

# CARIBOU REMAINS AT KILL SITES AND THE ROLE OF SCAVENGERS IN PRODUCING PATTERNED DISTRIBUTIONS IN BONE ASSEMBLAGES

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## INTRODUCTION

In the course of their daily activities, wildlife biologists often have the opportunity to observe the remains of large ungulate carcasses at predator kill sites, and to study remains acted on by scavengers. Remains and records from these sites provide valuable information to zooarchaeologists interested in taphonomic problems. This paper highlights data obtained by reviewing notes from four different wildlife studies carried out in Alaska. In this study we present information on the remains of 53 caribou (*Rangifer tarandus*), and discuss factors that may contribute to the formation and preservation of bone assemblage found at carcass sites. Because our research objectives varied by project, records of caribou remains were not collected in a consistent manner among all study areas. While taphonomy was not initially a focus of any of the studies, we still believe the data presented here will provide zooarchaeologists with some new insights into selected taphonomic processes.

## STUDY AREAS AND METHODS

Information was collected from three different study areas. The first was the northern foothills of the eastern Brooks Range, from the Canning River east to Peters-Schrader Lakes (Magoun 1976). The purpose of the study was to document the behavior of scavengers feeding on ungulate carcasses in general, and caribou carcasses in particular. Fieldwork was conducted during the summer when small, scattered groups of caribou resided in the area. Observations were made at 11 caribou carcass sites; remains were usually recorded within 10 days of when the carcasses became available. Most carcasses were established by shooting a single caribou. Nearby, a station for observation of the carcass was established. We did not approach or handle these carcasses. Another researcher who had collected them for a study of parasites and diseases provided two carcasses. These were placed at an observation site by helicopter and had human scent on them, delaying utilization by wolves (*Canis lupus*) but not bears (*Ursus* sp.). The carcasses were observed sequentially, and the carcass sites were separated by at least 2 km. All carcasses were continuously observed until scavengers had removed most of the meat.

The second study area was in the central Alaska Range, in the northern foothills and upper Nenana River drainage (Valkenburg et al. 1996). Two different studies were conducted in this area. The first was a study of wolf predation in March 1989 when 10,700 caribou resided in the area. The second was a study of caribou calf mortality in May 1995 when 4500 caribou were present.

In the first study, radio-collared wolves were tracked daily to caribou kill sites. Other predators and scavengers were sometimes observed near the carcasses. In the second study,

radio-collared caribou calves were radio-tracked daily until they were found dead. Predators and scavengers were usually not present when the carcasses were located. Most carcasses were examined and documented for evidence of predators and scavengers (tracks, scats, hair, etc.). Remains of carcasses were generally recorded within 10 days after the caribou died, with many recorded within the first three days after death.

The third study area was in the northern foothills of the western Brooks Range, along the Utukok River drainage (Magoun 1985). This study was an investigation of wolverine (*Gulo gulo*) ecology conducted coincidentally with wolf, grizzly bear (*Ursus arctos*), and caribou studies. About 200,000 caribou migrate through this area in the spring, with smaller numbers moving through in the fall. No caribou were in the area in winter during the study period. Remains of caribou scavenged by wolverines were recorded from February to November. Remains were found by radiotracking wolverines or visiting den sites. Other predators had already fed on most carcasses before the wolverines found them.

## RESULTS

The species we documented using caribou carcasses included grizzly bears, wolves, wolverines, coyotes (*Canis latrans*), red foxes (*Vulpes fulva*), ground squirrels (*Spermophilus parryi*), golden eagles (*Aquila chrysaetos*), ravens (*Corvus corax*), gulls (*Larus* sp.), jaegers (*Stercorarius* sp.), and gray jays (*Perisoreus canadensis*). Most of our comments here pertain to wolves, grizzly bears, and wolverines. Birds and smaller mammalian scavengers are capable of removing all of the meat from caribou carcasses, and even from portions of some bones. However, the three largest carnivores, wolves, bears and wolverines, were primarily responsible for utilizing caribou carcasses and/or scattering bones during the periods of observation.

Data on bones found at the carcass sites are presented in two categories: intact and fragmented (Tables 1-5). By intact, we mean the skull was largely in one piece, although the lower jaws may have been detached; the leg bones were largely intact, though ends may have been chewed and hooves removed; large sections of the vertebral column were still present; the rib cage was still mostly intact, though a few ribs may have been missing or tips of the ribs were chewed off; the pelvis was still intact; and meat may or may not have been left on the carcass.

Fragmented bones included pieces of the skull; lower jaws separated and the ends chewed; leg bones cracked and in pieces; vertebral columns disjointed and in small pieces; scapula separated from the rest of the leg and chewed on; pelvis in pieces; bone fragments; and pieces of the hooves.

INTACT										
PREDATOR	CARCASS NUMBER	LEGS	SKULL	VERT	RIBS	PELVIS	MEAT			
Bears	C8	x								
	C49	x								
	C52	x								
	C53	x								
Wolves (no bears)	C2	x								
	C3	x								
	C6	x					x			
	C12						x			
	C14	x								
	C17	x		x						
	C18	x				x				
	C19	x		x						
	C23			x						
	C25	x								
	C27	x								
	C28	x		x						
	C31	x								
	C33			x						
	C34	x								
	C35	x		x						
	C36	x					x			
	C38	x		x			x			
	C40	x					x			
	C41	x			x		x			
C42	x					x				
C43	x		x			x				
C44	x			x		x				
							x			
							x			
FRAGMENTED										
PREDATOR	CARCASS NUMBER	LEGS	SKULL	JAW	VERT	RIBS	SCAP	PELV	BONE FRAGS	HOOF PIECES
Bears	C1		x	x						
	C7			x						
	C8									
	C13		x	x						
	C15								x	
	C16									x
	C20								x	
	C24								x	
	C45	x			x		x		x	
	C47	x		x		x	x			x
	C48	x			x	x	x			
	C49							x		
	C52					x	x			
C53					x	x				
C3			x		x		x	x		
Wolves (no bears)	C6		x							
	C11									
	C12		x			x				
	C14		x						x	
	C17					x				
	C18		x							
	C19									
	C21		x							
	C27				x					
	C29				x					
	C30						x			
	C31				x					
	C32				x		x			x
	C34				x					
	C36				x					
	C37				x					
	C39				x		x			
C41				x			x			
C42				x						
C44				x						

Table 1. Remains of caribou carcasses fed on by bears, and by wolves but not bears.

## Bears

The presence of bears at the carcass site influenced the degree to which carcasses were utilized, with bears utilizing far more of the carcasses than did wolves over the same time period. We examined 14 carcasses that were visited by bears and 30 carcasses that were not visited by bears (Table 1).

Of carcasses visited by bears, only 11% of the remains were considered intact compared to 63% at carcasses visited by wolves but not by bears. Leg bones were intact at 29% of carcasses fed on by bears and at 67% of carcasses fed on by wolves but not bears. No skulls or pelvises were intact at sites where bears had been. Of carcasses fed on by wolves but not bears, 27% had the skull intact and 23% had the pelvis intact. An adult caribou carcass fed on by two wolves over a three-day period in summer had forelegs and hind legs still present, as well as the rib cage and vertebral column. Most of the meat was gone. On the fourth day a bear arrived; when this carcass was checked on the fifth day, a scapula was the only intact bone left at the site. A few small bone fragments were the only remains left at the site a month later.

## Number of Wolves

We compared the remains at carcasses that were visited by < four wolves and >11 wolves (Table 2). The number of wolves at a carcass did not appear to affect the type of remains found except for a higher number of intact pelvic girdles at carcasses with <4 wolves present. Over the period of observation, the utilization of carcasses by wolves, regardless of the number in the pack, was similar. This is probably because wolves move on to make other kills when most of the meat has been removed from the carcasses. When prey is scarce, utilization may be higher, especially over long periods of time as wolves are known to revisit kill sites repeatedly over a number of months.

## Utilization of Carcasses

Carcasses that were not visited by bears were examined to determine if the number of days of carcass availability affected the utilization pattern of the carcass (Table 3). More leg bones were present and intact after only four days compared to periods > eight days. Rib cages were also more intact. Meat might still be present, but wolves appeared to lose interest in carcasses after about four days. Of course the particular scavengers present at the carcass influence the level of utilization over time. For 10 days one carcass site was visited only by birds (golden eagles, jaegers, gulls, and ravens); all bones were still present at the end of this period except for the tips of the ribs, and the skeleton remained largely intact though most of the meat was gone. Smaller scavengers such as foxes and birds rely on larger carnivores to open adult caribou carcasses (Magoun 1976). When large carnivores are not present, carcasses remain intact for long periods of time.

## Size of the Carcass

We compared the difference in remains at sites where wolves had killed or scavenged adult caribou to sites of newborn calf caribou (Table 4). The remains are surprisingly similar despite differences in carcass size. There were more intact pelvic girdles at the adult caribou sites than at calf sites, but many of the other calf bones remained intact. More calf skull fragments remained than adult skull fragments; either the entire adult skull was removed from the site or the skull remained intact. Because wolves sometimes killed more than one calf caribou over a short period of time, some calves were not eaten by the wolves at all; some were eaten by scavengers, including bears, while the wolves cached others by burying them whole in moss or mud.

There were clear differences in remains at sites where bears fed on adult caribou versus calf caribou (Table 5). There were more intact or fractured leg bones at sites where bears fed on adult caribou rather than on calf caribou. Ribs, scapula, or pelvis pieces were also more commonly found at sites where bears fed on adult caribou. Bears consumed many of the calf caribou bones leaving, if anything, only small fragments of bone or pieces of hooves.

## SEASON AND AVAILABILITY

### Winter

Carcasses that become available in winter generally take longer to disappear than those available in summer. In winter bears are hibernating and meat freezes hard making it difficult for scavengers to dismember the carcass. If prey are readily available, wolves will make fresh kills rather than utilize frozen carcasses. Many of the bones remain at carcass sites for much of the winter, slowly disappearing through the following spring and summer. However, in areas where wolverines are common and food is limited, frozen carcasses will be heavily utilized because wolverines are able to dismember frozen carcasses. Like wolves, if additional carcasses become available, wolverines abandon the older carcasses to feed on fresher kills, periodically returning to the older carcasses through the winter as conditions and need warrant.

### Summer

Carcasses, which become available in the summer, usually disappear rapidly if carnivores are common in the area. In particular bears cause carcasses to disappear quickly. Carcasses may remain intact for relatively long periods if caribou availability is high, such as on calving grounds, or along the migration routes of large herds. Furthermore, we have observed breeding wolverines pass up fresh caribou kills during the summer, and even breeding bears sometimes leave carcasses before they are fully utilized.

During the denning period, scavengers may more fully utilize carcasses because they need additional food for their offspring. For example, in summer we observed denning wolves repeatedly return to a carcass to feed, cache meat, and to carry off bones to a den site. Wolverines are believed to cache more carcass parts before and during cub rearing in

INTACT										
PREDATOR	CARCASS NUMBER	LEGS	SKULL	VERT	RIBS	PELV	MEAT			
Wolves ≥12	C27	x								
	C38	x	x					x		
	C44	x			x	x				
Wolves ≤4	C28	x	x							
	C31	x								x
	C33		x							
	C34	x						x		
	C35	x	x					x		
	C36	x								
	C40	x			x				x	
	C41	x							x	
C42	x							x		
C43	x		x			x		x	x	
FRAGMENTED										
PREDATOR	CARCASS NUMBER	LEGS	SKULL	JAW	VERT	RIBS	SCAP	PELV	BONE FRAGS	HOOF PIECES
Wolves ≥12	C27			x						
	C32			x		x				
	C38			x						
	C44			x						
Wolves ≤4	C29			x						
	C30					x				x
	C31			x						
	C34			x						
	C36			x						
	C37			x						
	C39			x		x	x			
	C41			x						
C42			x							

Table 2. Remains of caribou carcasses fed on by ≤4 wolves and ≥12 wolves.

INTACT										
PREDATOR	CARCASS NUMBER	LEGS	SKULL	VERT	RIBS	PELV	MEAT			
Scavengers ≤4 days	C27	x								
	C28	x	x							
	C31	x								x
	C36	x								
	C38	x		x				x		
	C43	x		x			x	x		x
Scavengers ≥8 days	C44	x			x	x				
	C33			x						
	C34	x						x		
C40	x			x				x		
FRAGMENTED										
PREDATOR	CARCASS NUMBER	LEGS	SKULL	JAW	VERT	RIBS	SCAP	PELV	BONE FRAGS	HOOF PIECES
Scavengers ≤4 days	C27			x						
	C29			x						
	C30					x				x
	C31			x						
	C36			x						
C38			x							
Scavengers ≥8 days	C32			x		x				
	C34			x						
	C39			x		x	x			

Table 3. Remains of caribou carcasses fed on by scavengers ≤4 days and ≥8 days.

INTACT										
CARIBOU	CARCASS NUMBER	LEGS	SKULL	VERT	RIBS	PELV	MEAT			
Calves	C2	x								
	C3	x								
	C6	x				x				
	C11	x					x			
	C12	x								
	C14	x		x						
	C17	x								
	C18	x		x					x	
	C21			x						
C23	x									
Adults	C27	x								
	C28	x		x						
	C31	x								x
	C33			x						
	C34	x						x		
	C35	x		x				x		
	C36	x								
	C38	x		x				x		
	C40	x			x			x		
	C41	x						x		
	C42	x						x		
C43	x		x			x	x		x	
FRAGMENTED										
PREDATOR	CARCASS NUMBER	LEGS	SKULL	JAW	VERT	RIBS	SCAP	PELV	BONE FRAGS	HOOF PIECES
Calves	C3		x		x					
	C6		x		x					
	C11		x		x				11	
	C12		x							
	C17		x							
C19		x							x	
Adults	C27			x						
	C29			x						
	C30						x			x
	C31			x						
	C32			x			x			
	C34			x						
	C36			x						
	C37			x						
	C39			x			x	x		
	C41			x						
C42			x							

Table 4. Remains of adult and newborn calf caribou carcasses fed on by scavengers other than bears.

INTACT										
CARIBOU	CARCASS NUMBER	LEGS	SKULL	VERT	RIBS	PELV	MEAT			
Calves	C8	x								
Adult	C48	x								
	C49	x								
	C52	x								
	C53	x								
FRAGMENTED										
	CARCASS NUMBER	LEGS	SKULL	JAW	VERT	RIBS	SCAP	PELV	BONE FRAGS	HOOF PIECES
Calves	C1		x	x						
	C7			x						
	C8								x	
	C13		x	x						x
	C15								x	
	C16								x	
	C20								x	
Adult	C24									x
	C45	x		x		x	x			
	C47	x	x		x	x	x			
	C48			x	x	x	x			
	C49									
	C52				x	x		x		
C53				x	x	x				

Table 5. Remains of adult and calf caribou carcasses fed on by bears and other scavengers.

late winter and spring (Landa et al. 1997). We also observed wolverines storing caribou bones by burying them in the tundra or by hiding them under remnant snowdrifts during early summer.

Occasionally, a large number of caribou will die within a relatively small area. In 1994 there was a winter die-off on the north slope of Alaska near Cape Thompson. The caribou carcasses disappeared slowly with numerous remains still evident in the area two years later. The sheer number of carcasses probably overwhelmed the capability of scavengers to rapidly dispose of them.

#### Location and Scavenger Community

The location of a carcass may affect the length of time it lasts and the final disposition of the bones. In areas where bears are numerous, carcasses will generally disappear more rapidly than in areas where bears are scarce. In locations where wolverines are relatively common but where winter food sources are limited, many caribou bones will be fully utilized. For example, in the western Brooks Range study area where wolverines were common and large ungulates were absent in winter, wolverines consumed most of the remains of caribou carcasses over the winter, including most bones that remained from the spring and fall caribou migration through the area (Magoun 1985). They also fed on carcasses during summer. In contrast, wolverines did not visit any carcasses in summer in the eastern Brooks Range during our study. We found old caribou bones lying on the tundra after the winter season more commonly in this area than in the western Brooks Range.

#### SUMMARY

During four wildlife field studies in Interior and northern Alaska, we recorded the remains of caribou carcasses that had been fed on by predators and scavengers. Most of the information was gathered within 10 days of a carcass becoming available. The factors, which influenced the pattern and rate of disappearance of caribou carcass parts, included the community of carnivores in the area, the number of carcasses that were available, the length of time scavengers fed on the carcasses, the carcass size, and the season in which the carcass became available. The scavengers most efficient at removing bones from carcass sites were bears, wolves, and wolverines. When bears were present, carcasses disappeared more quickly and more completely than when bears were absent. Wolves rarely fed on carcasses for more than four consecutive days, preferring to make new kills rather than to return to carcasses on which little meat remained. Wolverines were capable of utilizing all the bones of a carcass over the winter if food was scarce.

Though taphonomy was not the focus of these field studies, useful taphonomic data was collected. Zooarchaeologists interested in taphonomy could benefit from information gathered by wildlife field biologists, who could provide even better data if co-operative studies were designed before fieldwork was conducted.

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2001