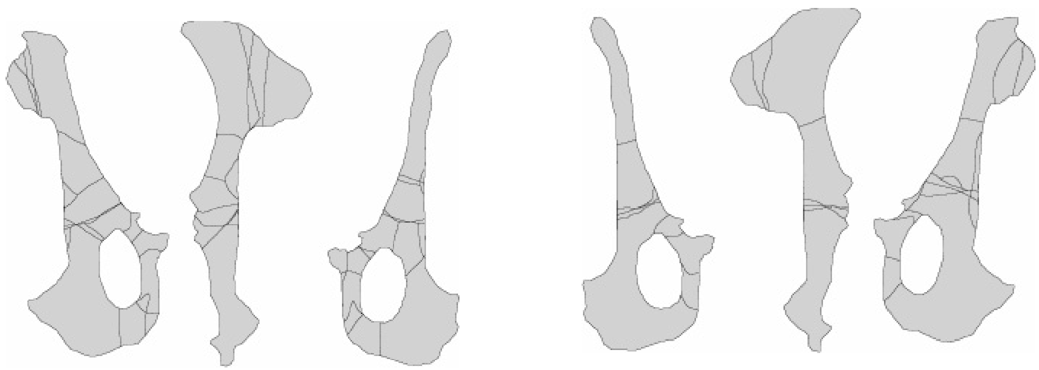
b) Distribution of all marks (symbol).

L R



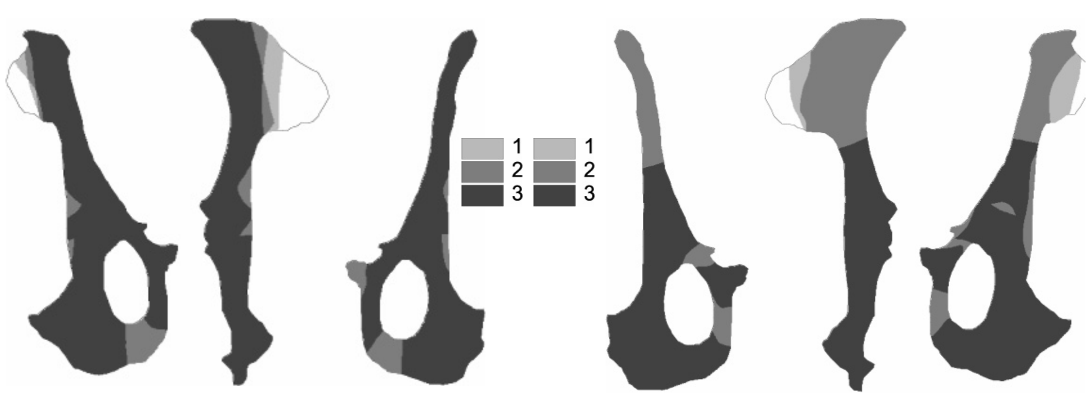
c) Fracture pattern.

L R



d) MNE map, showing preservation at time of recording.

L R



Medial Lateral Latero-inferior Latero-inferior Lateral Medial

Table 7.48: Summary of reindeer innominate surface modification.

a) Cuts by animal, zone, and cutmark type.
Marks visible immediately after parts butchery were recorded for SR04 and SR05. These definite marks from disarticulation (double dots) are overlaid on all marks from above specimens (white dots), and shown in table.

L (with additional marks fromSR04 and SR05) R (with additional marks from SR04)

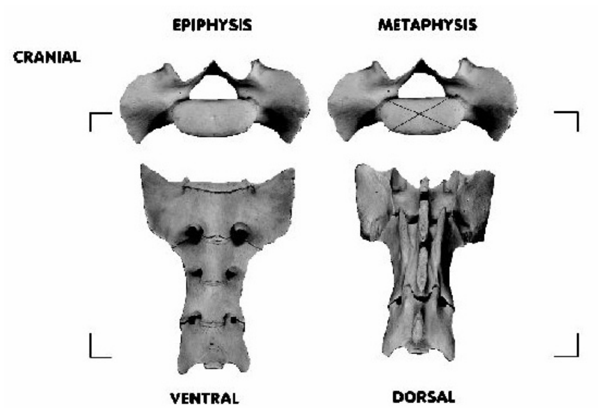
Medial Lateral Latero-inferior Latero-inferior Lateral Medial

	cut 1	c/s 3	c/s/c 5	s/c/s 6	shave 7	saw 10	axe 11	nick 12	tooth 15	hammer 20	Total	Notes
L FR01	2								1		3	
L SR01	2										2	axe (1 cut)
R FR01	8				3						11	axe (2, 3)
R SR01					3						3	
R SR02	2										2	
(L R04)	2										2	disartic.
(L R05)	3	1									4	disartic.
(R R04)	2										2	

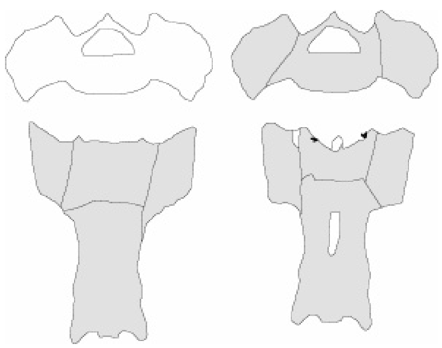
b) Summary of surface modification.
For all specimens butchered completely (i.e. excludes SR04 and SR05).

	cut 1	c/s 3	c/s/c 5	s/c/s 6	shave 7	saw 10	axe 11	nick 12	tooth 15	hammer 20	Total	% preserved	Corrected # cutmarks	Total axe	Corrected # cutmarks for disarticulation
INL	2										2	267%	0.7	1	0.4
INR	10				6						16	253%	6.3	5	4.4
IN													3.5		2.4

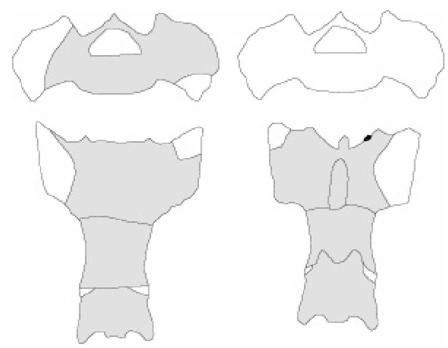
Figure 7.49: Reindeer sacrum.
a) Template and individual specimens.
Template.



SR01 (parts butchery: VD
Epiphysis off.)



SR02 (parts butchery: VS
cooking butchery: VS)



b) Distribution of all marks (symbol), and MNE map.

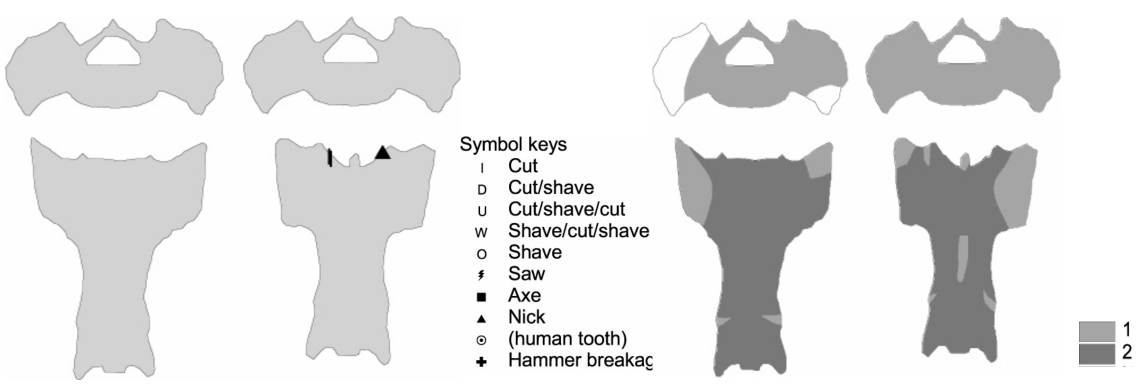
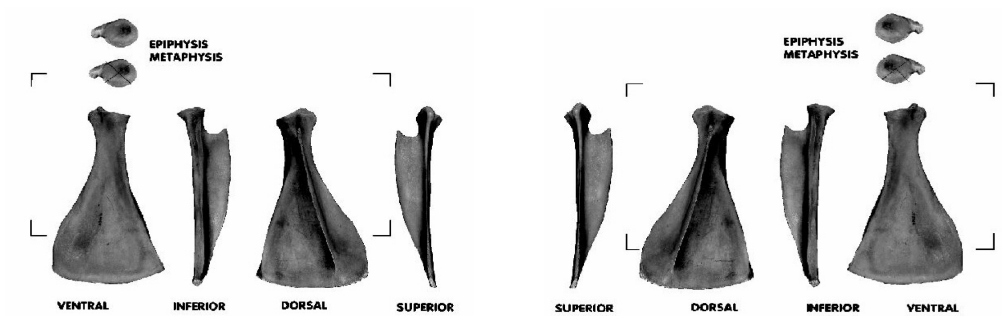


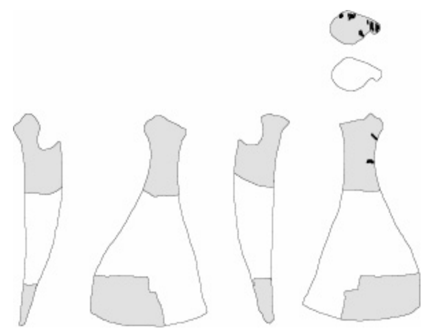
Table 7.50: Summary of reindeer sacrum surface modification.

	cut 1	c/s 3	c/s/c 5	s/c/s 6	shave 7	saw 10	axe 11	nick 12	tooth 15	hammer 20	Total	% preserved	Corrected # cutmarks
SA	2							2			4	146%	2.7

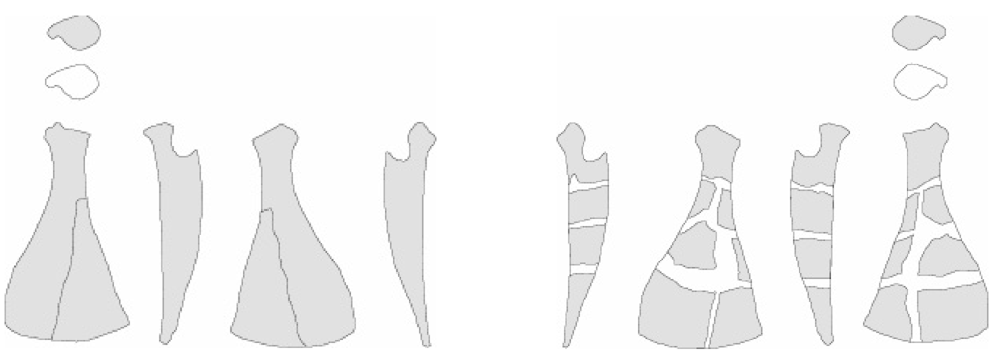
Figure 7.51: Reindeer scapula (L and R).
a) Template and individual specimens.
Templates.



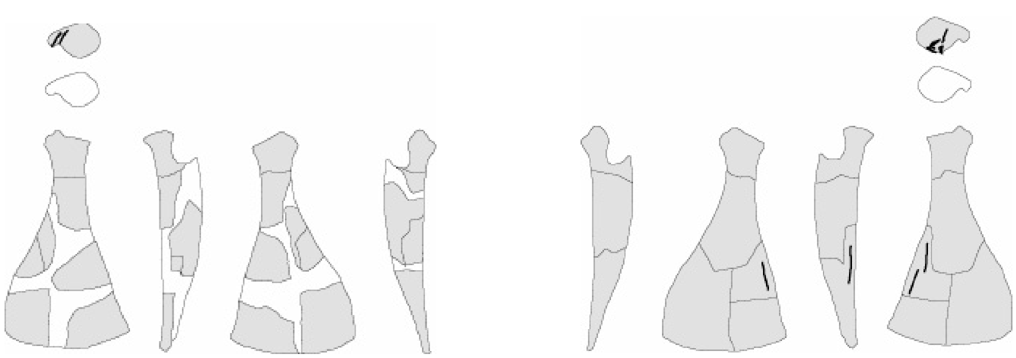
FR01 (SC-HU separation: VS (L or R?))
R



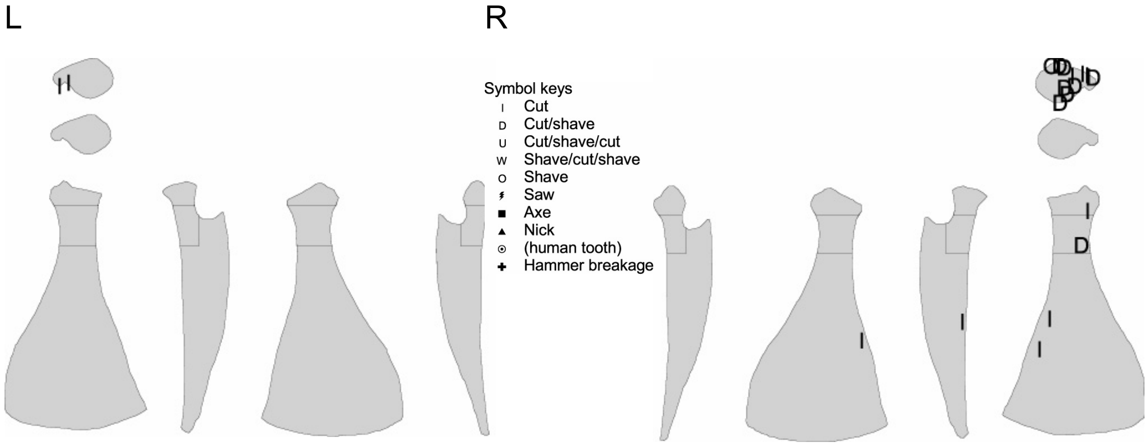
SR01 (parts butchery: VD)
L R



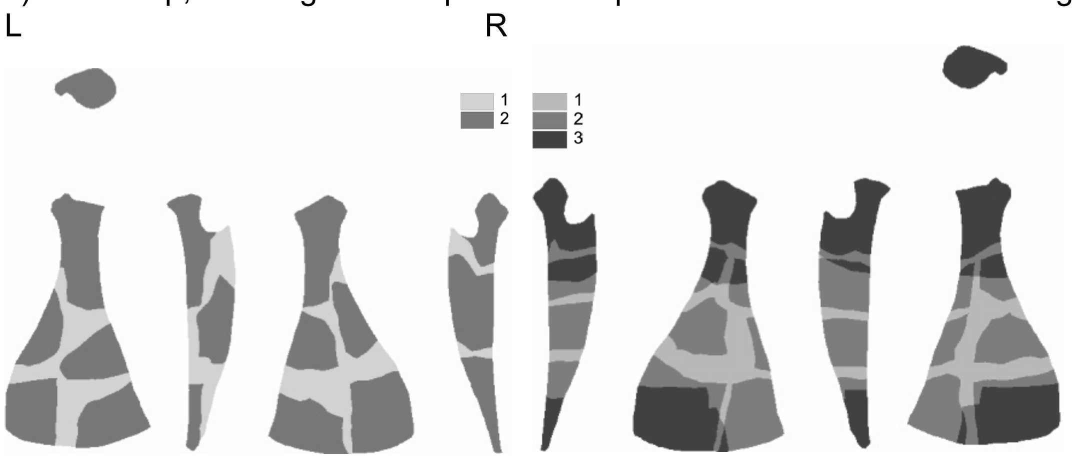
SR02 (parts butchery: VS, SC-HU separation: YU)
L R



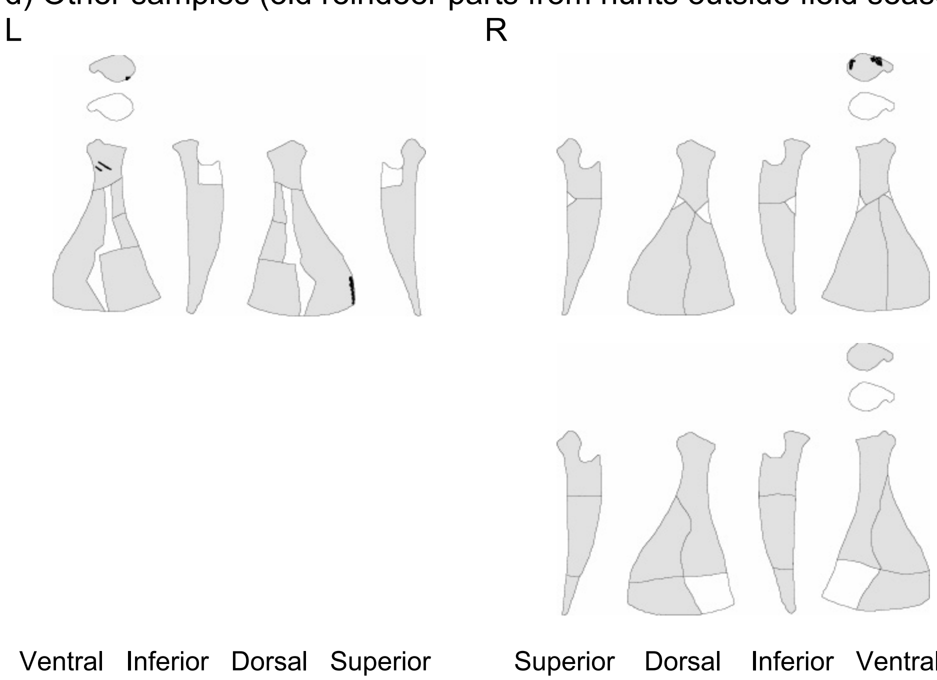
b) Distribution of all marks (symbol).



c) MNE map, showing fracture pattern and preservation at time of recording.



d) Other samples (old reindeer parts from hunts outside field seasons)



e) Zones.

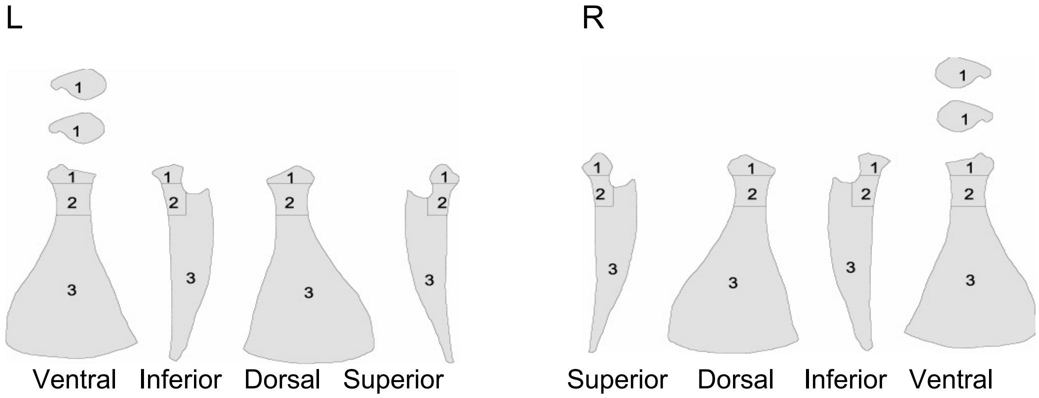


Table 7.52: Summary of reindeer scapula surface modification.

a) Cuts by animal, zone, and cutmark type.

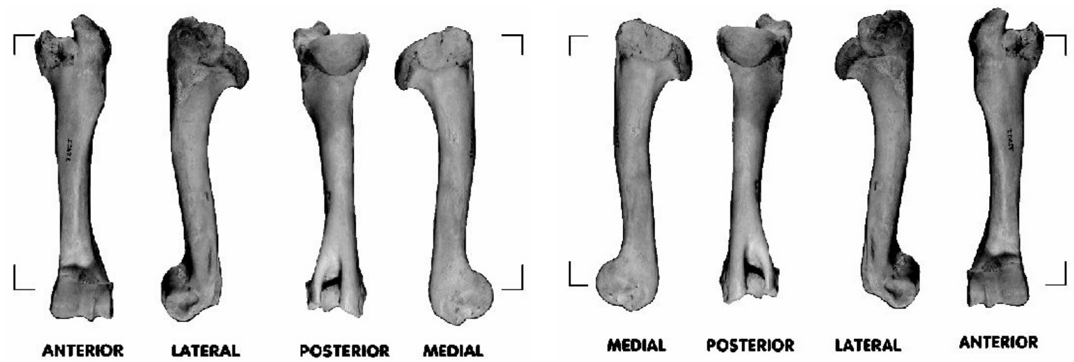
	Zone	cut 1	c/s 3	c/s/c 5	s/c/s 6	shave 7	saw 10	axe 11	nick 12	tooth 15	hammer 20	Total
L SR02	**1**	2										
R FR01	**1**	4	4			1						9
	2		1									1
	Total	*4*	*5*			*1*						*10*
R SR02	**1**	1	3									4
	3	4										4
	Total	*5*	*3*									*8*

b) Summary of surface modification.
In addition to marks that were noted as eating marks, marks in zones 2 and 3 were also classified as eating marks as these areas were not cut during parts butchery or cooking butchery.

	Zone	cut 1	c/s 3	c/s/c 5	s/c/s 6	shave 7	saw 10	axe 11	nick 12	tooth 15	hammer 20	Total	% preserved	Corrected # cutmarks	Corrected # cutmarks for disarticulation
SCL	**1**	2										2	200%	1.0	1
	2												199%	0.0	0.0
	3												169%	0.0	0.0
SCR	**1**	5	7			1						13	300%	4.3	4.3
	2		1									1	294%	0.3	0.0
	3	4										4	209%	1.9	0.0
SC	**1**													2.7	2.7
	2													0.2	0.0
	3													1.0	0.0

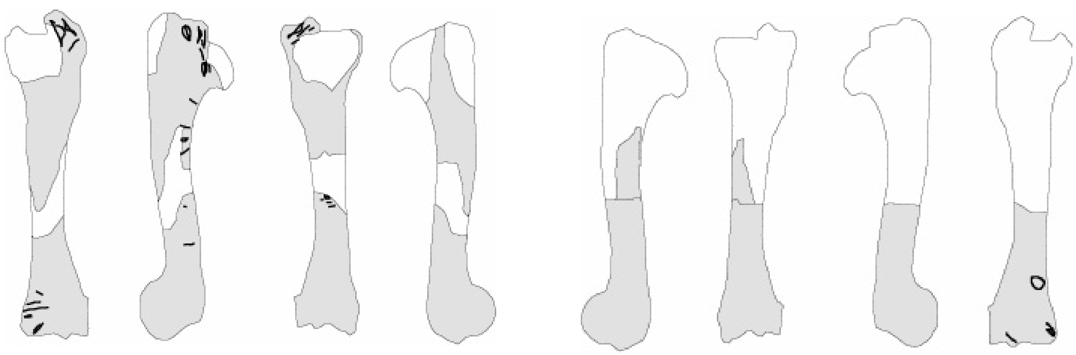
Figure 7.53: Reindeer humerus (L and R).
a) Template and individual specimens.
Templates.

L R



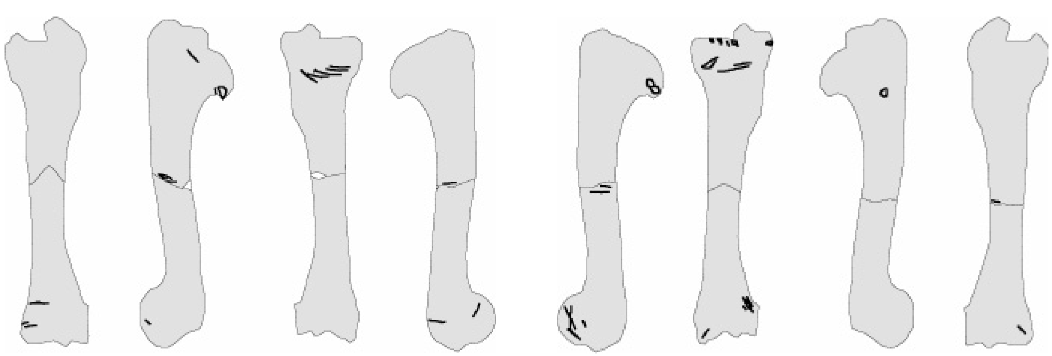
FR01 (SC-HU separation: VS (L or R?))
(proximal spongy bone chopped off by axe and given to dogs)

L R



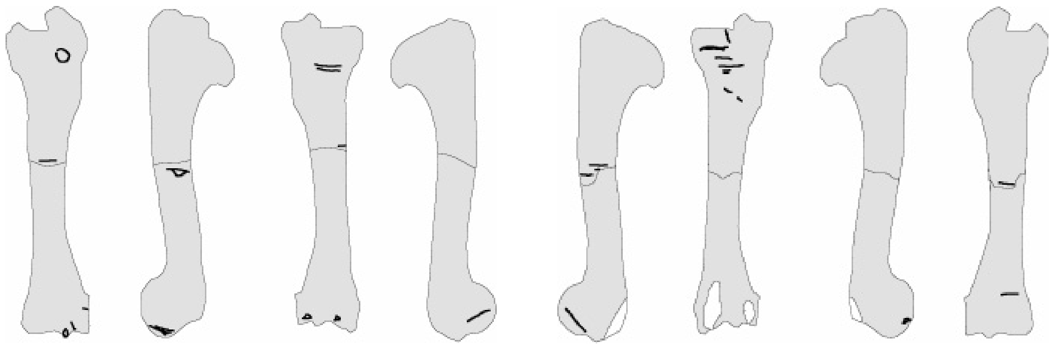
SR01 (HU-RAUL separation: VD)

L R



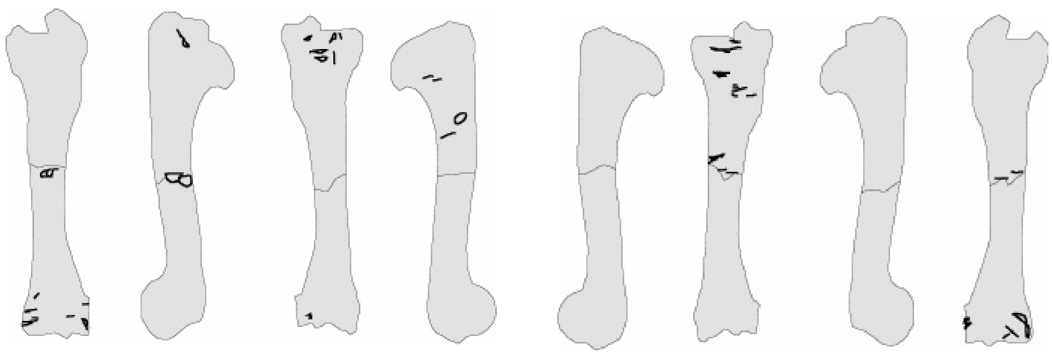
SR02 (HU-RAUL separation: VS/VD (L/R).
SC-HU separation: YU. Cooking butchery: YU

L R



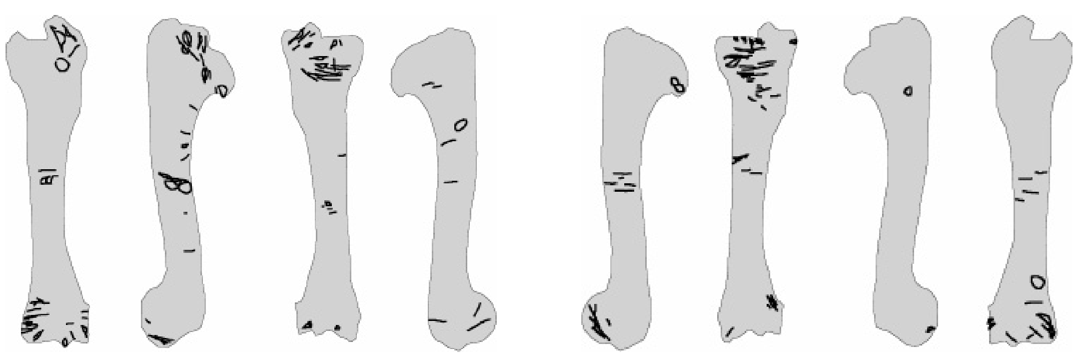
SR03 (HU-RAUL separation: VS/SA (L/R). Cooking butchery: VS)

L R



b) Distribution of all marks (drawing).

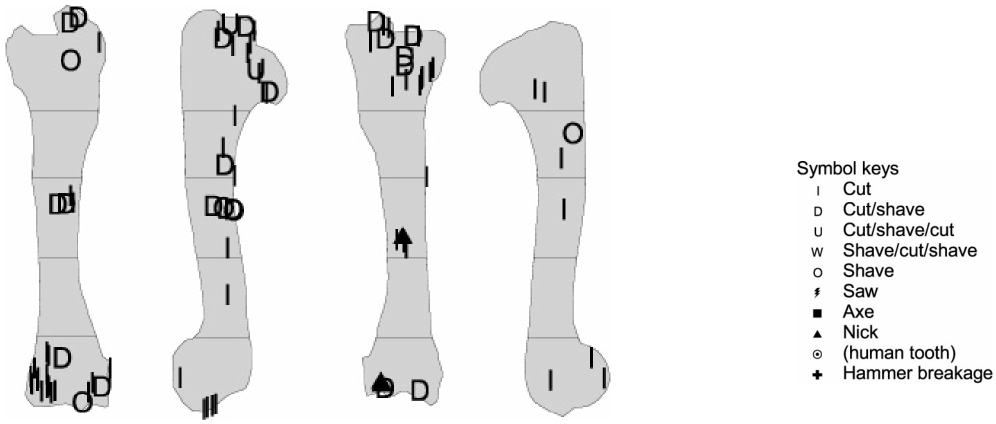
L R



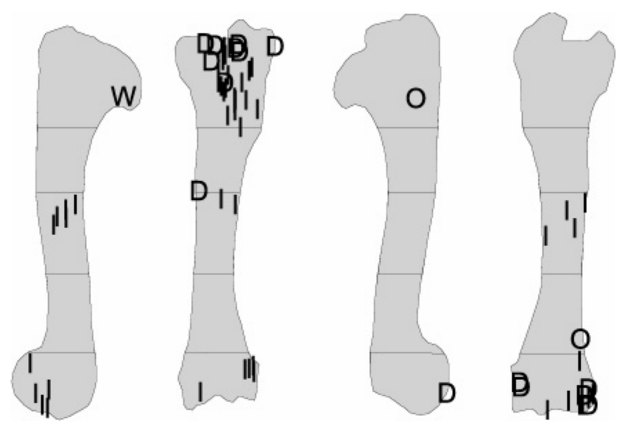
Anterior Lateral Posterior Medial Medial Posterior Lateral Anterior

c) Distribution of all marks (symbol).

L

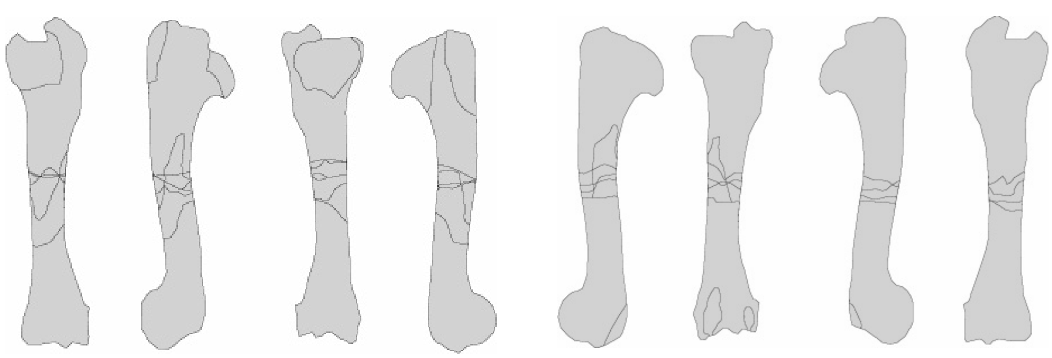


R



d) Fragmentation pattern.

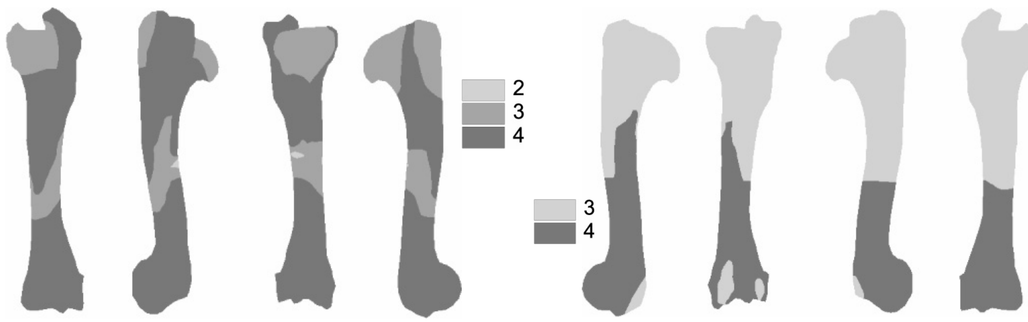
L R



Anterior Lateral Posterior Medial Medial Posterior Lateral Anterior

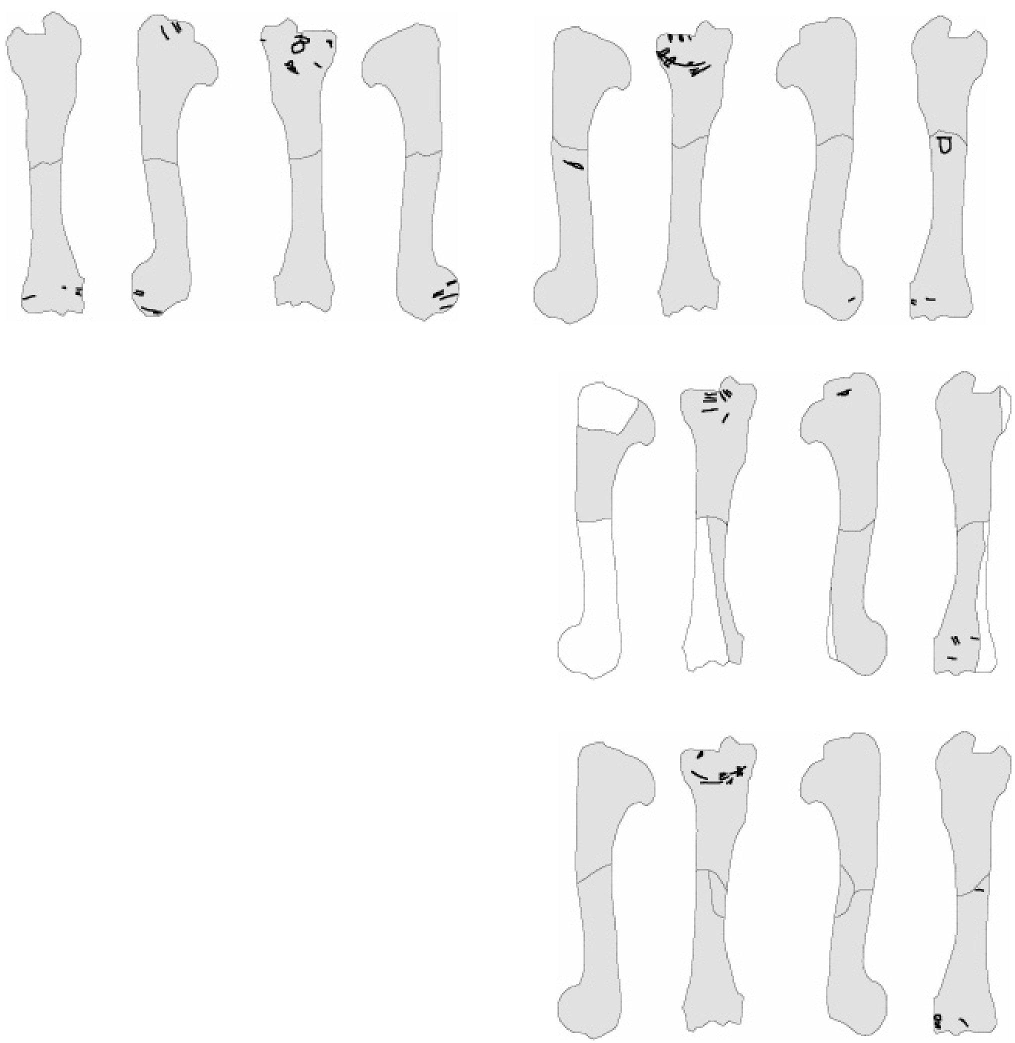
e) MNE map, showing preservation at time of recording.

L R



f) Other samples (old reindeer parts from hunts ouside field seasons)

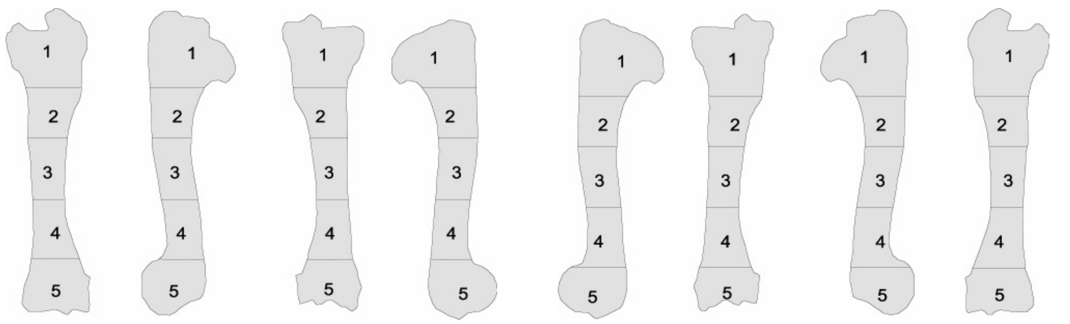
L R



Anterior Lateral Posterior Medial Medial Posterior Lateral Anterior

g) Zones.

L R

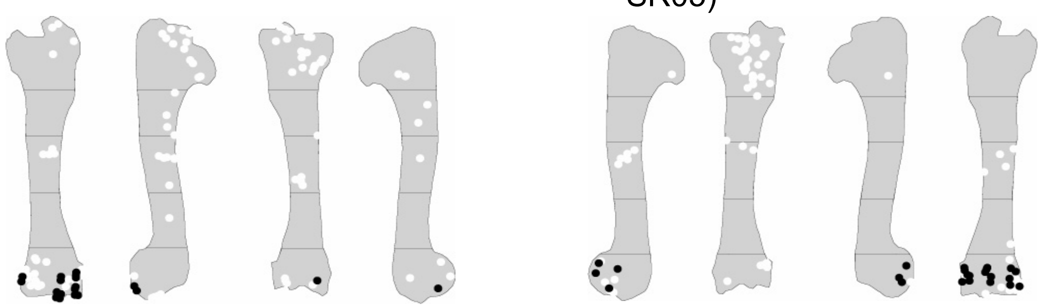


Anterior Lateral Posterior Medial Medial Posterior Lateral Anterior

Table 7.54: Summary of reindeer humerus surface modification.

a) Cuts by animal, zone, and cutmark type.
Marks visible immediately after parts butchery were recorded for SR04 and SR05. These definite marks from HU-RAUL disarticulation (black dots) are overlaid on all marks from above specimens (white dots), and shown in table.

L (with additional marks from SR05) R (with additional marks from SR04 and SR05)

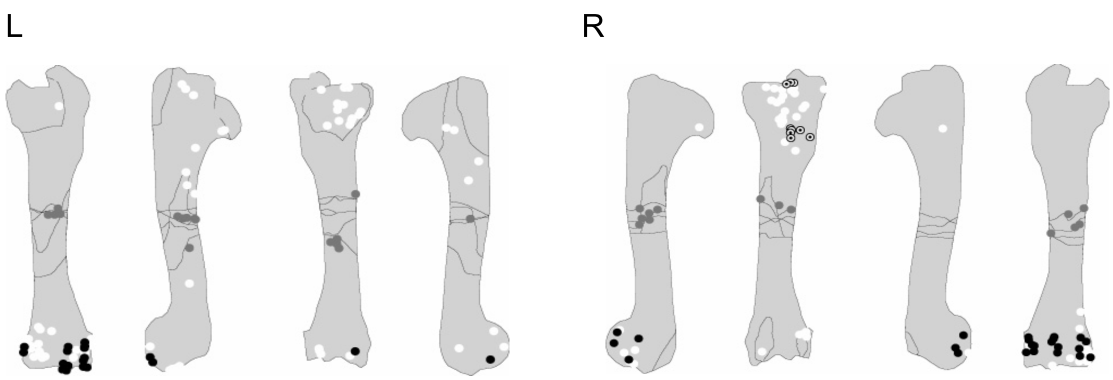


	Zone	cut 1	c/s 3	c/s/c 5	s/c/s 6	shave 7	saw 10	axe 11	nick 12	tooth 15	hammer 20	Total	Notes
L FR01	**1**	8	4	2								14	14/14 axe
	2	3	1									4	
	3	4							1			5	5/5 axe
	4	1										1	
	5	7										7	
	Total	*23*	*5*	*2*					*1*			*31*	
L SR01	**1**	7	1									8	
	3	2	1									3	3/3 axe
	5	5	1									6	
	Total	*14*	*3*									*17*	
L SR02	**1**	2				1						3	
	2	1										1	1/1 axe
	3	1	1									2	2/2 axe
	5	7	2			1						10	
	Total	*11*	*3*			*2*						*16*	
L SR03	**1**	5	5									10	
	2	1				1						2	
	3	1	2			2						5	5/5 axe
	5	8	1						2			11	
	Total	*15*	*8*			*3*			*2*			*28*	

(continued)

	Zone	cut 1	c/s 3	c/s/c 5	s/c/s 6	shave 7	saw 10	axe 11	nick 12	tooth 15	hammer 20	Total	Notes
R FR01	**4**					1						1	
	5	*2*	*1*									*3*	
	Total	*2*	*1*			*1*						*4*	
R SR01	**1**	3	5		1	1						10	
	3	3										3	3/3 axe
	5	10										10	
	Total	*16*	*5*		*1*	*1*						*23*	
R SR02	**1**	9										9	
	3	4										4	4/4 axe
	5	2	1									3	
	Total	*15*	*1*									*16*	
R SR03	**1**	7	3									10	
	2		1									1	1/1 axe
	3	4										4	4/4 axe
	5	2	4									6	
	Total	*13*	*8*									*21*	
Dismemberment only													
(L R05)	**5**	19										19	disartic.
(R R04)	**5**	8	1			1						10	disartic.
(R R05)	**5**	13										13	disartic.

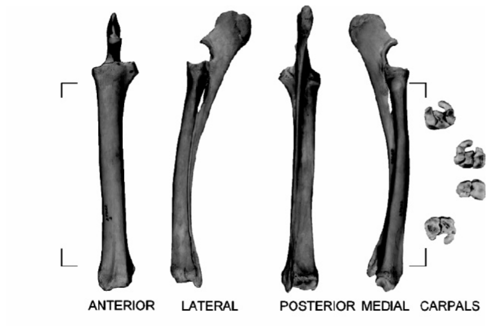
b) Summary of surface modification.
Gray = marks spatially in association with the axed central line (axe mark, other marks close to fracture and/or parallel to break). Axe-marks associated with spongy bone chopping in FR01 were removed, but there is still a high concentration of marks on the proximal articular surface from SC-HU disarticulation. The CNC excluding both kinds of axe marks are also shown in the table. Black dots, white dots = see a). Double dots = eating marks.



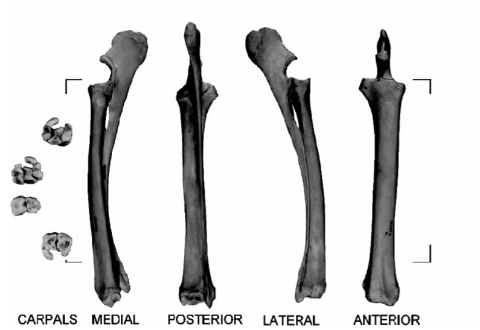
	Zone	cut 1	c/s 3	c/s/c 5	s/c/s 6	shave 7	saw 10	axe 11	nick 12	tooth 15	hammer 20	Total	% preserved	Corrected # cutmarks	Total axe (italics) and eating (bold)	Corrected # cutmarks w/o axe	Corrected # cutmarks for disarticulation (w/o eating)
HUL	**1**	22	10	2		1						35	348%	10.1	*14*	6.0	6.0
	2	5	1			1						7	396%	1.8	*1*	1.5	0.0
	3	8	4			2			1			15	345%	4.3	*15*	0.0	0.0
	4	1										1	389%	0.3		0.3	0.0
	5	27	4			1			2			34	400%	8.5		8.5	8.5
HUR	**1**	19	8		1	1						29	300%	9.7	**6**	9.7	7.7
	2		1									1	310%	0.3	*1*	0.0	0.0
	3	11										11	356%	3.1	*11*	0.0	0.0
	4					1						1	400%	0.3		0.3	0.0
	5	16	6									22	389%	5.7		5.7	5.7
HU	**1**													9.9		7.9	6.9
	2													1.0		0.8	0.0
	3													3.7		0.0	0.0
	4													0.3		0.3	0.0
	5													7.1		7.1	7.1

Figure 7.55: Reindeer radioulna (L and R).
a) Template and individual specimens. Carpals are shown if they were attached to the radioulna at time of recording.
Templates.

L

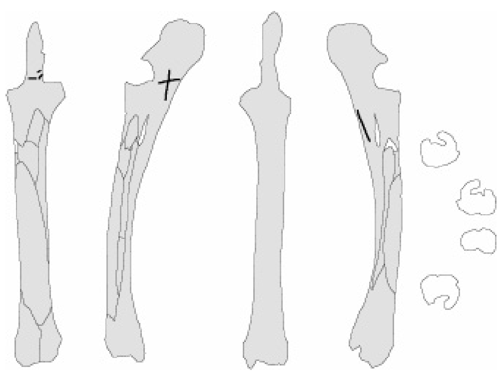


R

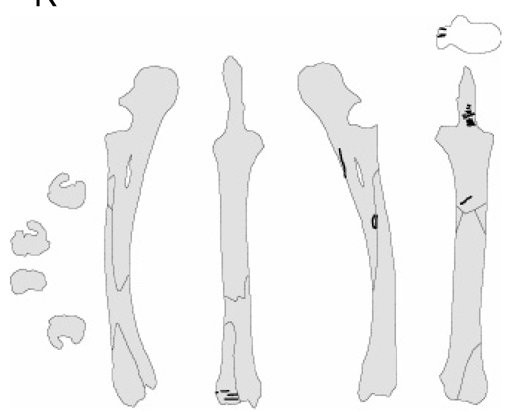


FR01

L

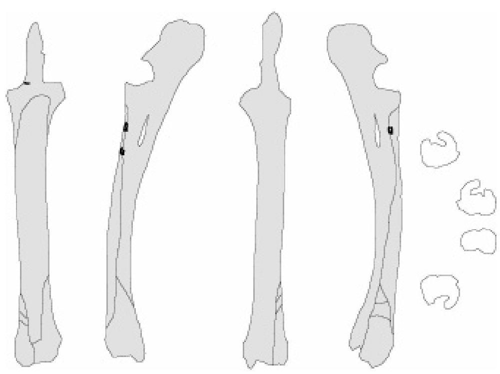


R

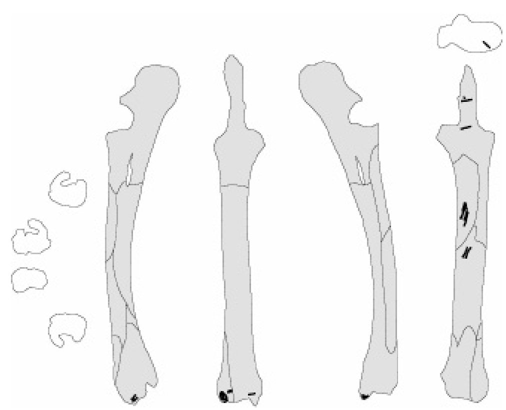


SR01 (HU-RAUL separation VD, RAUL-MC separation VD/SA (side?))

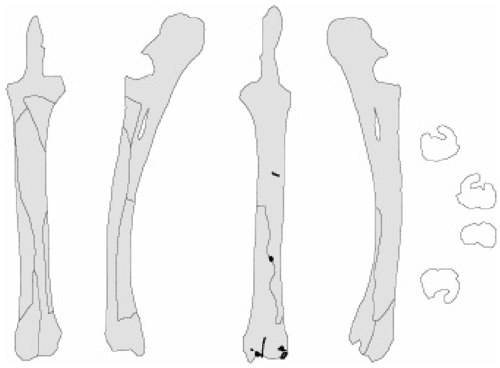
L

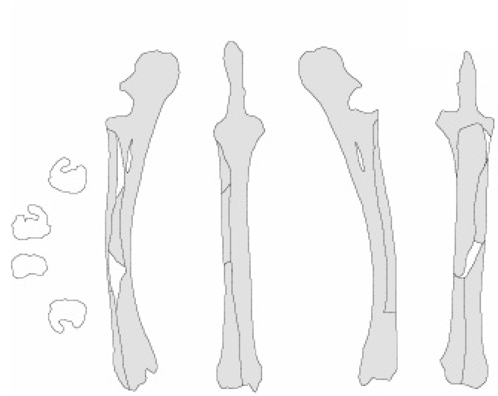


R

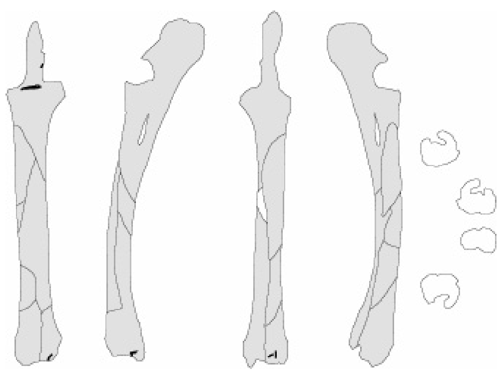


SR02 (HU-RAUL separation: VS(L) VS/VD(R). RAUL-MC separation: VD)
L R

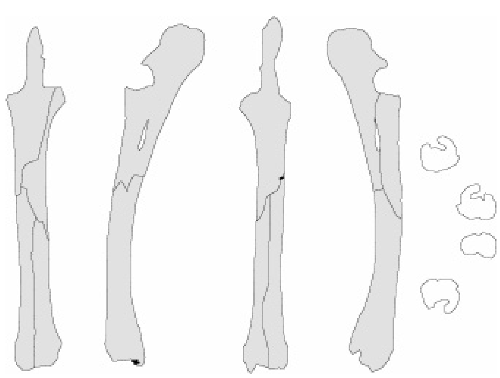


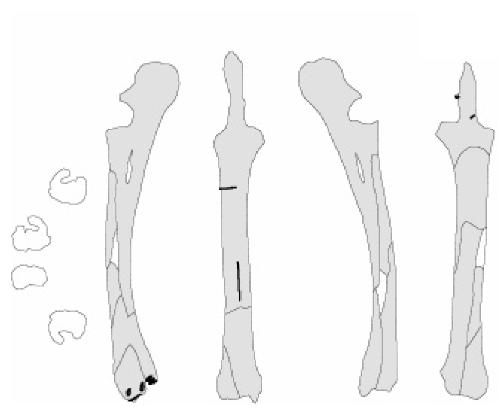


SR03 (HU-RAUL separation: VS. RAUL-MC separation: YA or SA)
L



SR04 (HU-RAUL separation: VD or SA. RAUL-MC separation: YA)
L R

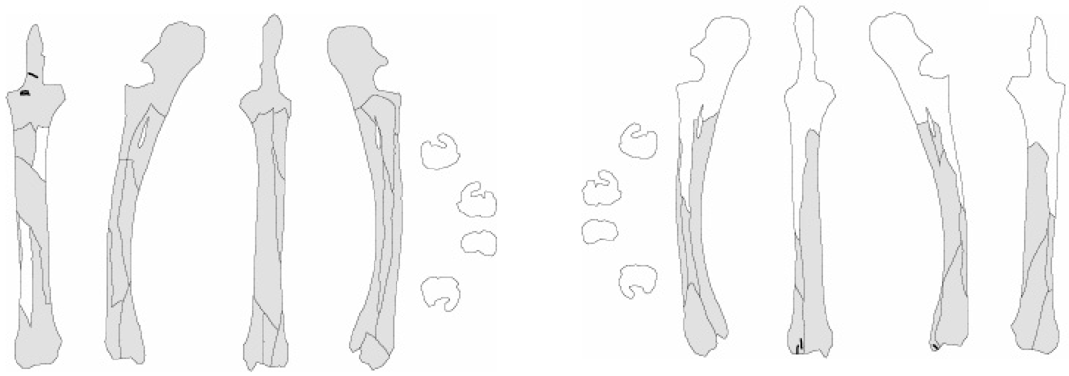




Anterior   Lateral   Posterior   Medial   Medial   Posterior   Lateral   Anterior

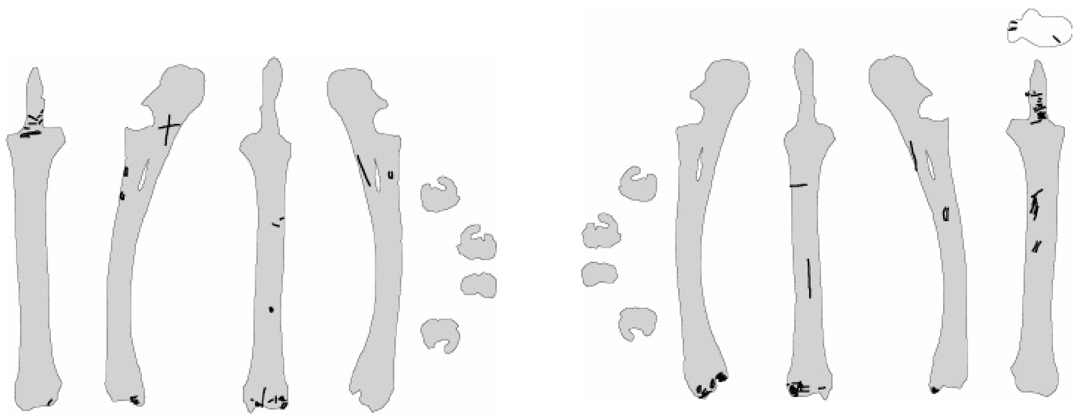
SR05 (HU-RAUL separation: VD or SA. RAUL-MC separation: YA)

L R



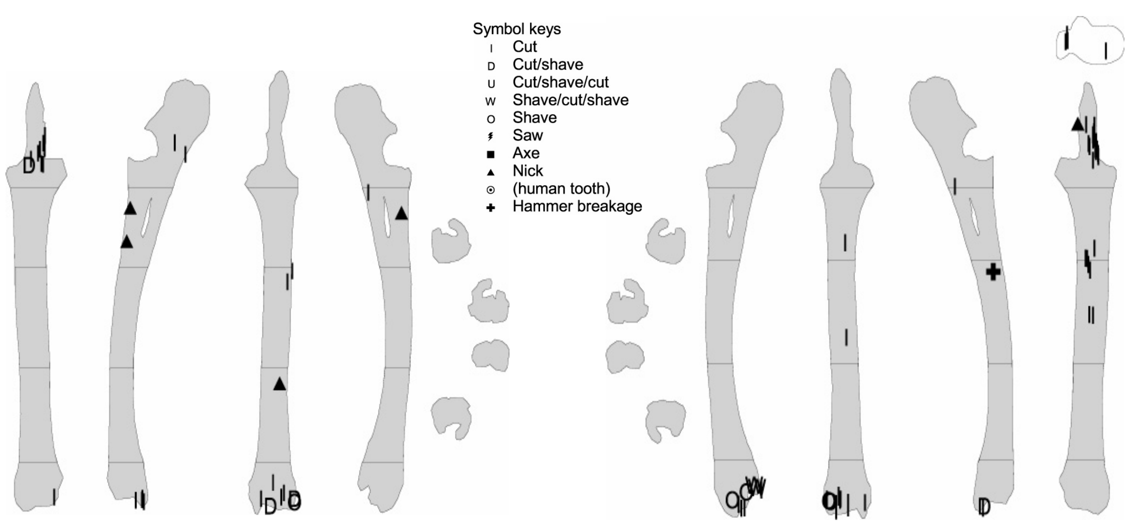
b) Distribution of all marks (drawing).

L R



c) Distribution of all marks (symbol).

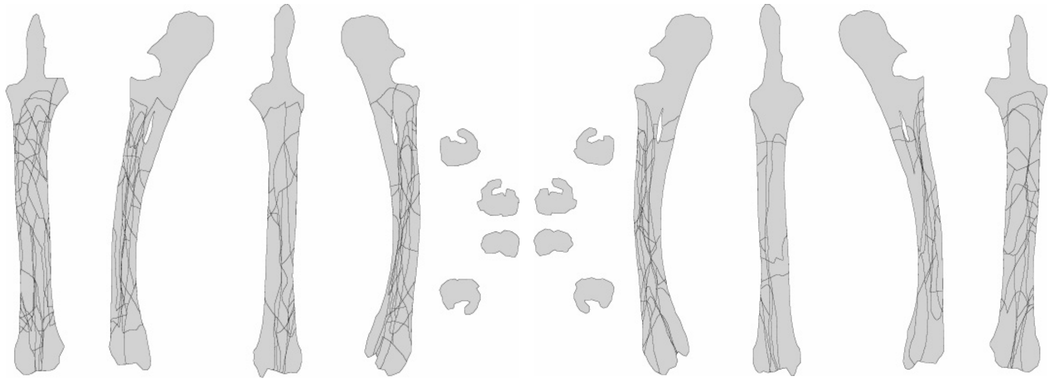
L R



Anterior Lateral Posterior Medial Medial Posterior Lateral Anterior

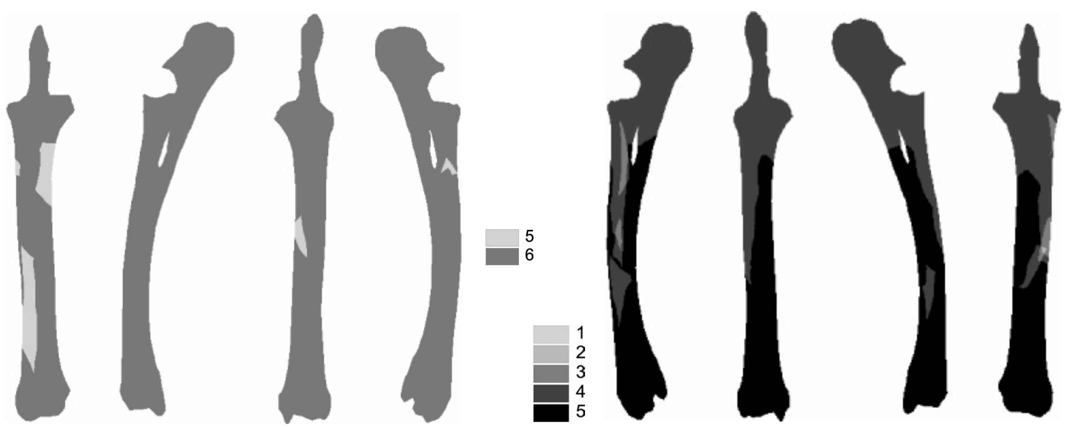
d) Fragmentation pattern.

L R



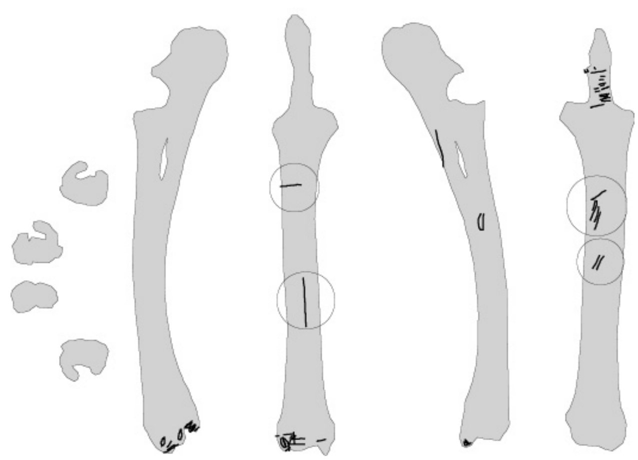
e) MNE map, showing preservation at time of drawing.

L R



f) Definite periosteum cleaning marks (circled).

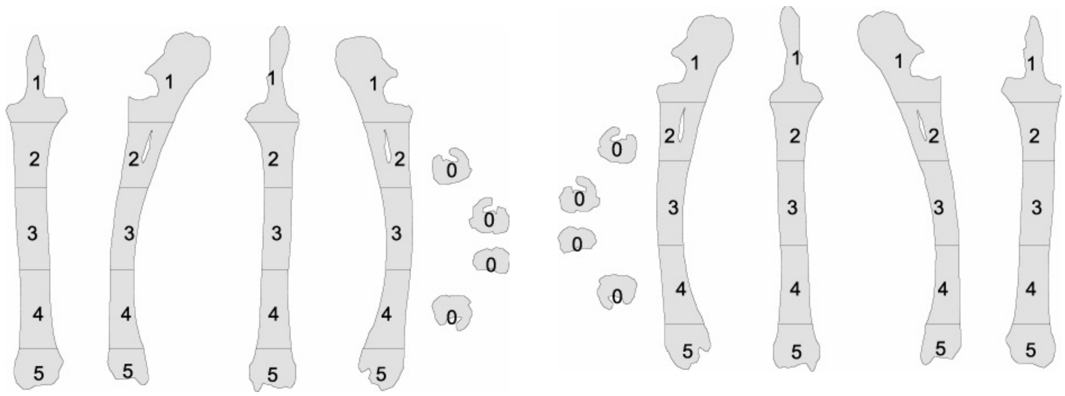
R



Anterior Lateral Posterior Medial Medial Posterior Lateral Anterior

g) Zones.

L R



Anterior Lateral Posterior Medial Medial Posterior Lateral Anterior

Table 7.56: Summary of reindeer radioulna surface modification.

a) Cuts by animal, zone, and cutmark type.

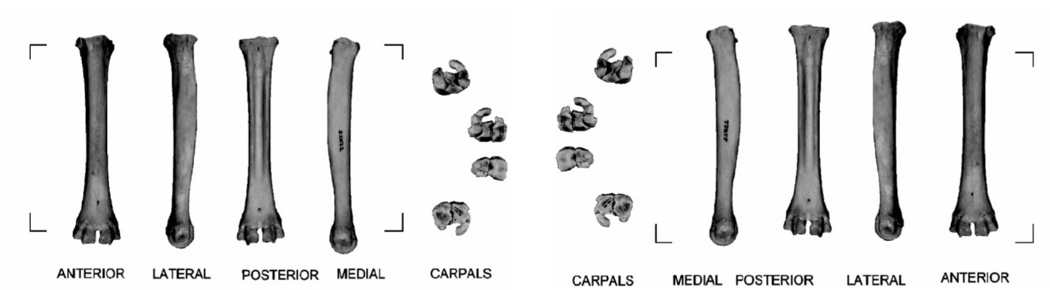
	Zone	cut 1	c/s 3	c/s/c 5	s/c/s 6	shave 7	saw 10	axe 11	nick 12	tooth 15	hammer 20	Total	Notes
L FR01	**1**	5										5	
	2	1										1	
	Total	*6*										*6*	
L SR01	**1**	1										1	
	2								3			3	prying
	Total	*1*							*3*			*4*	
L SR02	**3**	1										1	perio.
	4								1			1	prying
	5	2	2			1						5	
	Total	*3*	*2*			*1*			*1*			*7*	
L SR03	**1**	3										3	
	5	4										4	
	Total	*7*										*7*	
L SR04	**3**	1										1	
	5	3										3	
	Total	*4*										*4*	
L SR05	**1**	1	1									2	
R FR01	***1***	15										15	
	2	1										1	
	3										1	1	
	5	4										4	
	Total	*20*									*1*	*21*	
R SR01	**1**	3										3	
	5	4				2						6	
		7				2						9	
R SR02	**1**	1										1	
	2	2										2	perio.
	3	4										4	perio.
	5	2	1									3	
	Total	*9*	*1*									*10*	
R SR04	***1***	1							1			2	
	2	1										1	perio.
	3	1										1	perio.
	5	2			2	2						6	
	Total	*5*			*2*	*2*			*1*			*10*	
R SR05	**5**	3										3	

b) Summary of radioulna surface modification.

	Zone	cut 1	c/s 3	c/s/c 5	s/c/s 6	shave 7	saw 10	axe 11	nick 12	tooth 15	hammer 20	Total	% preserved	Corrected # cutmarks	Total periosteum, hammer, prying	Corrected # cutmarks for disarticulation
RAULL	**1**	10	1									11	600%	1.8		1.8
	2	1							3			4	592%	0.7	3	0.0
	3	2										2	593%	0.3	1	0.0
	4								1			1	591%	0.2	1	0.0
	5	9	2			1						12	600%	2.0		2.0
RAULR	**1**	20							1			21	400%	5.3		5.3
	2	4										4	419%	1.0	3	0.0
	3	5									1	6	464%	1.3	6	0.0
	4												493%	0.0		0.0
	5	15	1		2	4						22	500%	4.4		4.4
RAUL	**1**													3.5		3.5
	2													0.8		0.0
	3													0.8		0.0
	4													0.1		0.0
	5													3.2		3.2

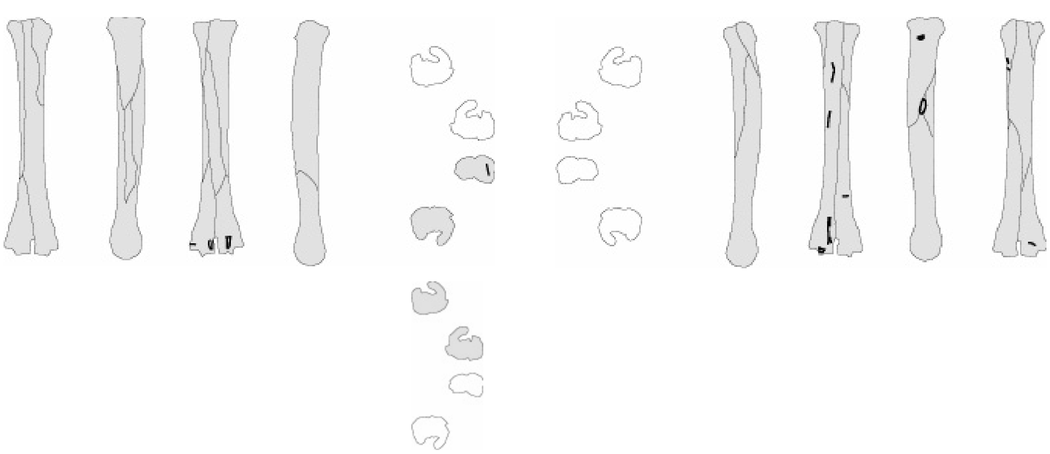
Figure 7.57: Reindeer metacarpal (L and R).
a) Template and individual specimens. Carpals are shown on template if they were attached to the metacarpal at the time of recording. If the separated carpals were identifiable to animal, they are shown below the template.
Templates.

L R



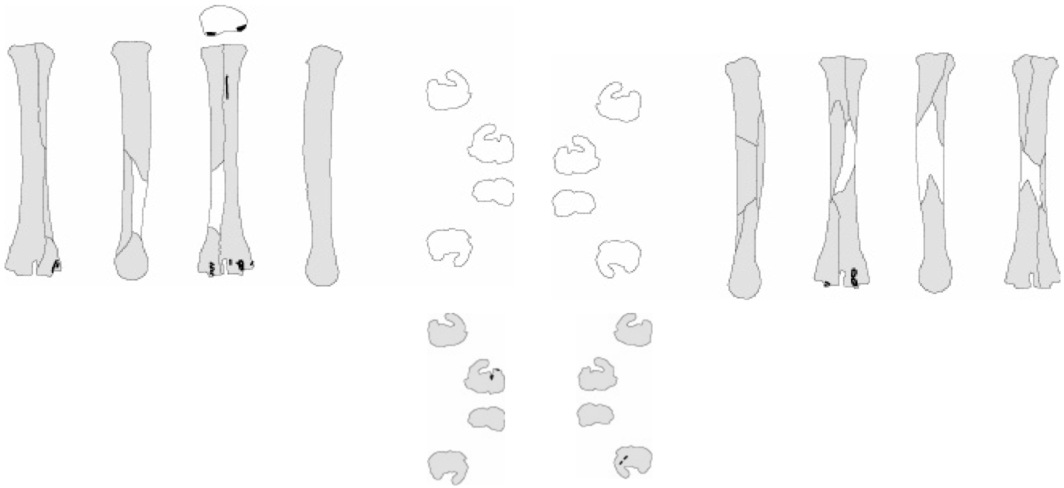
FR01 (RAUL-MC separation: VD. MC-PH separation: VS, VD (sides?))

L R



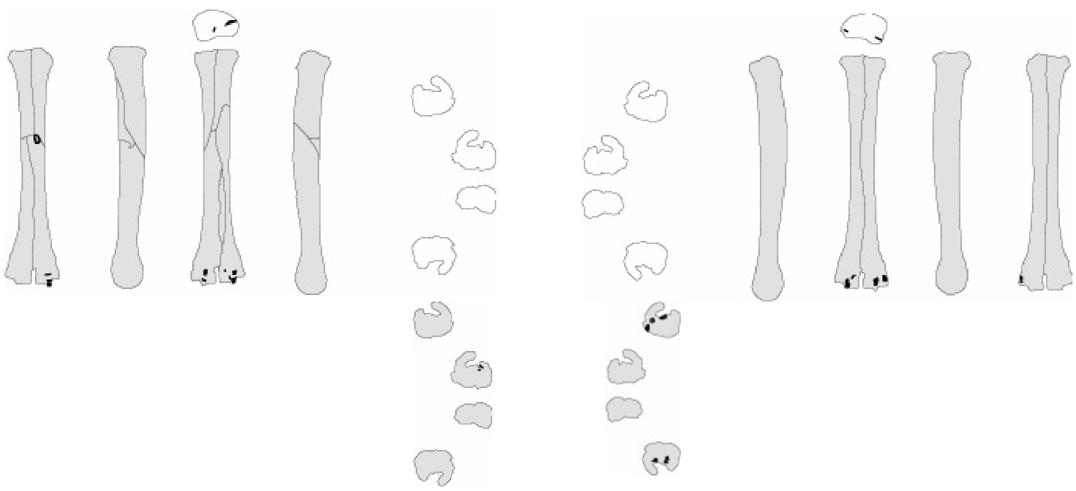
SR01(RAUL-MC separation, MC-PH separation, carpals off: VD, SA (sides?))

L R



SR02(RAUL-MC separation: VD. MC-phalanges separation: VD)

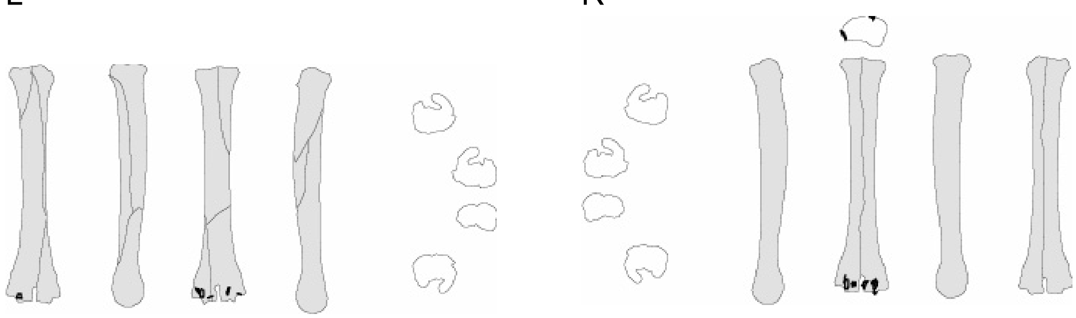
L R



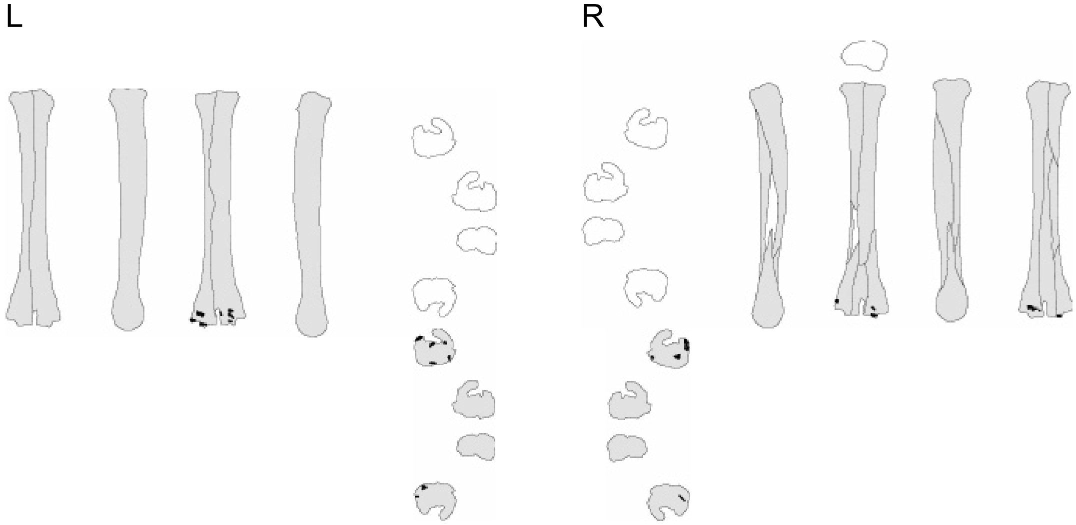
Anterior Lateral Posterior Medial   Medial   Posterior   Lateral Anterior

SR03 (RAUL-MC separation, MC-phalanges separation: YA, SA (1 side each))
L R

SR04 (RAUL-MC separation, MC-phalanges separation: YA)
L R



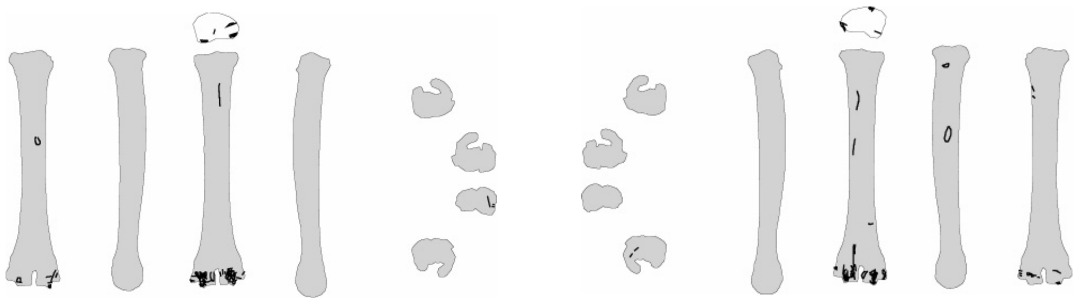
SR05 (RAUL-MC separation, MC-phalanges separation: YA)
L R



Anterior Lateral Posterior Medial Medial Posterior Lateral Anterior

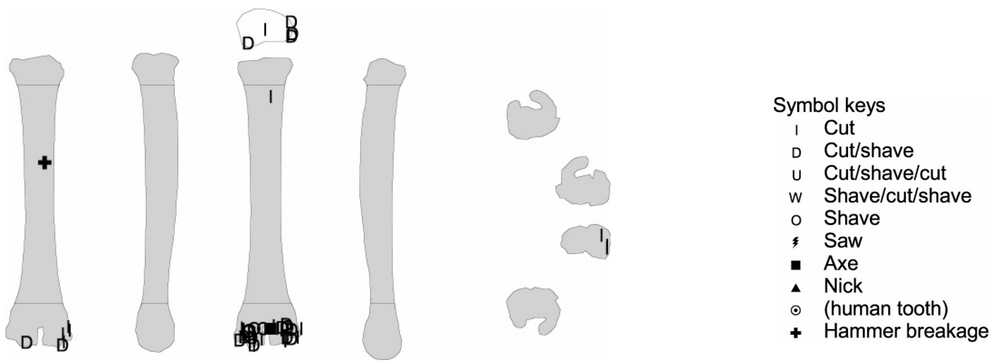
b) Distribution of marks (drawing)

L R

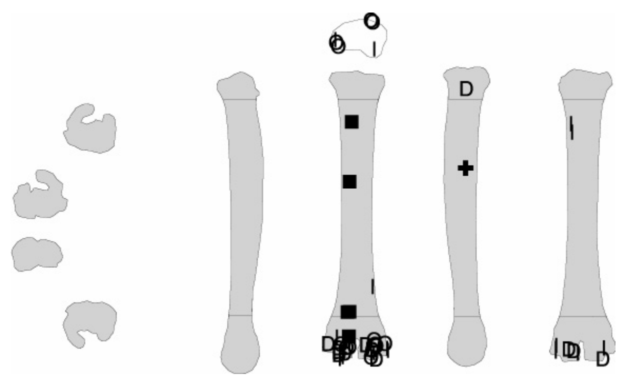


c) Distribution of marks (symbol)

L



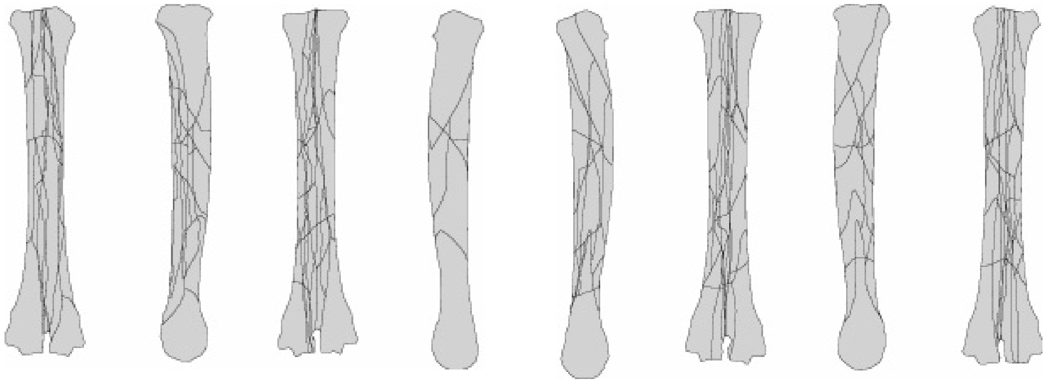
R



Anterior Lateral Posterior Medial Medial Posterior Lateral Anterior

d) Fragmentation pattern.

L R

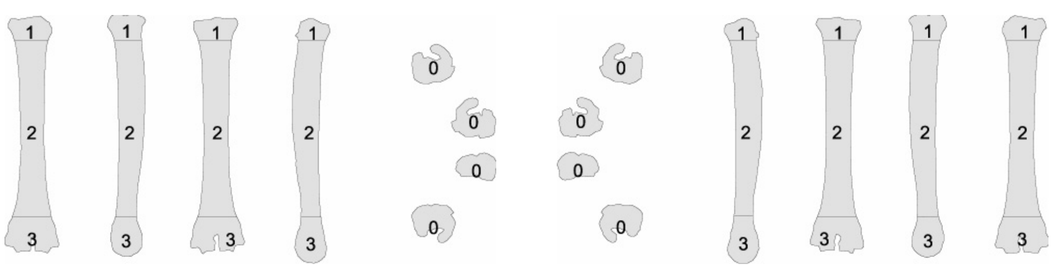


e) MNE map, showing preservation at time of recording.

L R

Zones

L R



Anterior Lateral Posterior Medial Medial Posterior Lateral Anterior

Table 7.58: Summary of reindeer metacarpal surface modification.

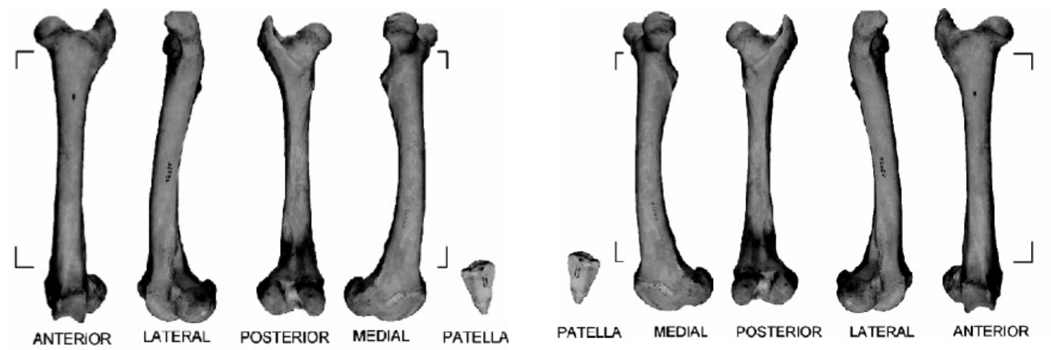
a) Cuts by animal, zone, and cutmark type.

	Zone	cut 1	c/s 3	c/s/c 5	s/c/s 6	shave 7	saw 10	axe 11	nick 12	tooth 15	hammer 20	Total
L FR01	**0**	1										1
	3	1	1			1						3
	Total	*2*	*1*			*1*						*4*
L SR01	**1**		3									3
	2	1										1
	3	9				1						10
	Total	*10*	*3*			*1*						*14*
L SR02	**1**	1	1									2
	2										1	1
	3	5	3			1						9
	Total	*6*	*4*			*1*					*1*	*12*
L SR03	**0**	2										2
	3	1				1						2
	Total	*3*				*1*						*4*
L SR04	**3**	2	3			1						6
L SR05	**3**	3	5					1				9
R FR01	**1**		1									1
	2	3						4			1	8
	3	1	1					1				3
	Total	*4*	*2*					*5*			*1*	*12*
R SR01	**3**	2				2						4
R SR02	**1**	2										2
	3	4	4			1						9
	Total	*6*	*4*			*1*						*11*
R SR03 3		4										4
R SR04 1						4						4
3		1	2			5						8
	Total	*1*	*2*			*9*						*12*
R SR05	**3**	2	4			1						7

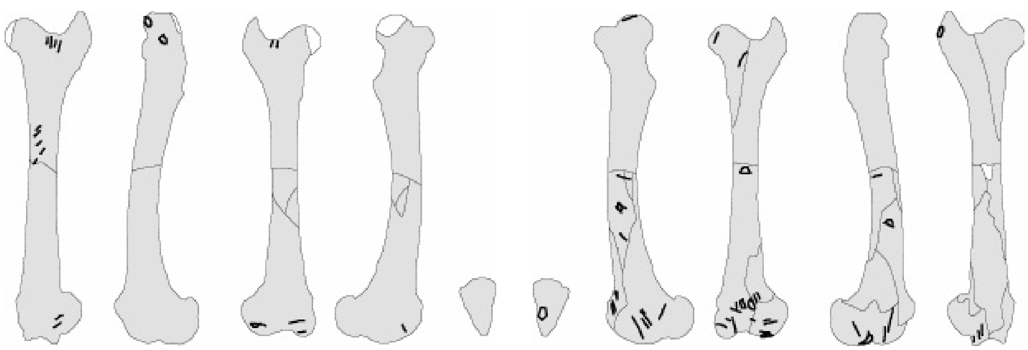
b) Summary of surface modification.

	Zone	cut 1	c/s 3	c/s/c 5	s/c/s 6	shave 7	saw 10	axe 11	nick 12	tooth 15	hammer 20	Total	% preserved	Corrected # cutmarks
MCL	**1**	1	4									5	600%	0.8
	2	1									1	2	591%	0.3
	3	21	12			5		1				39	600%	6.5
MCR	**1**	2	1			4						7	600%	1.2
	2	3						4			1	8	577%	1.4
	3	14	11			9		1				35	600%	5.8
MC	**1**													1.0
	2													0.9
	3													6.2

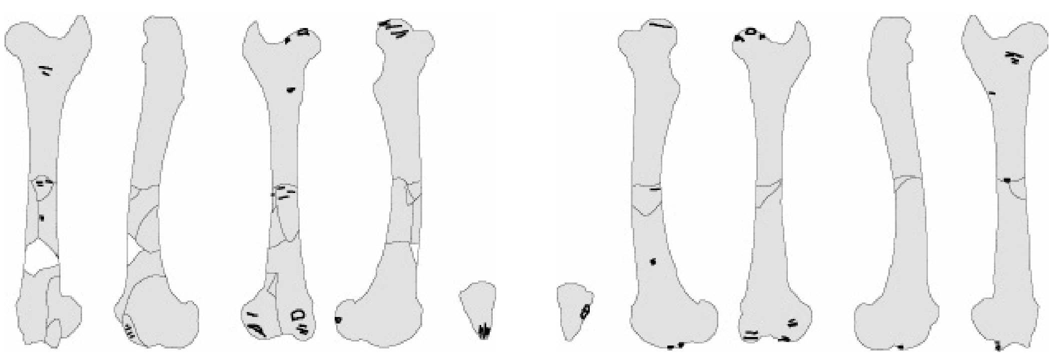
Figure 7.59: Reindeer femur (L and R).
a) Template and individual specimens. The patella is shown if it was attached to the femur at time of recording.
Templates.
L R



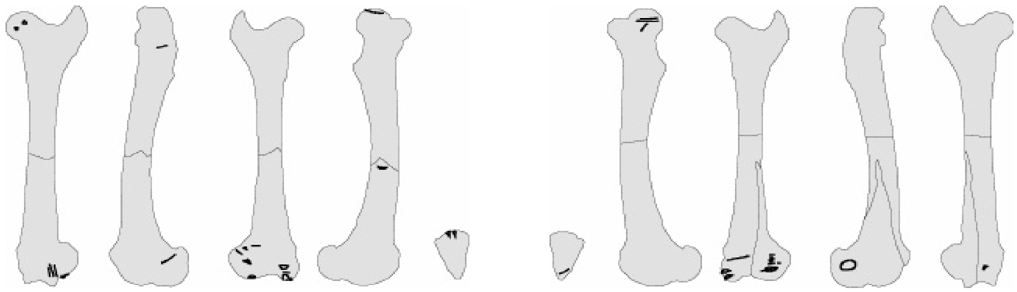
FR01
L R



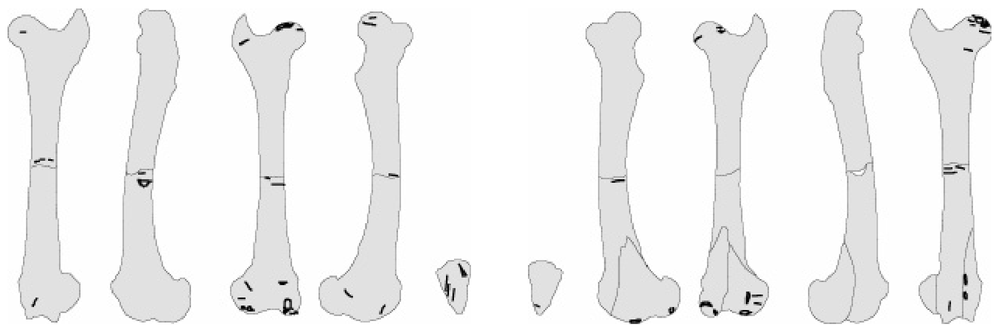
SR01 (parts butchery: VD, FE-TI separation: VS, cooking butchery YU/VS (L/R))
L R



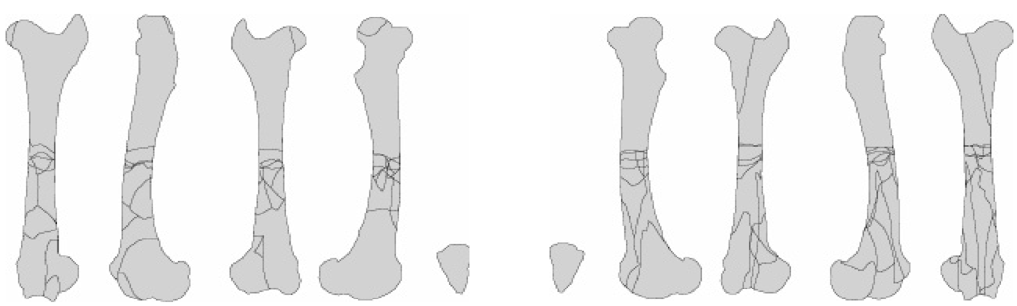
SR02 (parts butchery: VS, FE-TI separation: VS, cooking butchery VS/YA (L/R))
L R



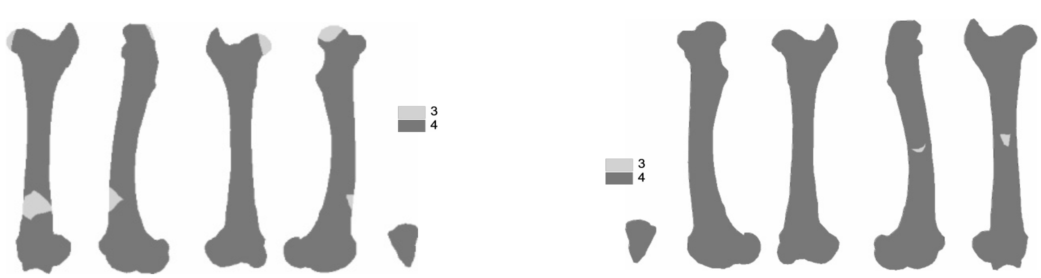
SR03 (parts butchery: SA, FE-TI separation: VS/SA (L/R), cooking butchery VS (R))
L R



b) Fracture pattern.
L R



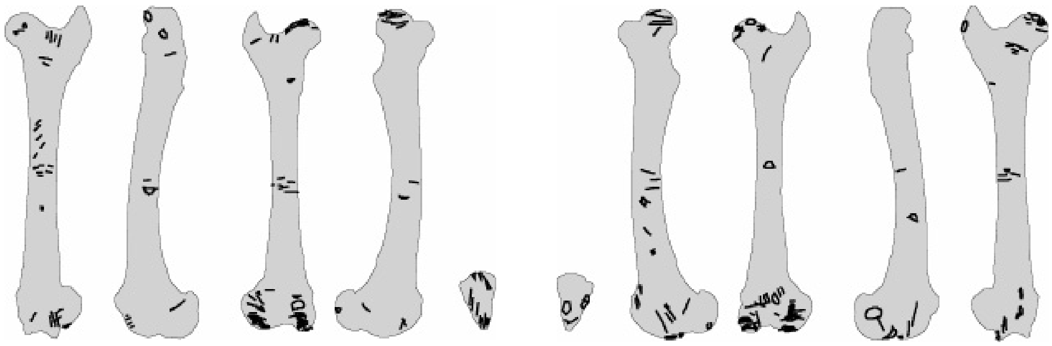
c) MNE map, showing preservation at time of recording.
L R



Anterior Lateral Posterior Medial   Medial Posterior Lateral Anterior

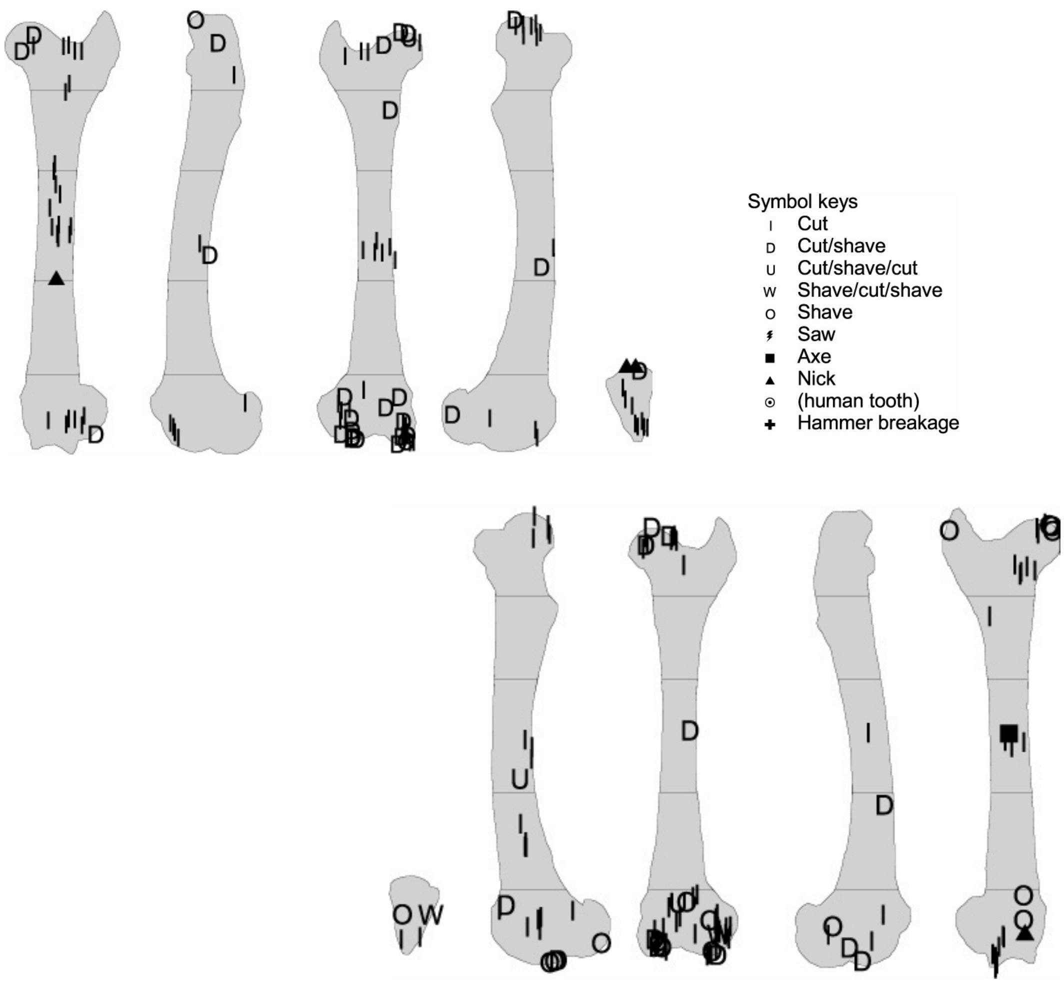
d) Distribution of all marks (drawing)

L R



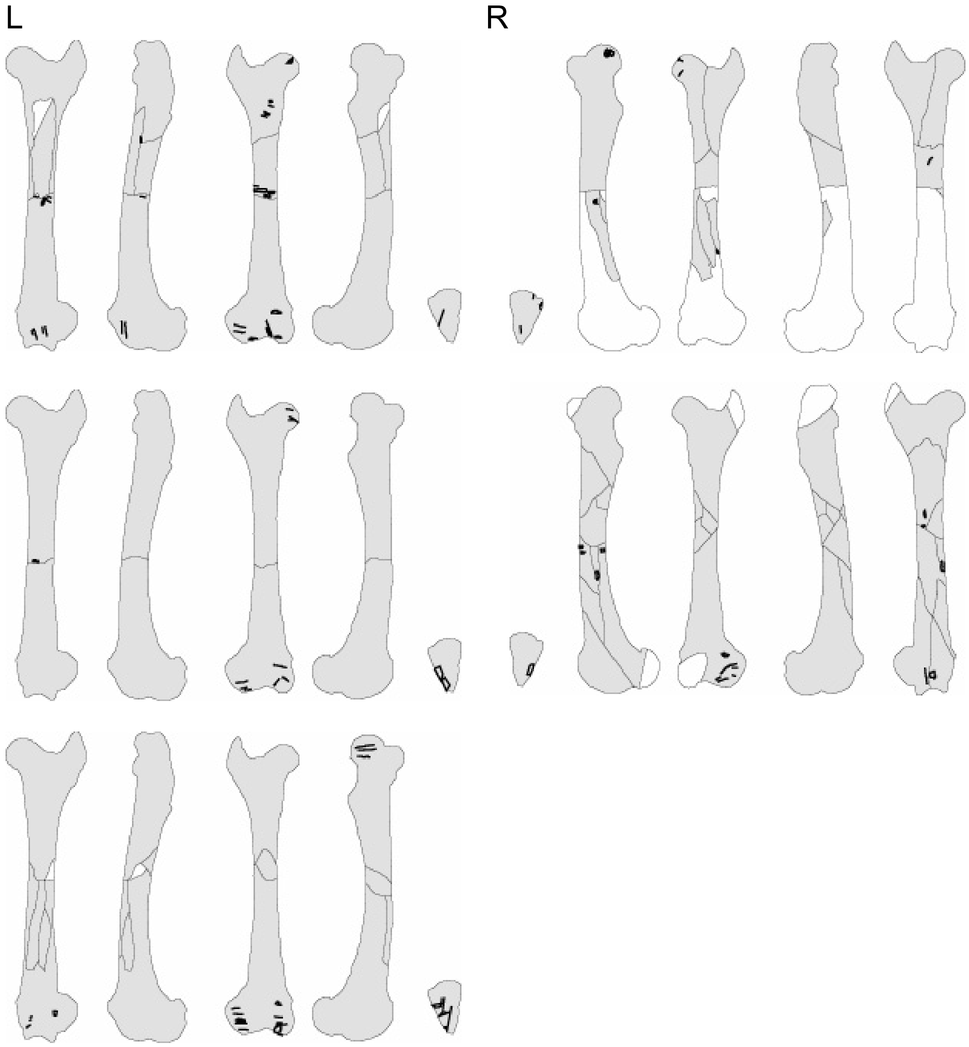
e) Distribution of all marks (symbol)

L R



Anterior Lateral Posterior Medial Medial Posterior Lateral Anterior

f) Other samples (old reindeer parts from hunts outside field seasons)



g) Zones.

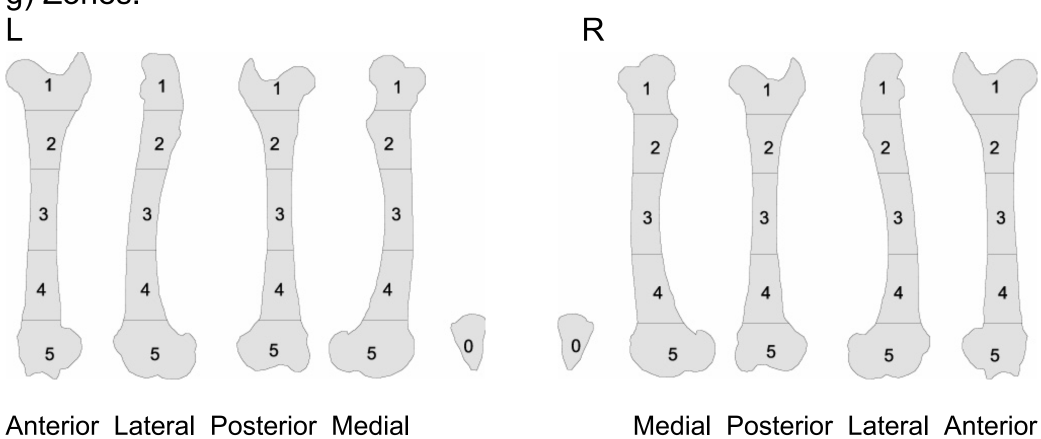
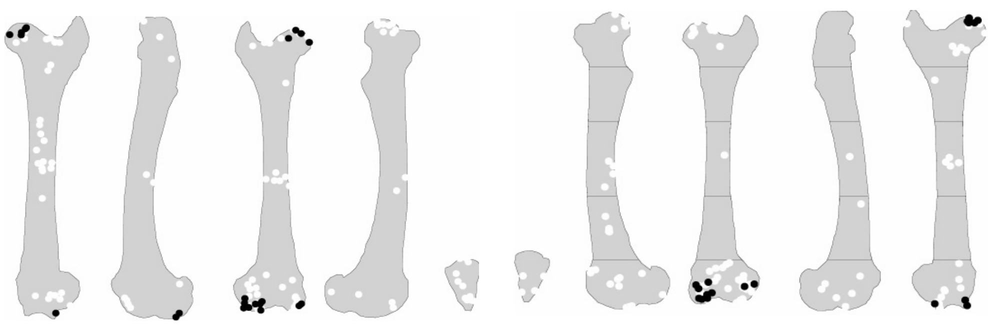


Table 7.60: Summary of reindeer femur surface modification.

a) Cuts by animal, zone, and cutmark type.
Marks visible immediately after parts butchery were recorded for SR04 and SR05. These definite marks from disarticulation (black dots) are overlaid on all marks from above specimens (white dots), and shown in table.

L R



	Zone	cut 1	c/s 3	c/s/c 5	s/c/s 6	shave 7	saw 10	axe 11	nick 12	tooth 15	hammer 20	Total	Notes
L FR01	1	6	1			1						8	
	2	1										1	
	3	4										4	axe
	5	5	1									6	
	Total	*16*	*2*			*1*						*19*	
L SR01	0	5										5	
	1	5	2	1								8	
	2	1	1									2	
	3	7							1			8	axe
	5	8	3									11	
	Total	*26*	*6*	*1*					*1*			*34*	
L SR02	0								2			2	
	1	2	2									4	
	3		1									1	axe
	5	7	6			1						14	
	Total	*9*	*9*			*1*			*2*			*21*	
L SR03	0	3	1									4	
	1	5	2									7	
	3	7	1									8	axe
	5	7	5									12	
	Total	*22*	*9*									*31*	
R FR01	0					1						1	
	1	3				1						4	
	3	2	1	1								4	axe
	4	1	1									2	
	5	24	3	1		1						29	axe (1 shave)
	Total	*30*	*5*	*2*		*3*						*40*	
R SR01	0				1							1	
	1	7	3									10	
	2	1										1	
	3	1						1				2	axe
	4	3										3	
	5	13	2			1						16	
	Total	*25*	*5*		*1*	*1*		*1*				*33*	
R SR02	0	1										1	
	1	3										3	axe (1 cut)
	5	8	2		1	1			1			13	eat (1 nick)
	Total	*12*	*2*		*1*	*1*			*1*			*17*	
R SR03	0	1										1	
	1	9				3						12	eat (1 cut)
	3	4										4	axe
	5	3	1			7						11	
	Total	*17*	*1*			*10*						*28*	

(continued)

	Zone	cut 1	c/s 3	c/s/c 5	s/c/s 6	shave 7	saw 10	axe 11	nick 12	tooth 15	hammer 20	Total	Notes
Dismemberment only													
(L R04)	**1**	5				1						6	disartic.
	5	3	2			1						6	disartic.
	Total	*8*	*2*			*2*						*12*	
(L R05)	**1**	3										3	disartic.
	5	7	1									8	disartic.
	Total	*10*	*1*									*11*	
(R R04)	**1**					2						2	disartic.
	5	2	3		1	3						9	disartic.
	Total	*2*	*3*		*1*	*5*						*11*	
(R R05)	**1**	3										3	disartic.
	5	2	2									4	disartic.
	Total	*5*	*2*									*7*	

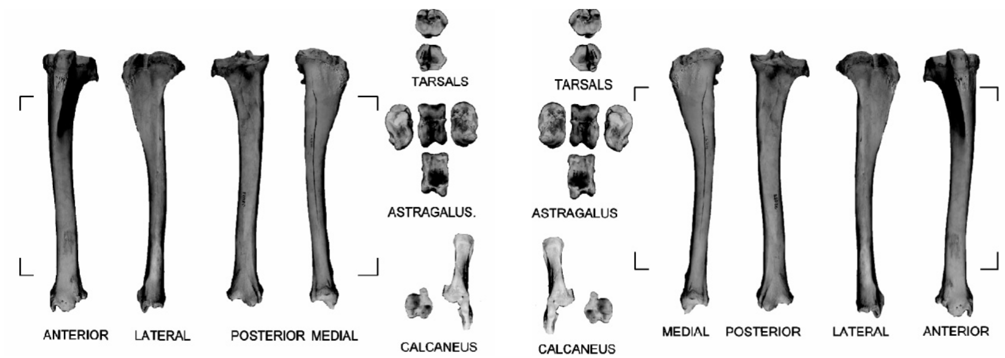
b) Summary of surface modification.
Gray = marks spatially in association with the axed central line (axe mark, other marks close to fracture and/or parallel to break). Axe-marks associated with spongy bone chopping in FR01 were removed, but there is still a high concentration of marks on the proximal articular surface from SC-HU disarticulation. The CNC excluding both kinds of axe marks are also shown in the table. Black dots, white dots = see a). Double dots = eating marks.

L R

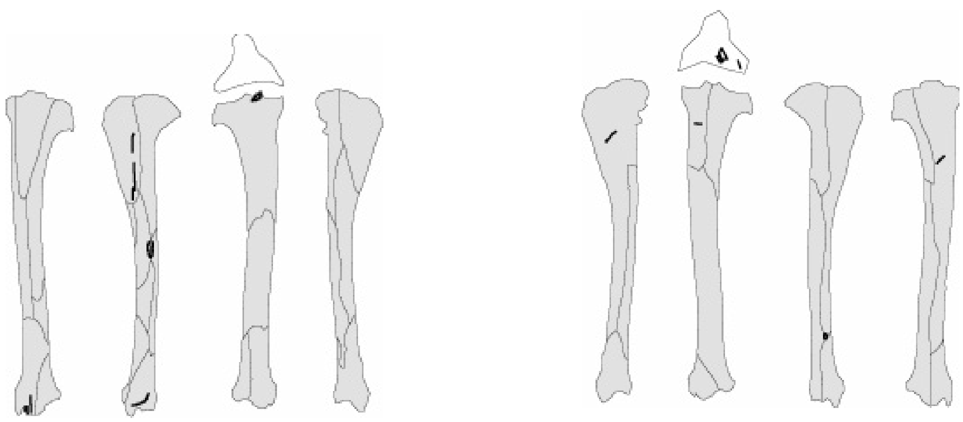
Anterior Lateral Posterior Medial Medial Posterior Lateral Anterior

	Zone	cut 1	c/s 3	c/s/c 5	s/c/s 6	shave 7	saw 10	axe 11	nick 12	tooth 15	hammer 20	Total	% preserved	Corrected # cutmarks	Total axe (italics) and eating	Corrected # cutmarks w/o axe	Corrected # cutmarks for disarticulation
FEL	**1**	18	7	1		1						27	391%	6.9		6.9	6.9
	2	2	1									3	400%	0.8		0.8	0.0
	3	18	2						1			21	400%	5.3	*17*	1.0	0.0
	4												387%	0.0		0.0	0.0
	5	27	15			1						43	400%	10.8		10.8	10.8
	patella	8	1						2			11					
FER	**1**	22	3			4						29	400%	7.3	*1* , 1	7.0	7.0
	2	1										1	400%	0.3		0.3	0.0
	3	7	1	1				1				10	398%	2.5	*10*	0.0	0.0
	4	4	1									5	400%	1.3		1.3	0.0
	5	48	8	1	1	10			1			69	400%	17.3	*1* , 1	17.0	17.0
	patella	2			1	1						4					
FE	**1**													7.1		7.0	7.0
	2													0.5		0.5	0.0
	3													3.9		0.5	0.0
	4													0.6		0.6	0.0
	5													14.0		13.9	13.9

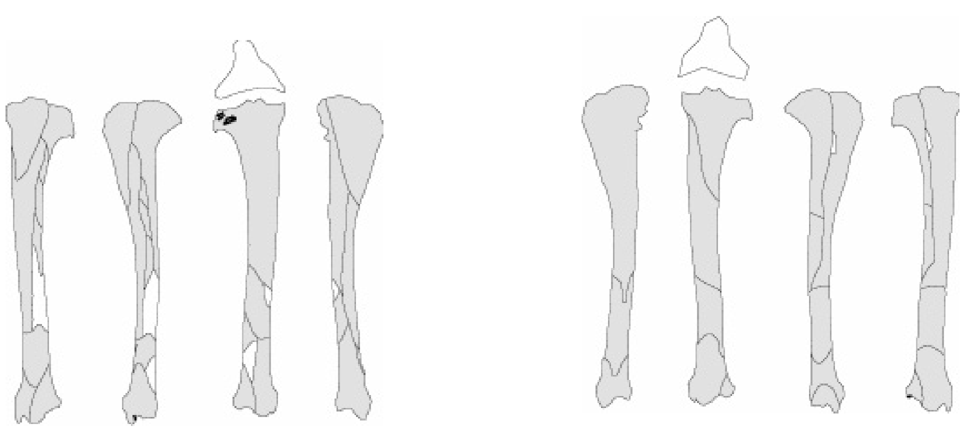
Figure 7.61: Reindeer tibia (L and R).
a) Template and individual specimens. Unlike the *kabarga*, tarsals were not attached to the tibia at time of recording.
Templates.
L R



FR01
L R

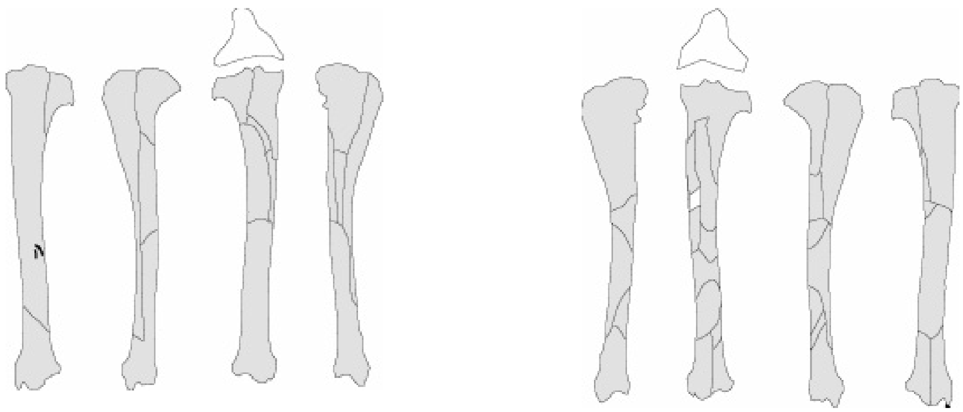


SR01 (FE-TI separation: VS, TI-tarsal separation SA/VD (sides?))
L R



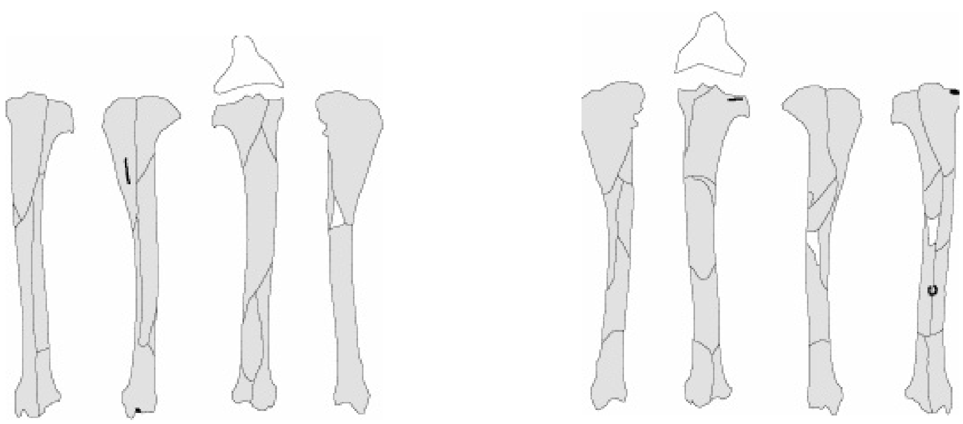
SR02 (FE-TI separation: VS, TI-tarsal separation YA)

L R



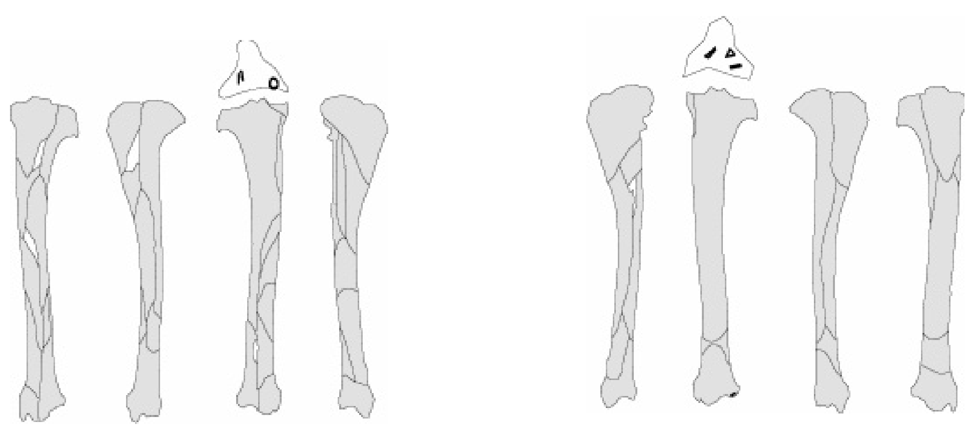
SR03 (FE-TI separation: VS/SA (L/R), TI-tarsal separation YA/SA (sides?))

L R



SR04 (FE-TI separation: VD or SA, TI-tarsal separation YA)

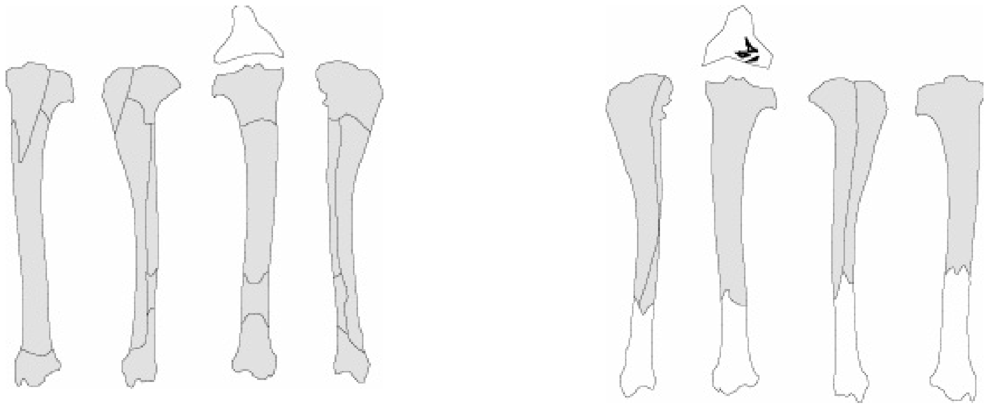
L R



Anterior Lateral Posterior Medial   Medial Posterior Lateral Anterior

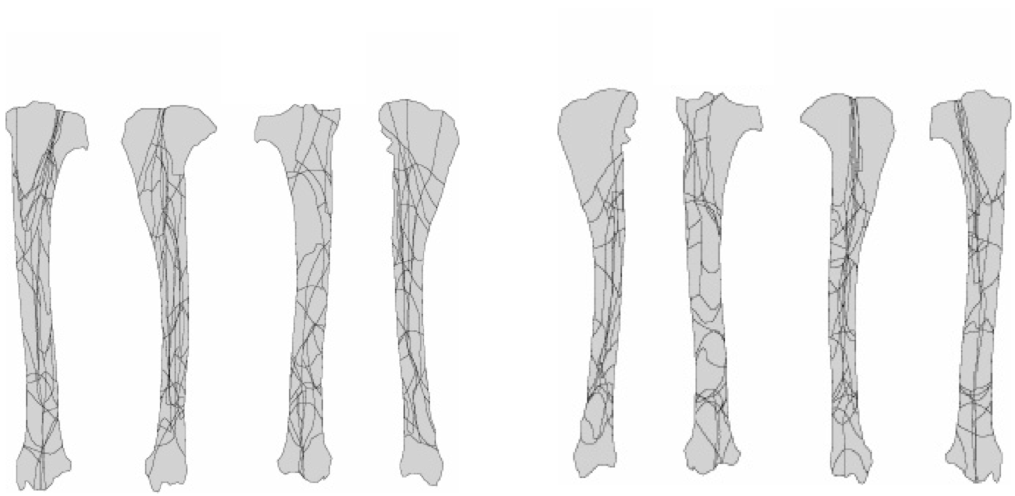
SR05 (FE-TI separation: VD or SA, TI-tarsal separation YA)

L R



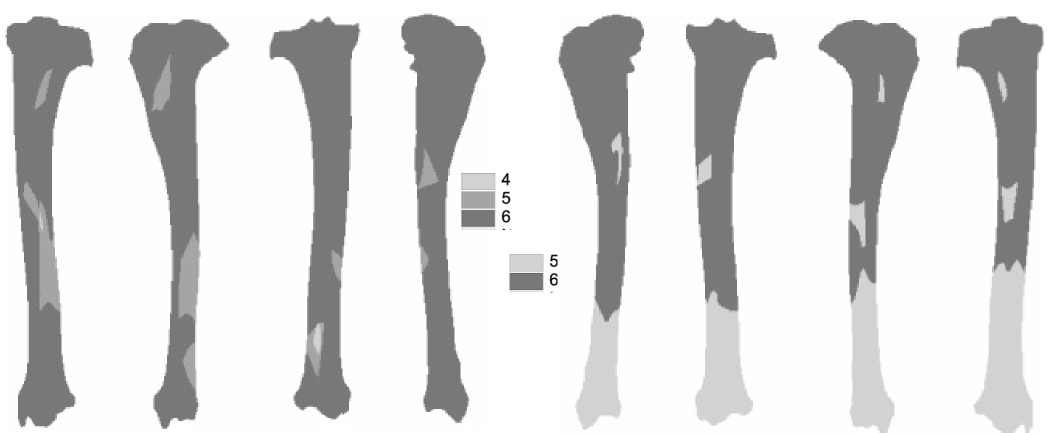
b) Fracture pattern.

L R



c) MNE map, showing preservation at time of recording.

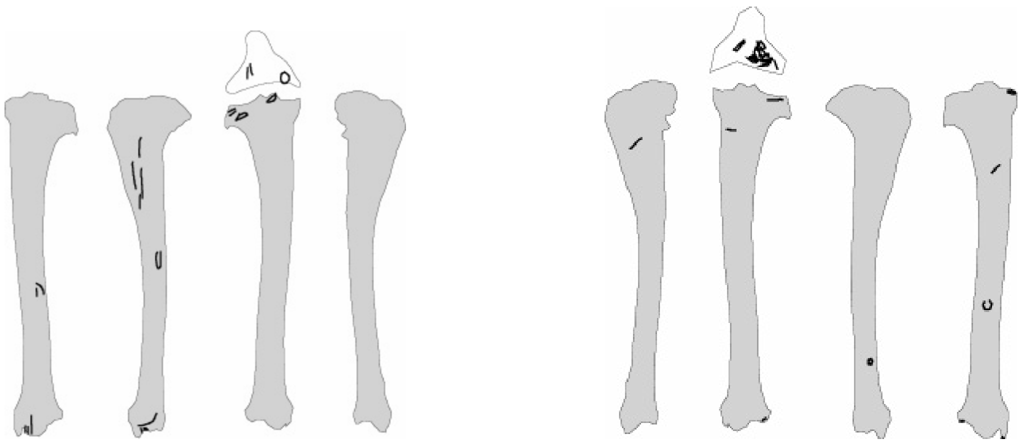
L R



Anterior Lateral Posterior Medial Medial Posterior Lateral Anterior

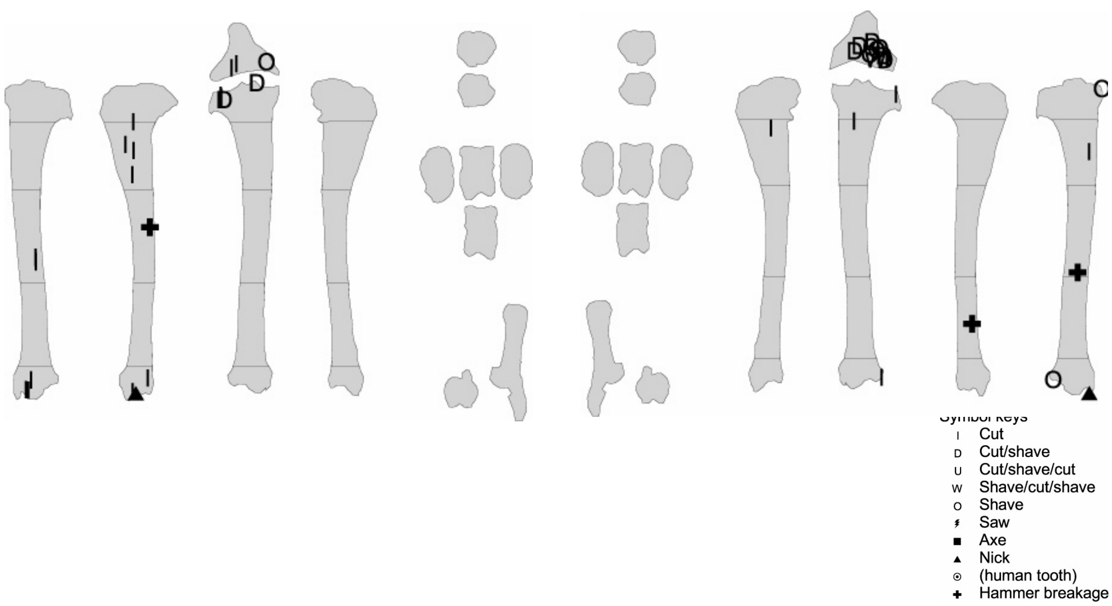
d) Distribution of all marks (drawing).

L R



e) Distribution of all marks (symbol).

L R



f) Zones.

L R

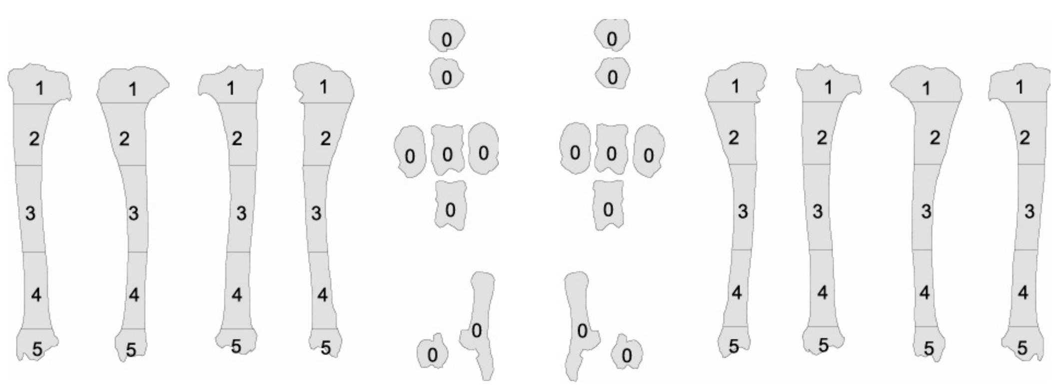


Table 7.62: Summary of reindeer tibia surface modification.

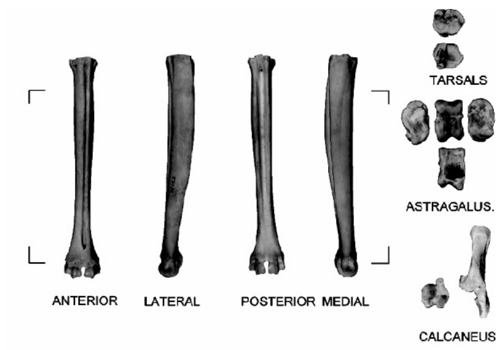
a) Cuts by animal, zone, and cutmark type.

	Zone	cut 1	c/s 3	c/s/c 5	s/c/s 6	shave 7	saw 10	axe 11	nick 12	tooth 15	hammer 20	Total	Notes
L FR01	**1**	1	1									2	
	2	2										2	
	3										1	1	
	5	4										4	axe (3)
	Total	*7*	*1*								*1*	*9*	
L SR01	**1**	2	1									3	
	5	1										1	
	Total	*3*	*1*									*4*	
L SR02	**3**	2										2	
L SR03	**2**	1										1	
	5								1			1	
	Total	*1*							*1*			*2*	
L SR04	**1**	2				1						3	
R FR01	**1**	1				2						3	
	2	3										3	
	4										1	1	
	Total	*4*				*2*					*1*	*7*	
R SR01	**5**					1						1	
R SR02	**5**								1			1	
R SR03	**1**	1				1						2	
	3										1	1	
	Total	*1*				*1*					*1*	*3*	
R SR04	**1**	2	2			1						5	disartic.
	5	1										1	disartic.
	Total	*3*	*2*			*1*						*6*	
R SR05	**1**		3		1	1						5	disartic.

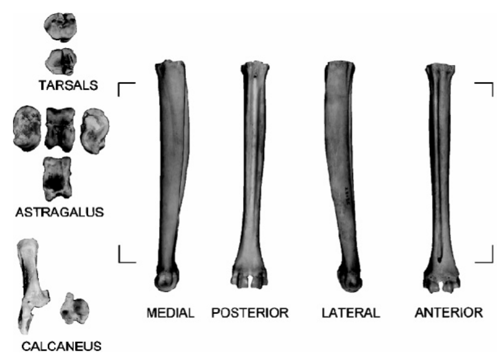
b) Summary of surface modification.

	Zone	cut 1	c/s 3	c/s/c 5	s/c/s 6	shave 7	saw 10	axe 11	nick 12	tooth 15	hammer 20	Total	% preserved	Corrected # cutmarks	Total axe	Corrected # cutmarks for disarticulation
TIL	**1**	5	2			1						8	600%	1.3		1.3
	2	3										3	595%	0.5		0.0
	3	2									1	3	583%	0.5		0.0
	4												582%	0.0		0.0
	5	5							1			6	600%	1.0	3	0.5
TIR	**1**	4	5		1	5						15	600%	2.5		2.5
	2	3										3	597%	0.5		0.0
	3										1	1	589%	0.2		0.0
	4										1	1	514%	0.2		0.0
	5	1				1			1			3	500%	0.6		0.6
TI	**1**													1.9		1.9
	2													0.5		0.0
	3													0.3		0.0
	4													0.1		0.0
	5													0.8		0.6

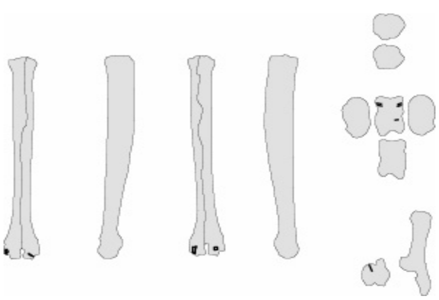
Figure 7.63: Reindeer metatarsal (L and R).
a) Template and individual specimens. Tarsals are shown on template if they were attached to the metatarsal at the time of recording. If the separated tarsals were identifiable to animal, they are shown below the template.
Templates.
L



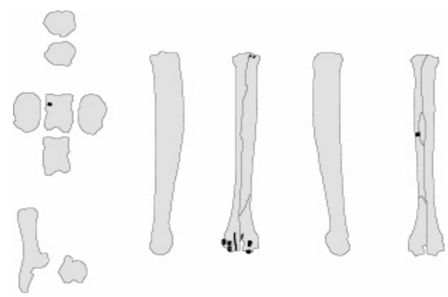
R



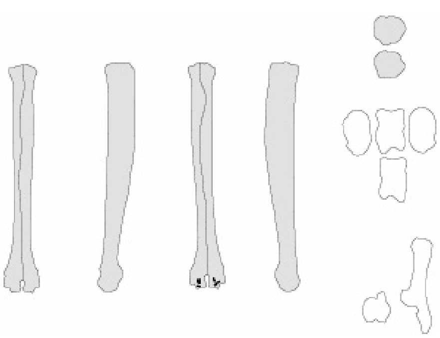
FR01 (kamus butchery: VS/YA (sides?))
L



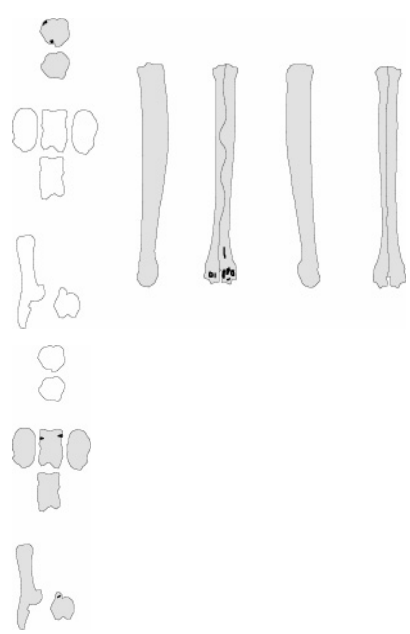
R



SR01 (kamus butchery: SA/VD (sides?))
L

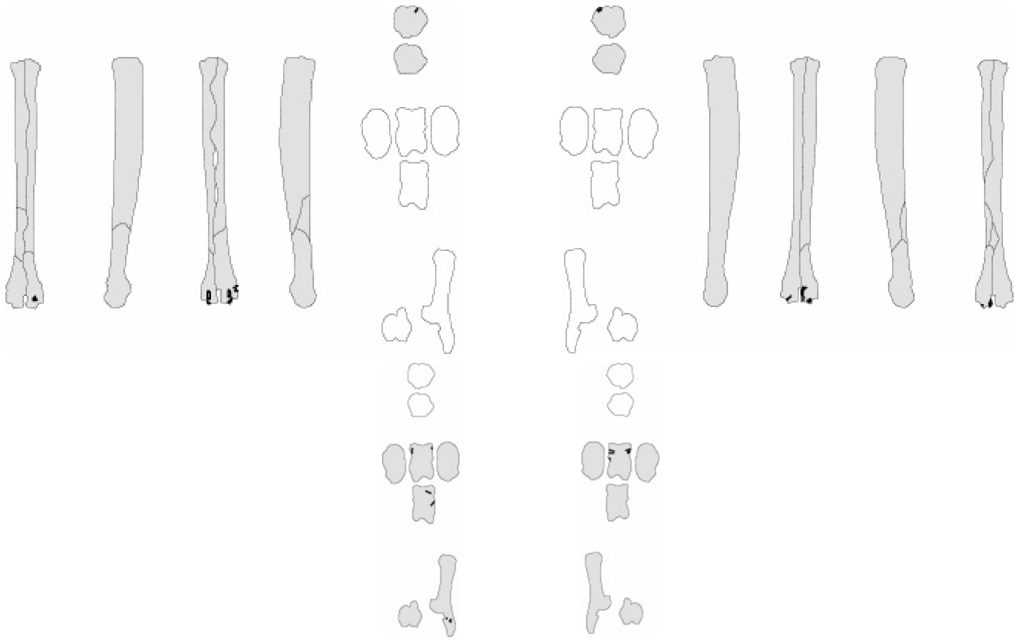


R



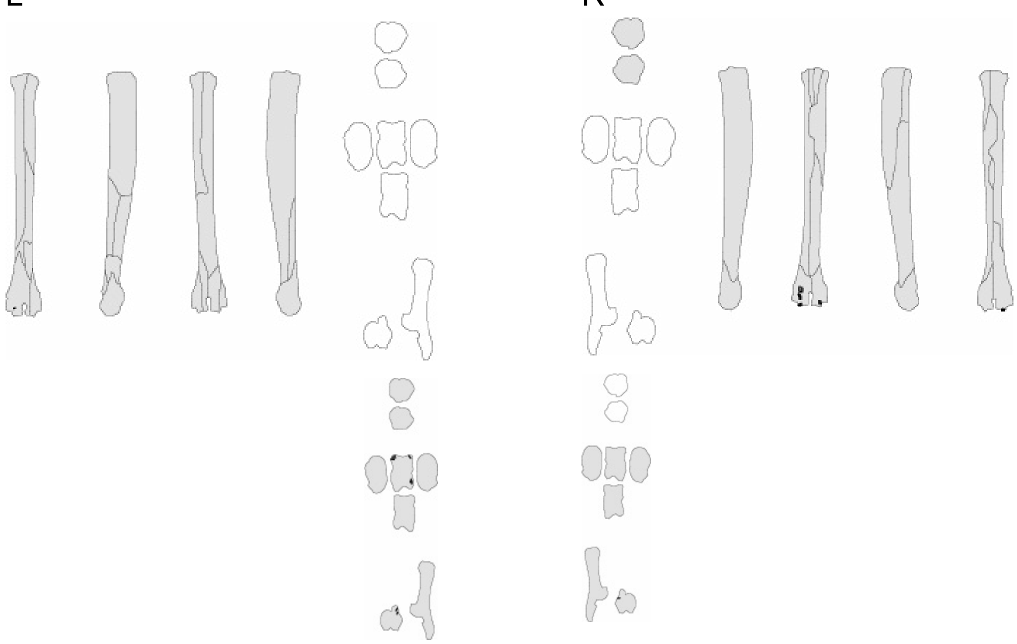
SR02 (kamus butchery: YA)

L R



SR03 (kamus butchery: SA/YA (sides?))

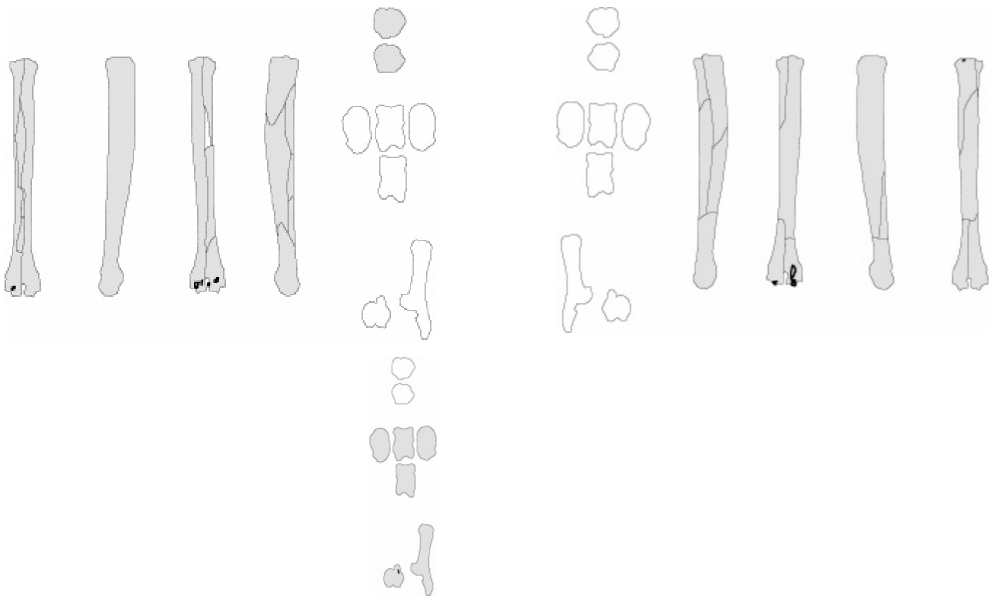
L R



Anterior Lateral Posterior Medial   Medial Posterior Lateral Anterior

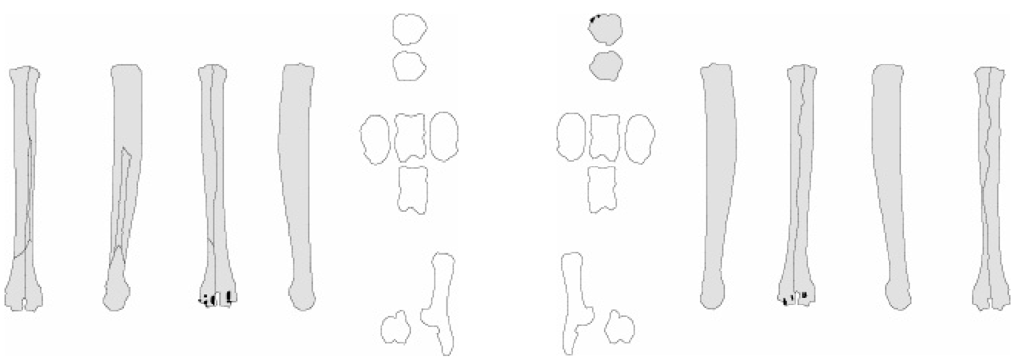
SR04 (kamus butchery: YA)

L R



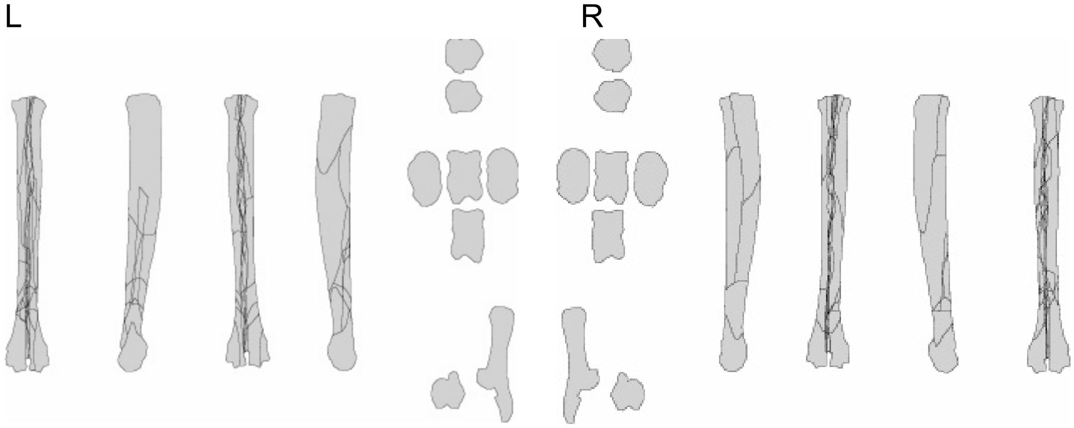
SR05 (kamus butchery: YA)

L R



b) Fracture pattern.

L R



Anterior Lateral Posterior Medial Medial Posterior Lateral Anterior

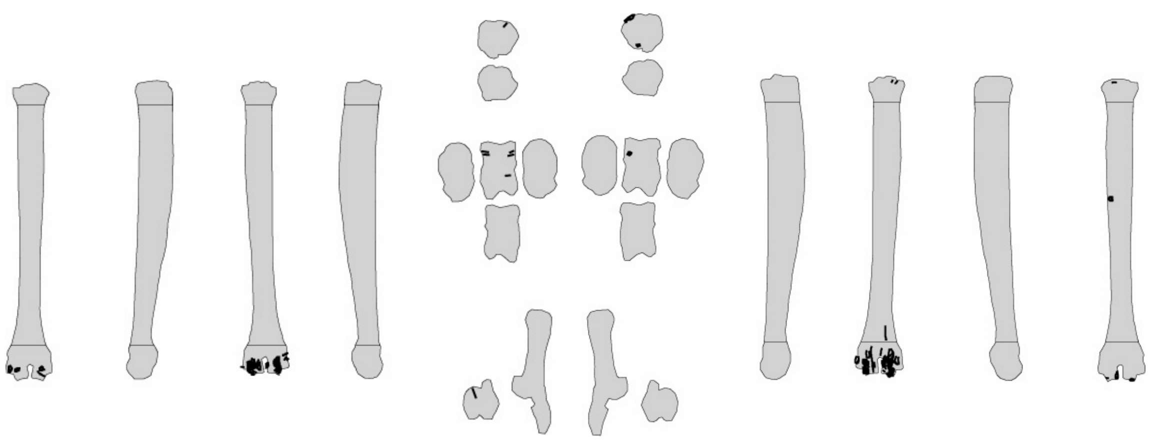
c) MNE map, showing preservation at time of recording.

L R

(all bones completely preserved, MNE = 6)

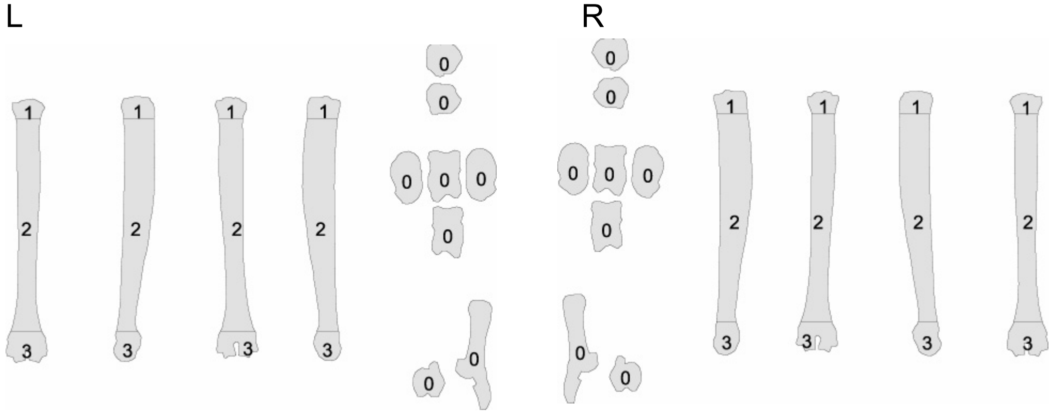
d) Distribution of all marks (drawing).

L



e) Zones.

L R



Anterior Lateral Posterior Medial Medial Posterior Lateral Anterior

Table 7.64: Summary of reindeer metatarsal surface modification.

a) Cuts by animal, zone, and cutmark type.

	Zone	cut 1	c/s 3	c/s/c 5	s/c/s 6	shave 7	saw 10	axe 11	nick 12	tooth 15	hammer 20	Total	Notes
L FR01	**0**	6										6	
	3	1	2			1						4	
	Total	*7*	*2*			*1*						*10*	
L SR01	**3**	3				1						4	
L SR02	**0**	1										1	
	3	6	2			2						10	
	Total	*7*	*2*			*2*						*11*	
L SR03	**3**	1										1	
L SR04	**3**	1	1		2	1						5	
L SR05	***3***	3	2			2						7	
R FR01	**0**	4										4	
	1	2										2	
	2										1	1	
	3	4	2		1	1						8	
	Total	*10*	*2*		*1*	*1*					*1*	*15*	
R SR01	**0**	3				1						4	
	2	1										1	
	3	2	2			2						6	
	Total	*6*	*2*			*3*						*11*	
R SR02	***0***					1						1	
	3	4	3			1						8	
	Total	*4*	*3*			*2*						*9*	
R SR03	**3**		2			3						5	
R SR04	**1**	1										1	
	3		3			1						4	
	Total	*1*	*3*			*1*						*5*	
R SR05	**0**		1			1						2	
	3	1	1			1						3	axe (1 cut)
	Total	*1*	*2*			*2*						*5*	

b) Summary of surface modification.

	Zone	cut 1	c/s 3	c/s/c 5	s/c/s 6	shave 7	saw 10	axe 11	nick 12	tooth 15	hammer 20	Total	% preserved	Corrected # cutmarks	Total axe or hammer	Corrected # cutmarks for disarticulation
MTL	**1**												600%	0.0		0.0
	2												598%	0.0		0.0
	3	15	7		2	7						31	600%	5.2		5.2
	tarsal	7										7				
MTR	**1**	3										3	600%	0.5		0.5
	2	1									1	2	600%	0.3	1	0.0
	3	11	13		1	9						34	600%	5.7	1	5.5
	tarsal	7	1			3						11				
MT	**1**													0.3		0.3
	2													0.2		0.0
	3													5.4		5.3

Table 7.65: Proportion of bones with surface modification.

	Reindeer			Kabarga		
	# bones drawn	# bones with marks	% with marks	% with marks	# bones drawn	# bones with marks
CR	6	6	**100%**	64%	14	9
MD	12	6	50%	32%	28	9
AT	4	4	**100%**	**100%**	5	5
AX	3	3	**100%**	**100%**	3	3
CE	9	8	89%	13%	8	1
TH	44	40	91%	10%	20	2
LU	19	13	68%	27%	15	4
RI	78	45	58%	33%	30	10
IN	6	5	83%	38%	8	3
SA	2	2	**100%**	60%	5	3
SC	5	3	60%	67%	12	8
HU	8	8	**100%**	**100%**	8	8
RAUL	11	10	91%	67%	6	4
MC	12	12	**100%**	25%	8	2
FE	8	8	**100%**	**100%**	9	9
TI	12	11	92%	46%	13	6
MT	12	12	100%	45%	11	5

Table 7.66: Corrected number of cutmarks (CNC) by animal for non long bones. Small/large bovid data from Nilssen (2000).

a) Two CNC values are given for each animal: 'total' and 'disarticulation'. 'Total' CNC includes all marks such as axing, eating (and in the case of the African bovids, extensive filleting). 'Disarticulation' CNC are mostly disarticulation marks. For details about disarticulation mark determination in reindeer and *kabarga*, see Figures 7.2-7.63.

		Reindeer		Kabarga		Large bovids		Small bovids	
		Total	Disartic.	Total	Disartic.	Total	Disartic.	Total	Disartic.
SC	**1**	2.4	2.7	1.3	1.1	4.9	2.1	1.3	0.0
	2	0.2	0.0	0.3	0.0	16.0	2.7	3.8	0.0
	3	1.0	0.0	1.1	0.0	57.5	2.4	17.1	0.0
MC	**1**	1.0		0.3					
	2	0.9		0.0					
	3	6.2		0.7					
MT	**1**	0.3	0.3	0.0					
	2	0.2	0.0	0.0					
	3	5.4	5.3	3.5					
IN		3.5	2.4	0.5		58.1	12.4	10.4	3.4
SA		2.7				35.7	14.9	4.3	0.7
CR		25.5	12.0	2.5	0.9	49.5	20.5	23.0	9.0
							(skinning)		(skinning)
			7.8		1.8		24.0		14.0
MD		1.0		0.7		23.0	16.0	5.0	1.3
AT		10.3	5.3	2.6	2.2	65.6	30.2	10.9	2.8
AX		17.0	12.3	2.3	1.0				
CE		8.8		0.3		93.4	16.0	16.7	0.4
TH		5.8		0.2		93.4	53.8	38.0	11.9
LU		2.8		0.4		73.7	4.3	233.3	0.7
RI		2.0	1.1	1.1		13.0	1.6	4.6	0.9

b) Sources in Nilssen (2000). The CNC was calculated by dividing the total number of cuts by MNE. The number of cuts was obtained from the tables listed below, and MNE from figures in Appendix E. The ‘disarticulation’ number of cuts was calculated as a sum of marks definitely made during disarticulation and marks possibly made by disarticulation (selected by the presence of ‘D’ in activity code).

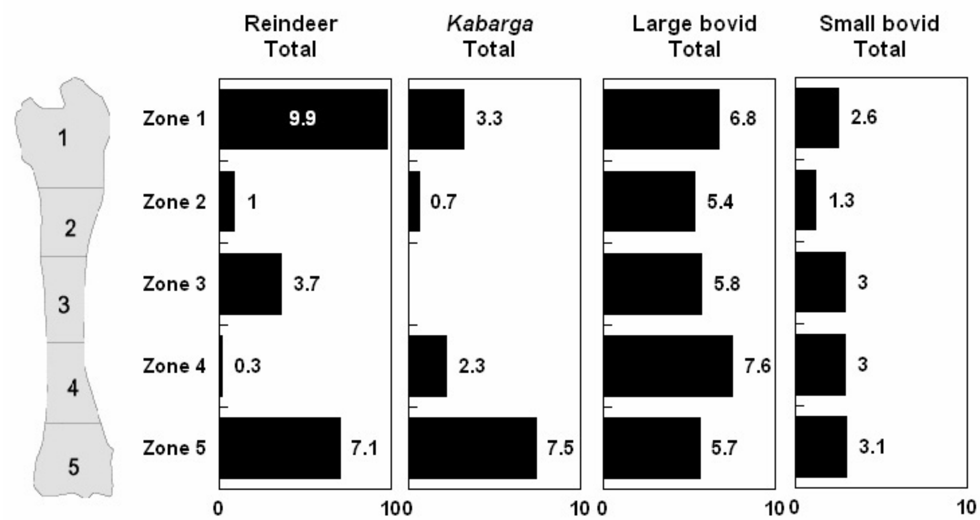
	Large bovid Activity category and table name	Small bovid Activity category and table name
SC	FD Table 4.16	D Table 4.15
IN	D+FD+DPS+SP Table 4.26	D+FD+DPS+SP Table 4.25
SA	D+FD Table 4.14	D+FD Table 4.13
CR	D+SFD Table 4.2	D Table 4.1
MD	D+FD+SF+SFD Table 4.4	SFD Table 4.3
AT	D+FD Table 4.6	D+FD Table 4.5
CE	D+FD Table 4.8	D Table 4.7
TH	D+DR+FD+EF+EDR+FDR+EFD+DDR Table 4.10	D+EDR+FDR Table 4.9
LU	D+FD+EFD Table 4.12	EFD Table 4.11
RI	DR+FDR+FEDR Table 4.35	DR+FDR+FEDR Table 4.34

Table 7.67: Corrected number of cutmarks (CNC) by animal for humeri. Small/large bovid data from Nilssen (2000).

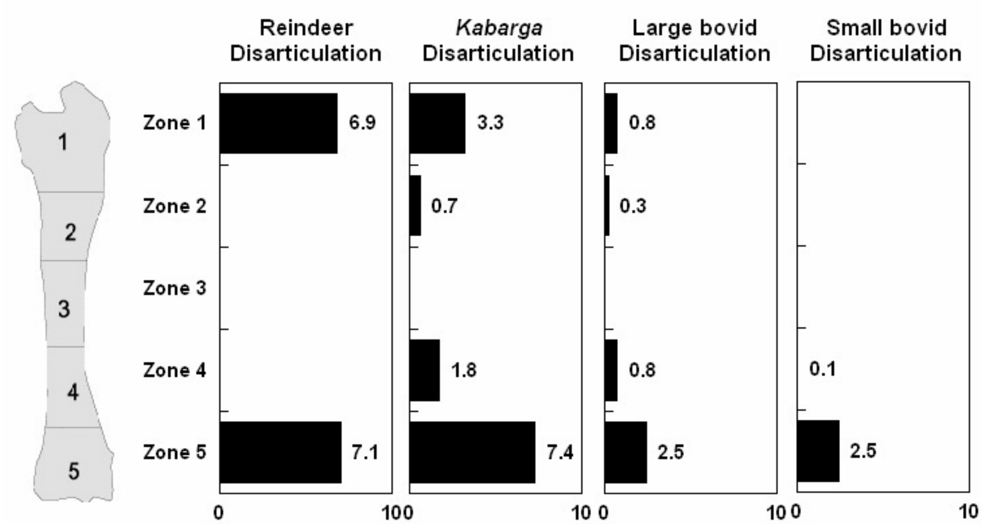
Zones	Reindeer																
	Individual samples								Corrected # cutmarks			Corrected # for disarticulation			Corrected # w/o axe		
	L	L	L	R	R	R			L	R	Reindeer	L	R	Reindeer	L	R	Reindeer
1	8	3	10	10	9	10			10.1	9.7	9.9	6.0	7.7	6.9	6.0	9.7	7.9
2	0	1	2	0	0	1			1.8	0.3	1.0	0.0	0.0	0.0	1.5	0.0	0.8
3	3	2	5	3	4	4			4.3	3.1	3.7	0.0	0.0	0.0	0.0	0.0	0.0
4	0	0	0	0	0	0			0.3	0.3	0.3	0.0	0.0	0.0	0.3	0.3	0.3
5	6	10	11	10	3	6			8.5	5.7	7.1	8.5	5.7	7.1	8.5	5.7	7.1
	Kabarga																
	Individual samples								Corrected # cutmarks			Corrected # for disarticulation					
	L	L	L	L	L	R	R	R	L	R	Kabarga	DL	DR	Kabarga			
1	1	3	1	4	0	1	6	8	1.6	5.0	3.3	1.6	5.0	3.3			
2	0	0	0	0	1	3	0	0	0.4	1.0	0.7	0.4	1.0	0.7			
3	0	0	0	0	0	0	0	0	0.0	0.0	0.0	0.0	0.0	0.0			
4	0	0	0	0	0	1	3	10	0.0	4.7	2.3	0.0	3.7	1.8			
5	7	11	6	5	6	13	9	2	7.0	8.0	7.5	6.8	8.0	7.4			
	Large bovids from Nilssen				(2000: Table 4.18)												
	Raw # cutmarks				Corrected # cutmarks				Corrected # cutmarks			Corrected # for disarticulation					
	FD	Tot		MNE	FD	Tot					Large bovid			Large bovid			
1	14.0	122.0		18.0	0.8	6.8					6.8			0.8			
2	5.0	98.0		18.0	0.3	5.4					5.4			0.3			
3	0.0	105.0		18.0	0.0	5.8					5.8			0.0			
4	15.0	136.0		18.0	0.8	7.6					7.6			0.8			
5	45.0	102.0		18.0	2.5	5.7					5.7			2.5			
	Small bovids from Nilssen				(2000:Table 4:17)												
	Raw # cutmarks				Corrected # cutmarks				Corrected # cutmarks			Corrected # for disarticulation					
	FD	Tot		MNE	FD	Tot					Small bovid			Small bovid			
1	0.0	31.0		12.0	0.0	2.6					2.6			0.0			
2	0.0	16.0		12.0	0.0	1.3					1.3			0.0			
3	0.0	36.0		12.0	0.0	3.0					3.0			0.0			
4	1.0	36.0		12.0	0.1	3.0					3.0			0.1			
5	30.0	37.0		12.0	2.5	3.1					3.1			2.5			

Figure 7.68: Comparison of mean corrected number of cutmarks (CNC) by animal: humerus.

a) Using the total number of cutmarks (including eating, axing, filleting).



b) Using the number of cutmarks linked to disarticulation.

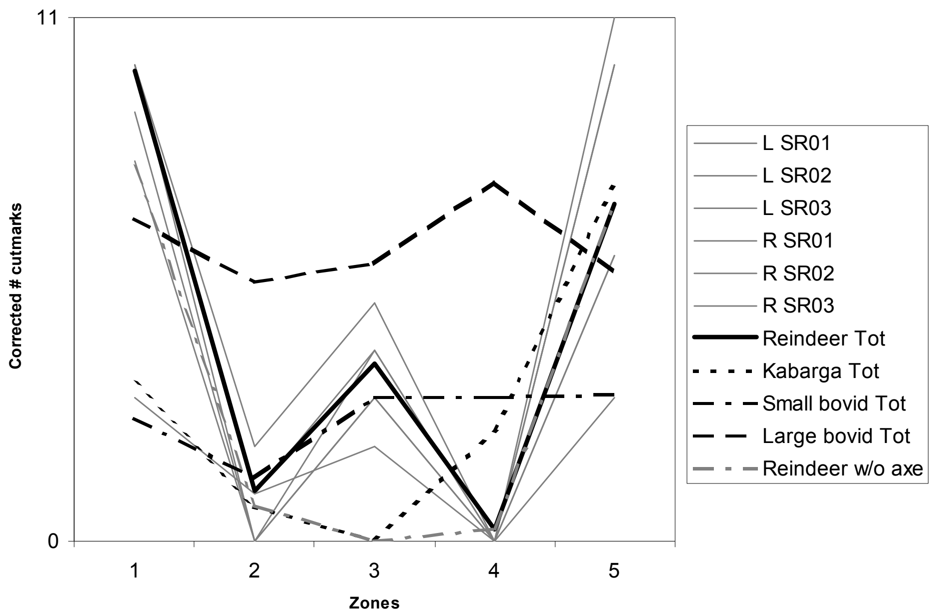


c) Correlation between sets of CNC. Critical values for linear correlation are 0.878 (p< .05) and 0.959 (p< .01). Relationships that are *not* significantly correlated are indicated in bold.

		Reindeer	*Kabarga*	*Small bovid*	*Large bovid*	*R disartic.*	*K disartic.*	*SB disartic.*	*LB disartic*	*R no axe*
HU	*Reindeer*	1.000	**0.547**	**0.295**	**-0.077**	0.912	**0.588**	**0.354**	**0.418**	0.917
	Kabarga		1.000	**0.417**	**-0.022**	**0.825**	0.997	0.901	0.987	**0.777**
	R disartic.					1.000	0.851	**0.620**	**0.728**	
	K disartic.						1.000	0.907	0.979	

Figure 7.69: Comparison of corrected number of cutmarks (CNC) for individual bones: humeri.

a) Reindeer. The changes in CNC across zones (1-5) are shown as a line graph as a visual aid. CNC from individual specimens are shown in gray, while the mean value for species are shown in black.



b) *Kabarga*.

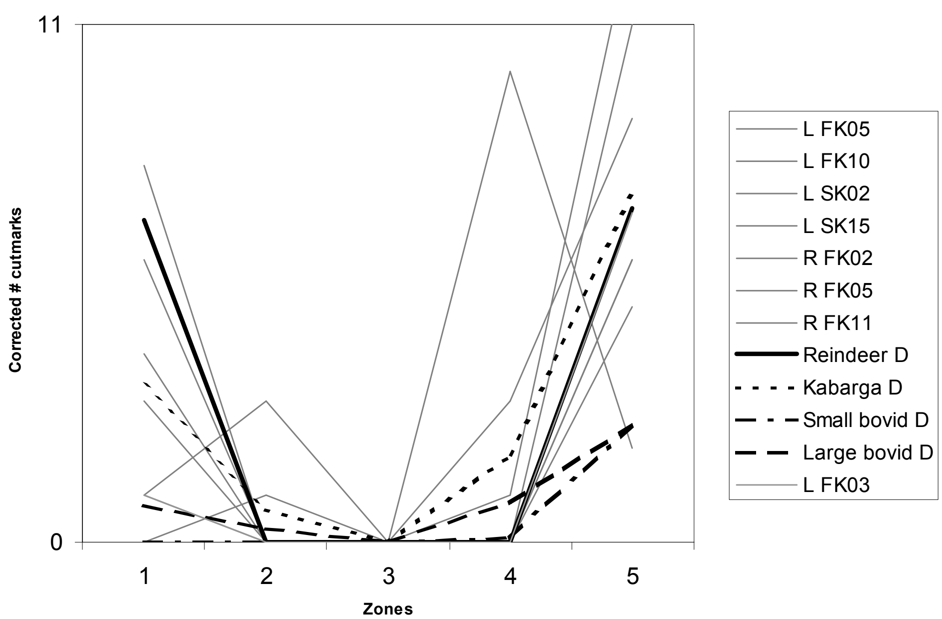


Table 7.70: Correlation between individual humerus in CNC distribution across zones.
Critical values for linear correlation are 0.878 (p< .05) and 0.959 (p< .01). Relationships that should significantly correlate are boxed, and of these, the relationships that were *not* significantly correlated are indicated in bold.

a) Reindeer.

	L SR01	*L SR02*	*L SR03*	*R SR01*	*R SR02*	*R SR03*
Reindeer Tot	0.996	**0.600**	0.947	0.965	0.908	0.991
Kabarga Tot	0.577	0.884	0.692	0.740	0.182	0.434
Small bovid Tot	0.377	0.371	0.326	0.393	0.267	0.259
Large bovid Tot	-0.049	-0.425	-0.291	-0.107	0.095	-0.057

b) Kabarga.

	L FK03	*L FK05*	*L FK10*	*L SK02*	*L SK15*	*R FK02*	*R FK05*	*R FK11*
Reindeer D	0.733	0.817	0.749	0.993	0.577	0.595	0.916	0.185
Kabarga D	0.947	0.970	0.953	0.902	**0.868**	0.885	0.964	**0.120**
Small bovid D	0.988	0.959	0.984	0.710	0.984	0.978	0.775	-0.216
Large bovid D	0.950	0.948	0.951	0.797	0.901	0.918	0.912	0.110
Reindeer Tot	0.490	0.594	0.510	0.874	0.302	0.301	0.702	0.102
Kabarga Tot	0.936	0.955	0.940	0.878	**0.856**	**0.875**	0.964	**0.170**
Small bovid Tot	0.376	0.376	0.376	0.321	0.213	0.182	0.474	0.351
Large bovid Tot	-0.333	-0.291	-0.326	-0.097	-0.470	-0.434	0.125	0.962

Table 7.71: Corrected number of cutmarks (CNC) by animal for radioulna. Small/large bovid data from Nilssen (2000). Marks on the olecranon in Nilssen's data were added to zone 1.

Zones	Reindeer															
	Individual samples										Corrected # cutmarks			Corrected # for disarticulation		
	L	L	L	L	L	L	R	R	R	R	L	R	Reindeer	L	R	Reindeer
1	5	1	0	3	0	2	15	3	1	2	1.83	5.3	3.5	1.8	5.3	3.5
2	1	3	0	0	0	0	1	0	2	1	0.68	1.0	0.8	0.0	0.0	0.0
3	0	0	1	0	1	0	1	0	4	1	0.34	1.3	0.8	0.0	0.0	0.0
4	0	0	1	0	0	0	0	0	0	0	0.17	0.0	0.1	0.0	0.0	0.0
5	0	0	5	4	3	0	4	6	3	6	2	4.4	3.2	2.0	4.4	3.2

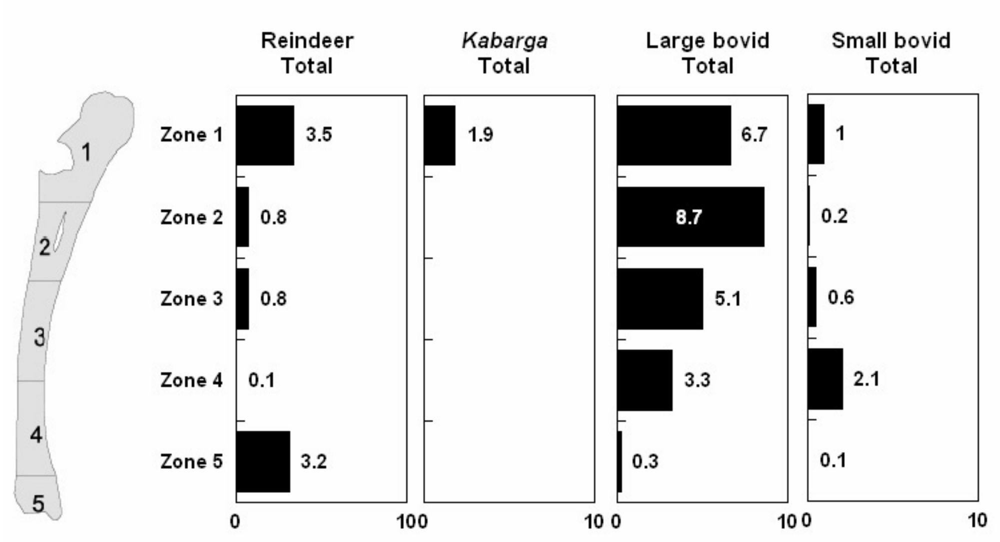
Zones	Kabarga									
	Individual samples				Corrected # cutmarks			Corrected # for disarticulation		
	L	L	R	R	L	R	Kabarga	DL	DR	Kabarga
1	3	5	1	2	2.7	1.0	1.9	2.7	1.0	1.9
2	0	0	0	0	0.0	0.0	0.0	0.0	0.0	0.0
3	0	0	0	0	0.0	0.0	0.0	0.0	0.0	0.0
4	0	0	0	0	0.0	0.0	0.0	0.0	0.0	0.0
5	0	0	0	0	0.0	0.0	0.0	0.0	0.0	0.0

Zones	Large bovids from Nilssen (2000: Table 4.20,22)								
	Raw # cutmarks				Corrected # cutmarks			Corrected # cutmarks	Corrected # for disarticulation
	D	D+SF	Tot	MNE	D	D+SF	Tot	Large bovid	Large bovid
1	9.0	8.0	121.0	18.0	0.5	0.4	6.7	6.7	0.4
2	0.0	2.0	156.0	18.0	0.0	0.1	8.7	8.7	0.1
3	0.0	0.0	92.0	18.0	0.0	0.0	5.1	5.1	0.0
4	0.0	0.0	60.0	18.0	0.0	0.0	3.3	3.3	0.0
5	0.0	3.0	5.0	18.0	0.0	0.2	0.3	0.3	0.2

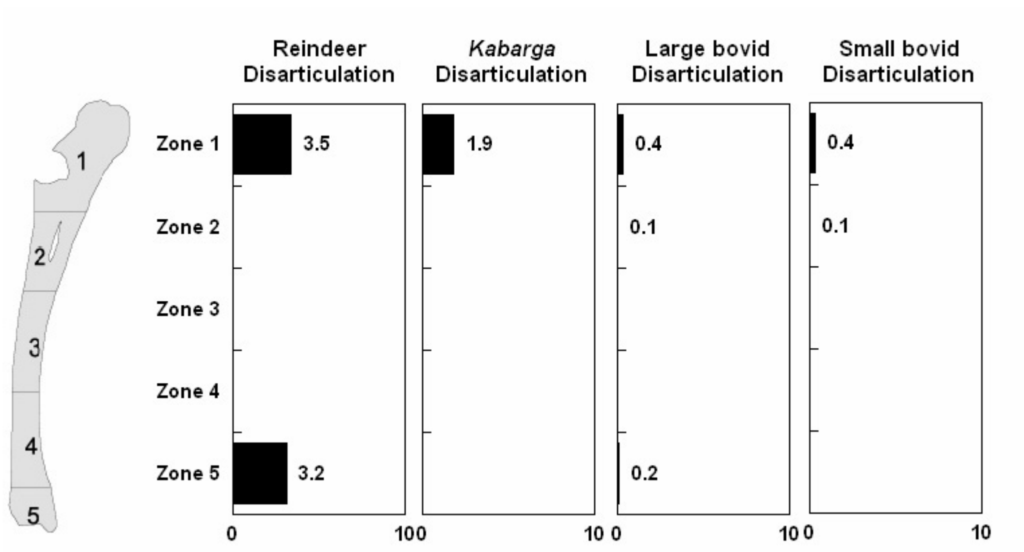
Zones	Small bovids from Nilssen (2000:Table 4:19,21)						
	Raw # cutmarks			Corrected # cutmarks		Corrected # cutmarks	Corrected # for disarticulation
	D	Tot	MNE	D	Tot	Small bovid	Small bovid
1	5.0	12.0	12.0	0.4	1.0	1.0	0.4
2	1.0	2.0	12.0	0.1	0.2	0.2	0.1
3	0.0	7.0	12.0	0.0	0.6	0.6	0.0
4	0.0	25.0	12.0	0.0	2.1	2.1	0.0
5	0.0	1.0	12.0	0.0	0.1	0.1	0.0

Figure 7.72: Comparison of mean corrected number of cutmarks (CNC) by animal: radioulna.

a) Using the total number of cutmarks (including eating, axing, filleting).



b) Using the number of cutmarks linked to disarticulation.

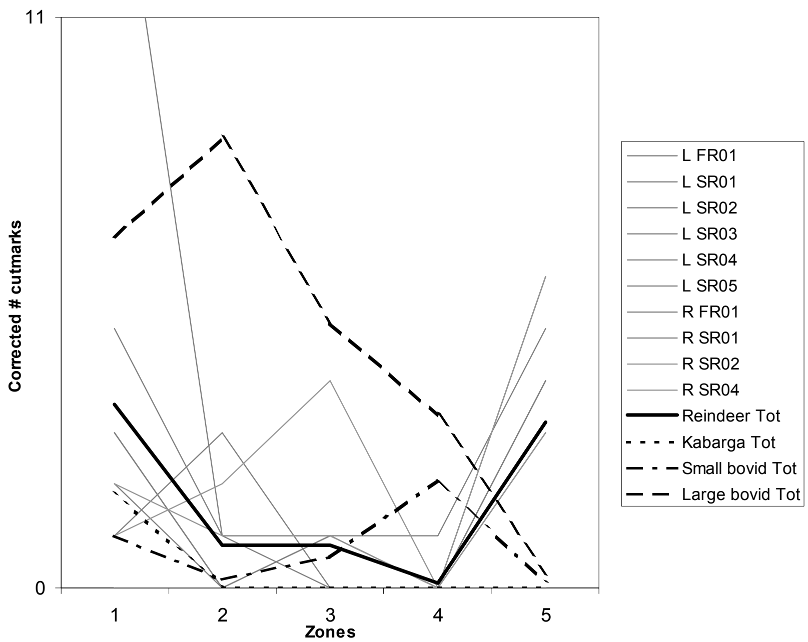


c) Correlation between sets of CNC. Critical values for linear correlation are 0.878 (p< .05) and 0.959 (p< .01). Relationships that are *not* significantly correlated are indicated in bold.

		Reindeer	*Kabarga*	*Small bovid*	*Large bovid*	*R disartic.*	*K disartic.*	*SB disartic.*	*LB disartic*
RAUL	*Reindeer*	1.000	**0.660**	**-0.398**	**-0.227**	0.982	**0.660**	**0.617**	**0.854**
	Kabarga		1.000	**0.149**	**0.330**	**0.663**	1.000	0.980	0.919
	R disartic.					1.000	**0.663**	**0.600**	**0.839**
	K disartic.						1.000	0.980	0.919

Figure 7.73: Comparison of corrected number of cutmarks (CNC) for individual bones: radioulna.

a) Reindeer. The changes in CNC across zones (1-5) are shown as a line graph as a visual aid. CNC from individual specimens are shown in gray, while the mean value for species are shown in black.



b) *Kabarga*.

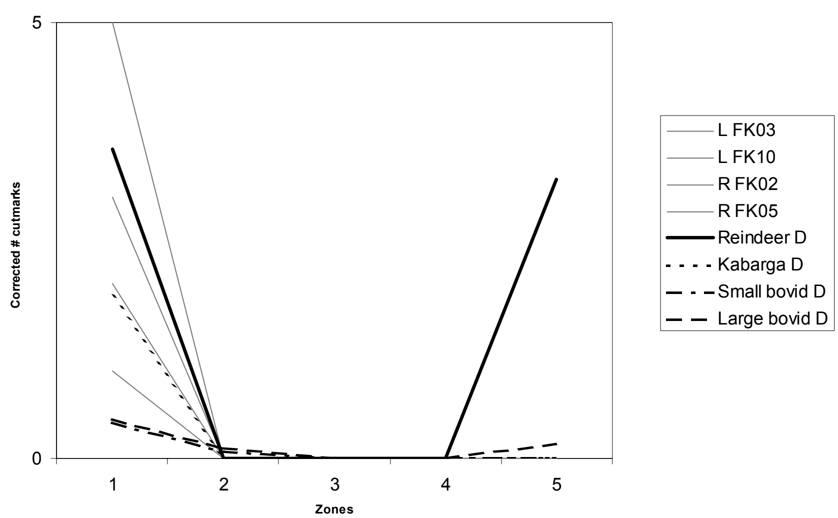


Table 7.74: Correlation between individual radioulna in CNC distribution across zones.
Critical values for linear correlation are 0.878 (p< .05) and 0.959 (p< .01). Relationships that should significantly correlate are boxed, and of these, the relationships that were *not* significantly correlated are indicated in bold.

a) Reindeer.

	L FR01	*L SR01*	*L SR02*	*L SR03*	*L SR04*	*L SR05*	*R FR01*	*R SR01*	*R SR02*	*R SR04*
Reindeer Tot	**0.617**	**-0.095**	**0.389**	0.948	**0.447**	**0.660**	**0.822**	**0.868**	**0.113**	**0.748**
Kabarga Tot	0.980	0.086	-0.377	0.459	-0.343	1.000	0.970	0.250	-0.354	0.000
Small bovid Tot	0.066	-0.385	-0.356	-0.339	-0.542	0.149	-0.018	-0.407	-0.761	-0.601
Large bovid Tot	0.479	0.801	-0.897	-0.498	-0.796	0.330	0.181	-0.625	-0.142	-0.641

b) *Kabarga*.

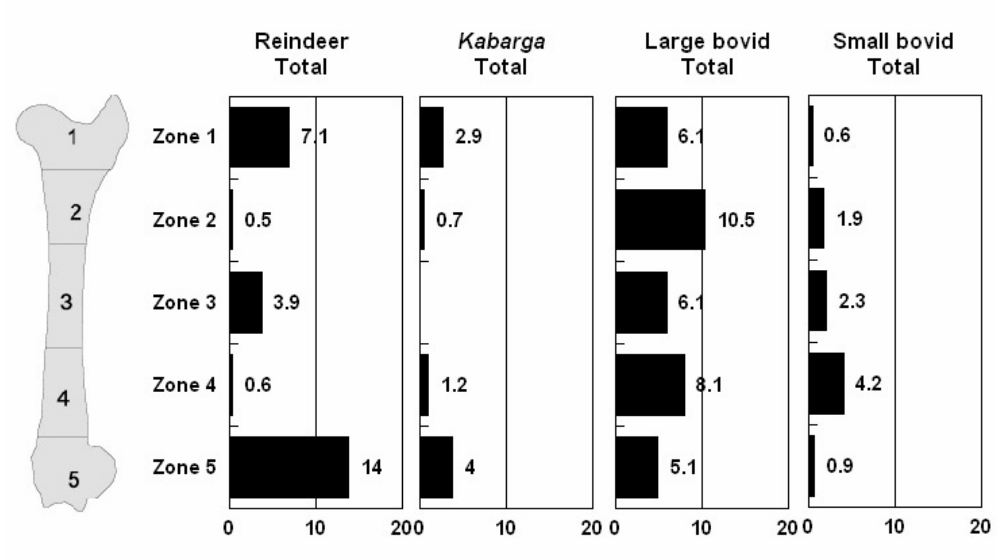
	L FK03	*L FK10*	*R FK02*	*R FK05*
Reindeer D	0.663	0.663	0.663	0.663
Kabarga D	1.000	1.000	1.000	1.000
Small bovid D	0.980	0.980	0.980	0.980
Large bovid D	0.919	0.919	0.919	0.919

Table 7.75: Corrected number of cutmarks (CNC) by animal for femur. Small/large bovid data from Nilssen (2000).

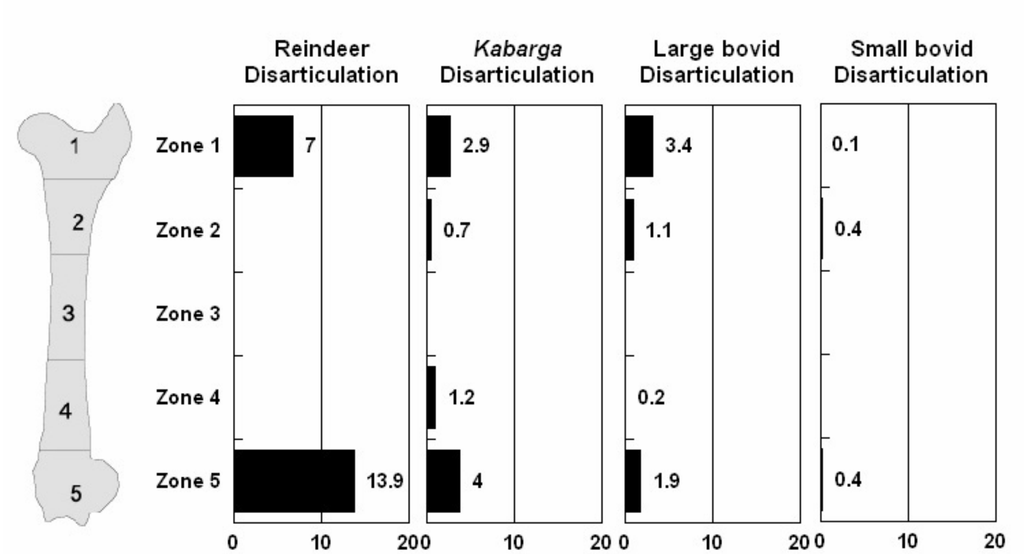
Zones	Reindeer																
	Individual samples								Corrected # cutmarks			Corrected # for disarticulation			Corrected # w/o axe		
	L	L	L	L	R	R	R	R	L	R	Reindeer	L	R	Reindeer	L	R	Reindeer
1	8	8	4	7	4	10	3	12	6.9	7.3	7.1	6.9	7.0	7.0	6.9	7.0	7.0
2	1	2	0	0	0	1	0	0	0.8	0.3	0.5	0.0	0.0	0.0	0.8	0.3	0.5
3	4	8	1	8	4	2	0	4	5.3	2.5	3.9	0.0	0.0	0.0	1.0	0.0	0.5
4	0	0	0	0	2	3	0	0	0.0	1.3	0.6	0.0	0.0	0.0	0.0	1.3	0.6
5	6	11	14	12	29	16	13	11	10.8	17.3	14.0	10.8	17.0	13.9	10.8	17.0	13.9
	Kabarga																
	Individual samples								Corrected # cutmarks			Corrected # for disarticulation					
	L	L	R	R	R				L	R	Kabarga	DL	DR	Kabarga			
1	0	0	4	3	5				1.7	4.2	2.9	1.7	4.2	2.9			
2	0	0	1	0	0				0.7	0.8	0.7	0.7	0.8	0.7			
3	0	2	0	0	0				0.0	0.0	0.0	0.0	0.0	0.0			
4	4	1	2	0	0				1.9	0.5	1.2	1.9	0.5	1.2			
5	5	5	4	1	4				4.8	3.3	4.0	4.8	3.3	4.0			
	Large bovids from Nilssen				(2000: Table 4.28)												
	Raw # cutmarks				Corrected # cutmarks				Corrected # cutmarks			Corrected # for disarticulation					
	D	D+FD	Tot	MNE	D	D+FD	Tot				Large bovid			Large bovid			
1	40.0	62.0	109.0	18.0	2.2	3.4	6.1				6.1			3.4			
2	0.0	20.0	189.0	18.0	0.0	1.1	10.5				10.5			1.1			
3	0.0	0.0	109.0	18.0	0.0	0.0	6.1				6.1			0.0			
4	0.0	3.0	145.0	18.0	0.0	0.2	8.1				8.1			0.2			
5	15.0	34.0	91.0	18.0	0.8	1.9	5.1				5.1			1.9			
	Small bovids from Nilssen				(2000:Table 4:27)												
	Raw # cutmarks				Corrected # cutmarks				Corrected # cutmarks			Corrected # for disarticulation					
	D	D+FD	Tot	MNE	D	D+FD	Tot				Small bovid			Small bovid			
1	1.0	1.0	9	16.0	0.1	0.1	0.6				0.6			0.1			
2	0.0	7.0	30	16.0	0.0	0.4	1.9				1.9			0.4			
3	0.0	0.0	37	16.0	0.0	0.0	2.3				2.3			0.0			
4	0.0	0.0	67	16.0	0.0	0.0	4.2				4.2			0.0			
5	6.0	6.0	14	16.0	0.4	0.4	0.9				0.9			0.4			

Figure 7.76: Comparison of mean corrected number of cutmarks (CNC) by animal: femur.

a) Using the total number of cutmarks (including eating, axing, filleting).



b) Using the number of cutmarks linked to disarticulation.

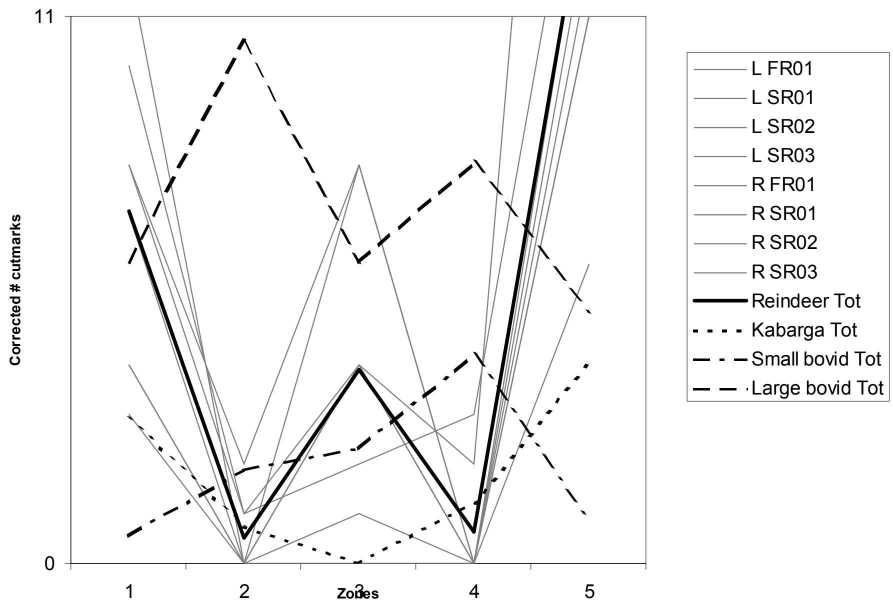


c) Correlation between sets of CNC.
Critical values for linear correlation are 0.878 ($p < .05$) and 0.959 ($p < .01$).
Relationships that are *not* significantly correlated are indicated in bold.

		Reindeer	*Kabarga*	*Small bovid*	*Large bovid*	*R disartic.*	*K disartic.*	*SB disartic.*	*LB disartic*	*R no axe*
FE	*Reindeer*	1.000	**0.854**	**-0.697**	**-0.800**	0.968	**0.854**	**0.281**	**0.537**	0.968
	Kabarga		1.000	**-0.615**	**-0.559**	0.951	1.000	**0.319**	**0.746**	0.950
	R disartic.					1.000	0.951	**0.375**	**0.646**	
	K disartic.						1.000	**0.319**	**0.746**	

Figure 7.77: Comparison of corrected number of cutmarks (CNC) for individual bones: femur.

a) Reindeer. The changes in CNC across zones (1-5) are shown as a line graph as a visual aid. CNC from individual specimens are shown in gray, while the mean value for species are shown in black.



b) *Kabarga*.

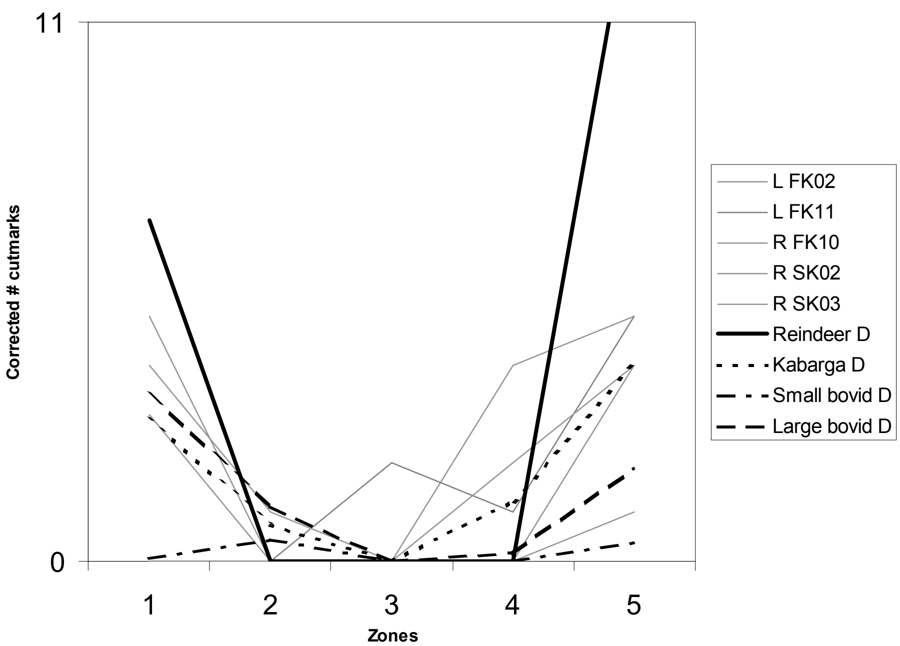


Table 7.78: Correlation between individual femora in CNC distribution across zones.
Critical values for linear correlation are 0.878 (p< .05) and 0.959 (p< .01). Relationships that should significantly correlate are boxed, and of these, the relationships that were *not* significantly correlated are indicated in bold.

a) Reindeer.

	L FR01	*L SR01*	*L SR02*	*L SR03*	*R FR01*	*R SR01*	*R SR02*	*R SR03*
Reindeer Tot	**0.766**	0.885	0.970	0.911	0.923	0.957	0.949	**0.871**
Kabarga Tot	0.655	0.574	0.870	0.592	0.772	0.966	0.873	0.816
Small bovid Tot	-0.855	-0.778	-0.602	-0.663	-0.456	-0.654	-0.568	-0.821
Large bovid Tot	-0.766	-0.843	-0.674	-0.905	-0.650	-0.724	-0.623	-0.801

b) *Kabarga*.

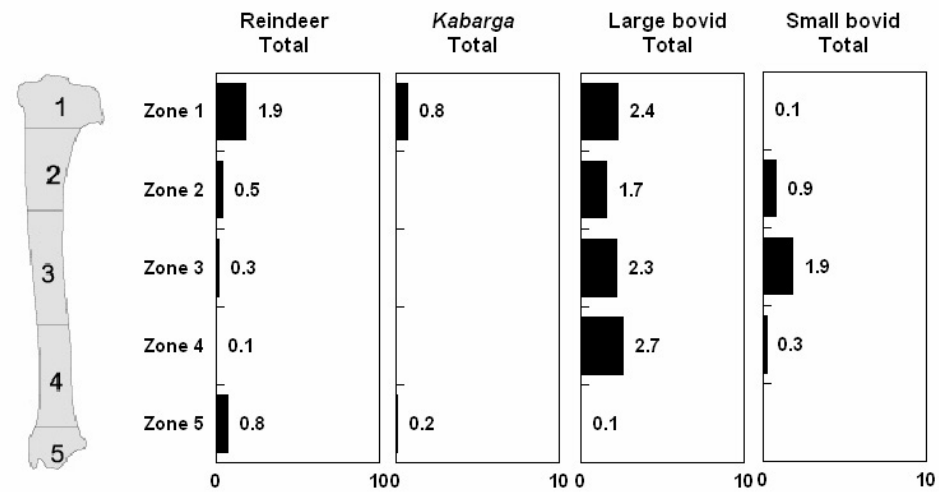
	L FK02	*L FK11*	*R FK10*	*R SK02*	*R SK03*
Reindeer D	0.516	0.700	0.844	0.558	0.854
Kabarga D	**0.542**	**0.513**	0.964	**0.663**	0.895
Small bovid D	0.141	0.268	0.172	-0.123	0.112
Large bovid D	-0.127	-0.083	0.816	0.943	0.917

Table 7.79: Corrected number of cutmarks (CNC) by animal for tibia. Small/large bovid data from Nilssen (2000).

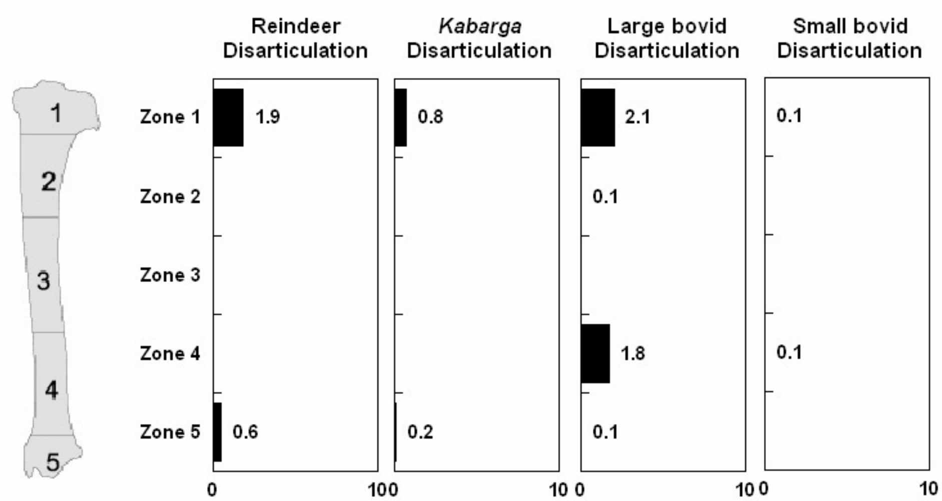
Zones	Reindeer															
	Individual samples										Corrected # cutmarks			Corrected # for disarticulation		
	L	L	L	L	L	R	R	R	R	R	L	R	Reindeer	L	R	Reindeer
1	2	3	0	0	3	3	0	0	2	5	1.3	2.5	1.9	1.3	2.5	1.9
2	2	0	0	1	0	3	0	0	0	0	0.5	0.5	0.5	0.0	0.0	0.0
3	1	0	2	0	0	0	0	0	1	0	0.5	0.2	0.3	0.0	0.0	0.0
4	0	0	0	0	0	1	0	0	0	0	0.0	0.2	0.1	0.0	0.0	0.0
5	4	1	0	1	0	0	1	1	0	1	1.0	0.6	0.8	0.5	0.6	0.6
	Kabarga															
	Individual samples										Corrected # cutmarks			Corrected # for disarticulation		
	L	L	L	R	R						L	R	Kabarga	DL	DR	Kabarga
1	3	0	1	3	1						0.7	0.8	0.8	0.7	0.8	0.8
2	0	0	1	1	0						0.0	0.0	0.0	0.0	0.0	0.0
3	0	8	1	0	0						0.0	0.0	0.0	0.0	0.0	0.0
4	1	0	0	0	0						0.0	0.0	0.0	0.0	0.0	0.0
5	0	0	0	0	0						0.0	0.3	0.2	0.0	0.3	0.2
	Large bovids from Nilssen				(2000: Table 4.30)											
	Raw # cutmarks				Corrected # cutmarks						Corrected # cutmarks			Corrected # for disarticulation		
	D	D+SF	Tot	MNE	D	D+SF	Tot						Large bovid			Large bovid
1	19.0	38.0	43.0	18.0	1.1	2.1	2.4						2.4			2.1
2	0.0	2.0	31.0	18.0	0.0	0.1	1.7						1.7			0.1
3	0.0	0.0	41.0	18.0	0.0	0.0	2.3						2.3			0.0
4	0.0	32.0	49.0	18.0	0.0	1.8	2.7						2.7			1.8
5	0.0	2.0	2.0	18.0	0.0	0.1	0.1						0.1			0.1
	Small bovids from Nilssen				(2000:Table 4:29)											
	Raw # cutmarks				Corrected # cutmarks						Corrected # cutmarks			Corrected # for disarticulation		
	FD	Tot		MNE	FD	Tot							Small bovid			Small bovid
1	2.0	2.0		16.0	0.1	0.1							0.1			0.1
2	0.0	15.0		16.0	0.0	0.9							0.9			0.0
3	0.0	31.0		16.0	0.0	1.9							1.9			0.0
4	1.0	4.0		16.0	0.1	0.3							0.3			0.1
5	0.0	0.0		16.0	0.0	0.0							0.0			0.0

Figure 7.80: Comparison of mean corrected number of cutmarks (CNC) by animal: tibia.

a) Using the total number of cutmarks (including eating, axing, filleting).



b) Using the number of cutmarks linked to disarticulation.
c) Correlation between sets of CNC.

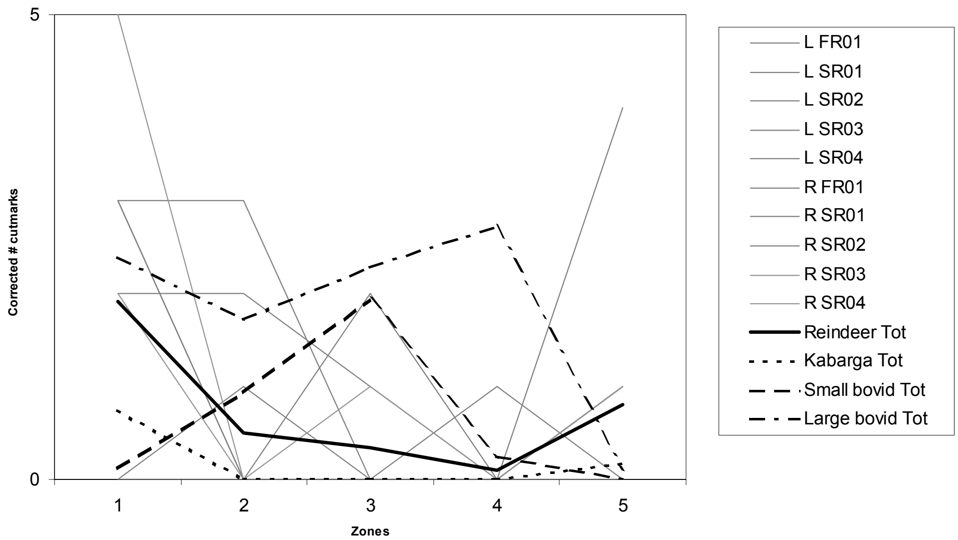


Critical values for linear correlation are 0.878 (p< .05) and 0.959 (p< .01). Relationships that are *not* significantly correlated are indicated in bold.

		Reindeer	Kabarga	*Small bovid*	*Large bovid*	*R disartic.*	*K disartic.*	*SB disartic.*	*LB disartic*
TI	*Reindeer*	1.000	0.976	**-0.428**	**-0.058**	0.979	0.976	**0.683**	**0.462**
	Kabarga		1.000	**-0.479**	**0.089**	0.998	1.000	**0.817**	**0.632**
	R disartic.					1.000	0.998	**0.792**	**0.606**
	K disartic.						1.000	**0.817**	**0.632**

Figure 7.81: Comparison of corrected number of cutmarks (CNC) for individual bones: tibia.

a) Reindeer.
The changes in CNC across zones (1-5) are shown as a line graph as a visual aid. CNC from individual specimens are shown in gray, while the mean value for species are shown in black.



b) *Kabarga*.

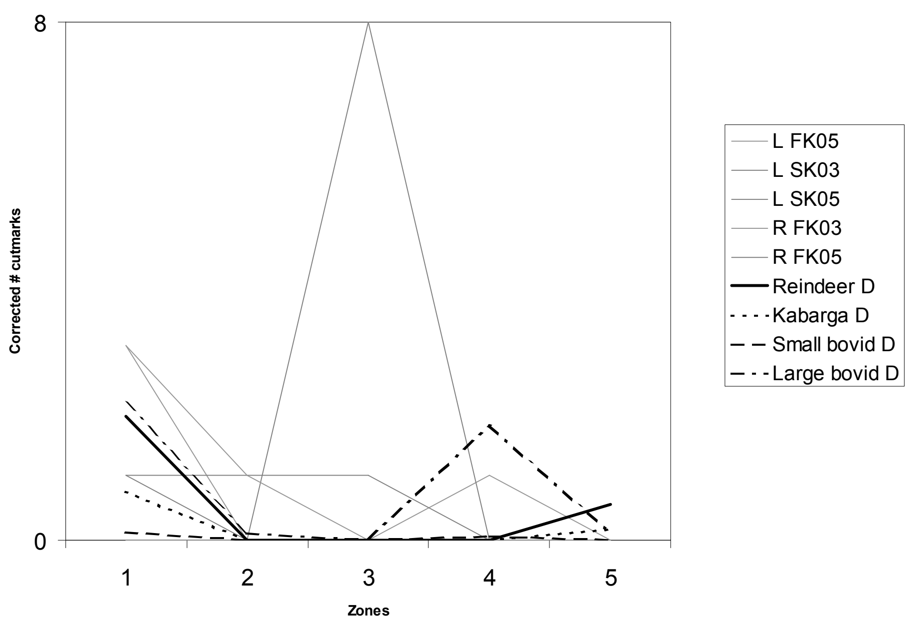


Table 7.82: Correlation between individual tibiae in CNC distribution across zones.

Critical values for linear correlation are 0.878 (p< .05) and 0.959 (p< .01). Relationships that should significantly correlate are boxed, and of these, the relationships that were *not* significantly correlated are indicated in bold.

a) Reindeer.

	L FR01	*L SR01*	*L SR02*	*L SR03*	*L SR04*	*R FR01*	*R SR01*	*R SR02*	*R SR03*	*R SR04*
Reindeer Tot	**0.426**	0.979	**-0.307**	**-0.103**	0.933	**0.519**	**0.054**	**0.054**	**0.780**	0.974
Kabarga Tot	0.268	0.993	-0.315	-0.281	0.975	0.490	-0.029	-0.029	0.817	1.000
Small bovid Tot	-0.374	-0.529	0.893	-0.205	-0.364	-0.228	-0.451	-0.451	0.082	-0.469
Large bovid Tot	-0.922	-0.019	0.234	-0.819	0.294	0.342	-0.937	-0.937	0.412	0.110

b) *Kabarga*.

	L FK05	*L SK03*	*L SK05*	*R FK03*	*R FK05*
Reindeer D	0.872	-0.332	0.240	0.872	0.958
Kabarga D	0.895	**-0.315**	**0.281**	0.895	0.975
Small bovid D	0.986	-0.375	0.102	0.772	0.875
Large bovid D	0.896	-0.445	-0.108	0.586	0.698
Reindeer Tot	0.789	-0.307	0.364	0.898	0.933
Kabarga Tot	0.895	**-0.315**	**0.281**	0.895	0.975
Small bovid Tot	-0.470	0.893	0.595	-0.306	-0.364
Large bovid Tot	0.466	0.234	0.378	0.280	0.294

Table 8.1: Reindeer use order compared to Nunamiut meat preference ranking. From Binford (1978: 41, Table 1.14).
Correlation coefficient = 0.814 (p< .01).

	Reindeer	Binford
Head unit	4	9
Neck unit	11	12
Th/dramah	8	4
RI 1	2	2
RI 2	3	2
ST	1	1
LU	4	5
Hip	9	6
Forelimb 1	10	10
Forelimb 2	12	11
FE 1	6	7
FE 2	7	7

Table 8.2: Comparison of butchery pattern to other ethnographic studies.

From Binford (1981:92, Figure 4.01) — Study group

	Akamba	Maasai	Caprin Dassanetch	Kalinjmo	Bovine Dassanetch	Navajo	!Kung	Nunamiut	Reindeer	Kabarga
Skull	1	1	1	1	1	1	1	1	1	1
Mandible	1	1	1	1	1	1	1	1	1	1
Atlas	2	2	2	2	2	2	2	2	1	2
Axis	2	2	2	2	2	2	2	2	2	2
Cervical	2	2	3	3	2	2	2	2	2	2
Ribs	3	3	4	4	3	3	3	3	3	3
Sternum	3	4	5	4	4	3	4	4	4	4
Thoracic	3	4	5	4	4	2	5	4	5	5
Lumbar upper	4	4	5	5	5	2	5	5	6	6
Lumbar lower	4	4	6	5	5	2	5	5	6	6
Sacrum	5	4	7	5	6	4	5	5	7	7
Pelvis	6	5	7	6	6	3	5	5	8	7
Femur	6	5	7	7	7	3	6	6	9	8
Tibia	6	5	7	8	8	3	6	6	10	8
Tarsals	6	5	7	8	8	3	6	6	10	8
Metatarsals	6	5	8	9	9	5	7	7	10	8
Phalanges	6	5	8	9	9	5	8	7	10	8
Scapula	7	6	9	10	10	6	9	8	11	9
Humerus	7	6	9	11	11	6	9	8	11	9
Radioulna	7	6	9	12	12	6	9	8	12	9
Carpals	7	6	9	13	13	7	10	9	12	9
Metacarpals	7	6	10	13	13	7	10	9	12	9
Phalanges	7	6	10	13	13	7	11	9	12	9

Table 8.3: Comparison of characteristics between study group and other ethnoarchaeological studies.

		Nunamiut	**Evenki**	Hadza	Okiek	!Kung	Kua
Conditions	Environment		**Forested**		Forested		
	Prey characeristic	Migratory/ seasonal	**Random/ year-round**	Migratory	Random/ year-round	Migratory	Migratory
Behavior	Main hunting method	mostly intercept	**mostly encounter**	mostly encounter	encounter	encounter	encounter
	Kill pattern	mass kills	**single kills**	single kills	single kills	single kills	single kills
	Transportation	Differential	**Whole**	Differential	Whole	Differential	Diferential
	Butchery variation	By season	**None**	By species	By species	By species	By species
Other	Marrow bones roasted	Yes		Yes	Yes	Yes	Yes
	Early marrow consumption	Yes	**Yes**	Yes	Yes	Yes	Yes
	Vertebrae smashing					Yes	Yes