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Pronghorn and Bison Procurement During the Uinta Phase in Southwest Wyoming: A Case Study from Site 48SW270

Craig S. Smith and Lance M. McNees

ABSTRACT

The dramatic bonebeds occasionally uncovered in southwest Wyoming have strongly influenced perceptions of pronghorn procurement in the region during prehistoric times. However, they provide a misleading picture of the typical pattern of pronghorn procurement. Pronghorn bonebeds are generally rare and many may even represent a number of kill events. More typically, the prehistoric hunter-gatherers probably pursued and killed single pronghorn non-communally, often interchangeably with bison when available. The remains recovered from 48SW270 dating to the Uinta phase exemplify these procurement practices. The hunter-gatherers at 48SW270 intensively butchered at least two, and probably three, bison and at least two pronghorn in the late fall and spring during repeated visits to the site. The butchering took place in an area adjacent to the habitation structure. The hunter-gatherers brought the entire animals back to the site for extensive processing, which included bone marrow extraction and bone grease production. The prehistoric inhabitants were probably operating under stress conditions.

Keywords: pronghorn; southwest Wyoming; Uinta phase; bone grease; hunter-gatherers.

Pronghorn were an important resource for the prehistoric hunter-gatherers of southwest Wyoming. Sites providing dramatic evidence of pronghorn utilization include the 5800 year old Trapper's Point site, the Austin Wash site dating to 1187 radiocarbon years before present (RCYBP), and later sites such as Firehole Basin (628 RCYBP), Eden Farson (230 RCYBP), Gailiun (150 RCYBP), and Boar's Tusk (100 RCYBP) (Frison 1971: Schroedl 1985; Lubinski 1997; Miller et al. 1999). Many of these sites contain remains of mass kills or at least multiple kills of pronghorn during the fall or winter. Based on the presence of several possible mass kills during the last 700 years in southwest Wyoming, intensification of pronghorn use has been suggested for this period (Lubinski 1997). A survey of excavated sites in southwest Wyoming, however, emphasizes that pronghorn mass kill sites or large pronghorn bonebeds are quite rare in the archaeological record (Lubinski 2000). Data from most sites paint a less spectacular picture of prehistoric pronghorn exploitation than is shown by the more exciting sites.

The archaeological record of southwest Wyoming suggests that a more typical pattern of pronghorn use involved hunting individual pronghorn as part of a more generalized animal procurement strategy. In addition to pronghorn, this strategy also included most prominently the use of bison, as well as smaller animals, such as jackrabbit and cottontail. Small quantities of highly fragmented bone from one to a few large (larger than deer) and/or medium mammals (deer to larger than coyote), generally bison and pronghorn, typify excavated hunter-gatherer campsites in southwest Wyoming. In many cases, both species are represented. Out of a sample of 25 archaeological components post-dating 3000 years ago investigated for the Black Butte Mine project on the eastern slope of the Rock Springs Uplift, 11 com-

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ponents had both bison and pronghorn bone, eight contained only bison bone, three yielded only pronghorn bone, and only three lacked both identified bison or pronghorn bone (McNees et al. 1992) (Figure 1). Conversely, no more than three individual bison or pronghorn are indicated in any of these components, and in most instances, only single individuals of one or both species appear to be represented.

Similar patterns are indicated at other sites throughout the region, particularly with regard to the Uinta phase, which dated approximately 1800 to 1000 years ago. This period has the most excavated sites in southwest Wyoming, probably brackets the greatest prehistoric population as evidenced by the overwhelmingly large number of radiocarbon dates compared to other periods (although this increase of radiocarbon dates may also be a function of a different subsistence and settlement orientation), and marks significant technological and organizational changes. Most typical excavated Uinta phase campsites in the Wyoming Basin of southwest Wyoming reflect the exploitation of a broad range of animal species including pronghorn in limited numbers. Obtaining a clearer understanding of pronghorn use during the Uinta phase thus will allow a better delineation of the lifeways of the prehistoric hunter-gatherers. A review of the species composition of identified bone at a few select Uinta phase sites illustrates these subsistence practices.

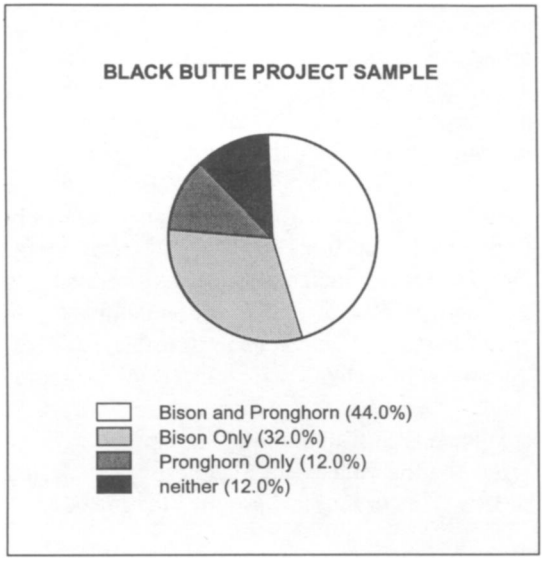

Figure 1. Percentage of components less than 3000 years old (n=25) containing pronghorn and/or bison, Black Butte Project sample.

SPECIES COMPOSITION AT UINTA PHASE SITES

Pronghorn and bison, as well as small mammals, played a significant role in the subsistence of the prehistoric hunter-gatherers of southwest Wyoming during the Uinta phase. Most sites display a broad, but limited, use of these species. A selection of excavated Uinta phase sites—Buffalo Hump (Harrell 1989), Taliaferro (Smith and Creasman 1988), Bessie Bottom (McKern 1988), Austin Wash (Schroedl 1985), and Pescadero (McKibbin 1995)—typify these patterns of animal species use in southwest Wyoming (Figure 2). Most other Uinta phase sites exhibit similar patterns, although many sites yield only limited, fragmentary collections (Lubinski 2000).

Sites in southwest Wyoming with evidence for an emphasis on a single species during this period are relatively rare. They include the Austin Wash site (Reiss and Walker 1982; Schroedl 1985) and Oyster Ridge site (Zier 1982) for pronghorn, and the Inman Buffalo site (Latady et al. 1996), Barnes site (McKern 1995), and Wardell site (Frison 1973) for bison. Although bison was often the primary focus at many sites on the northwestern Plains grasslands outside of southwest Wyoming, remains of pronghorn usually occur only in mixed assemblages with many other species (Davis and Fisher 1990). Among the few sites where pronghorn dominate are Lost Terrace (Davis and Fisher 1988, 1990) and two sites (39FA23 and 39FA83) in the Angostura Reservoir area of South Dakota (White 1952; Wheeler 1995); however, even at the two Angostura sites bison remains are still a component of the bone collections.

The percentage plots of the identified specimens for the different animal taxa from select excavated Uinta phase sites reveal several patterns (Figure 3). First, pronghorn was only one of many taxa that constituted the broad diet of the prehistoric inhabitants. Bison is represented at least as often as pronghorn, suggesting that the prehistoric hunter-gatherers interchangeably took these two large mammals depending on their availability.

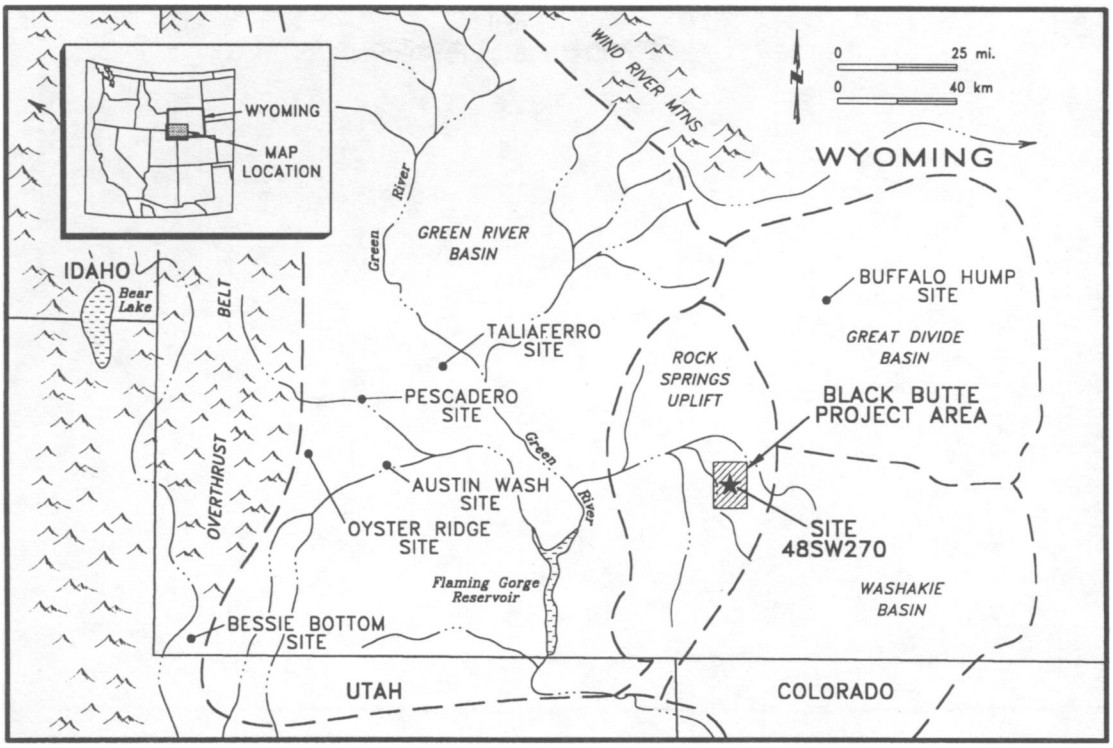

Figure 2. Location of 48SW270 and other select sites in the Wyoming Basin of southwest Wyoming.

Second, small mammals, especially rabbits, form an important component of the total recovered bone specimens identified at some sites. The prehistoric hunter-gatherers probably opportunistically captured these small mammals as they were encountered near the camps. The use of the small mammals may indicate that larger mammals were rare in the environment in the vicinity of certain sites. Third, the majority of the specimens in the assemblages were fragments that could be classified only to general size class at best or were unidentifiable. Many of these unidentified fragments were from bison- or pronghorn-size animals, and bone from large mammals wasusually more fragmentary than that from smaller mammals. The plots do not contain these specimens. This consequently underestimates the relative proportion of specimens from larger mammals.

The two Uinta phase components at the Buffalo Hump site contained only eight specimens identifiable as bison and one specimen classifiable as pronghorn (Harrell 1989). Other species identified in small numbers were coyote or dog (five specimens), bobcat (eight specimens), badger (10 specimens), and jackrabbit (48 specimens). However, 1003 specimens (82% of collection) were classified as large or large-to-medium mammal, indicating the important role of bison and pronghorn at the site.

Analysis of animal remains from the Taliaferro site revealed similar patterns (Smith and Creasman 1988). The four Uinta phase components had small numbers of identified pronghorn bone. Only two of the components had identified bison bone. Other identified species included jackrabbit, cottontail, muskrat, prairie dog, ground squirrel, vole, fish, and bird. More than 50% of the bone from most of the four components was classified as large or large-to-medium mammal, again attesting to the importance of both bison and pronghorn at Uinta phase sites.

Animal bone assemblages from the Bessie

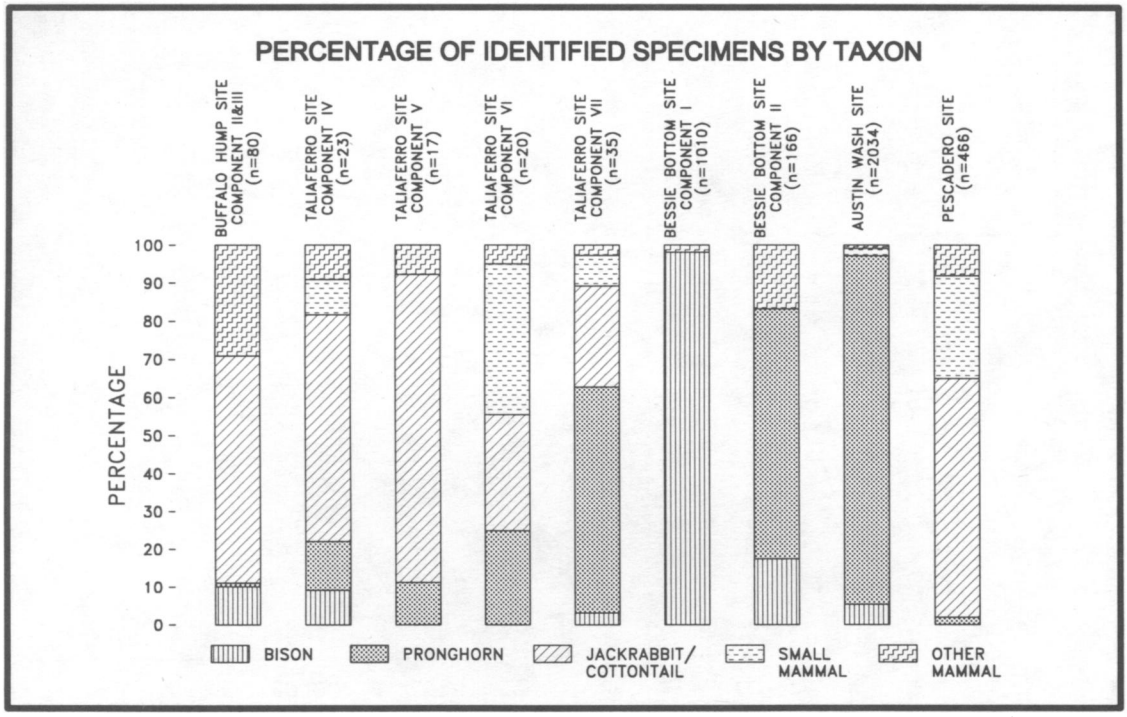

Figure 3. Percentage of identified specimens by taxon for select sites, southwest Wyoming.

Bottom site demonstrate the interchangeable role the two large mammals had in the Uinta phase forager diet (McKern 1988). The older component, Component 1, dating to 1170 RCYBP contained 991 bison specimens representing at least four individuals, with no pronghorn bone. In contrast, Component 2, dating to 910 RCYBP, yielded 110 pronghorn specimens classified as two individuals and 28 bison bone specimens representing one individual. A few small animal species were also represented in limited numbers in both components. Apparently, bison were common in the vicinity of the site during the occupations represented by Component 1. During the Component 2 occupations bison either were rarer or pronghorn were more common and easier to obtain.

Even at the Austin Wash site, the major Uinta phase pronghorn bonebed, the prehistoric inhabitants processed bison along with limited numbers of smaller species (Schroedl 1985). The excavations recovered 1880 pronghorn bone specimens and 9208 specimens identified as pronghorn-size mammal representing at least 15 individuals. The excavations also yielded 99 bison bone specimens classified as two individuals. Other species included jackrabbit, cottontail, prairie dog, ground squirrel, pocket gopher, and vole.

Although containing some identified pronghorn and bison specimens, a few sites such as the Pescadero site reveal more of a focus on smaller mammals (McKibbin 1995). Identified jackrabbit bone made up over 37% (186 specimens) of the mammal bone, and cottontail was over 21% (108 specimens). Ten additional small mammal species were also identified, as well as fish and bird.

These patterns suggest that the prehistoric inhabitants of southwest Wyoming during the Uinta phase pursued a strategy that involved the repeated hunting of individual large and medium mammals, complemented by the procurement of smaller animals, rather than more intensive procurement of large numbers of animals of a single species at one time. Bison and pronghorn were the most important large animal species obtained, both in terms of frequency and probable contri-

bution to the diet, at least in the semiarid interior basin ecological zones typically investigated in southwest Wyoming. This strategy of hunting and intensively processing individual animals was repeated from campsite to campsite. The results of block excavations at 48SW270 exemplify these patterns and provide an excellent opportunity to examine prehistoric hunter-gatherer use of pronghorn and bison at a residential camp dating to the Uinta phase of southwest Wyoming.

48SW270 OVERVIEW

Site 48SW270 is a large site complex on the face of a broad, open, gently undulating dip slope west of Bitter Creek, a major perennial drainage on the eastern side of the Rock Springs Uplift (Figure 2). It is associated with extensive deep dunal deposits on a residual sandstone surface (McNees et al. 1992; Smith et al. 1995). The area is characterized by parallel dissected cuesta ridges. Black Buttes, the dominant feature in the area, is west of the site. Sagebrush and rabbitbrush dominate the vegetation at the site. The understory includes grasses and forbs. Several ecological zones are located near the site, including juniper and occasionally pine on the higher ridges to the west and southwest.

The investigated portion of the site is at 2133 m in elevation within a small interdunal basin entirely ringed by a series of sand dunes. An 88 m^2 block was excavated on a bench of aeolian deposits within the interdunal basin. It encompassed a buried stone circle and exterior activity areas (Smith et al. 1995). Radiocarbon ages from the component are 1210 ± 90 (Beta-38306), 1400 ± 80 (Beta-41851), and 1460 ± 90 (Beta-41850) RCBYP, dating it to the Uinta phase. The cultural remains occurred in aeolian deposits at about 25-30 cm below surface. They included the stone circle, eight additional features, 3236 pieces of heat-altered rock, 60 flaked stone tools, one core, 6483 pieces of debitage, one hammerstone, three pieces of groundstone, two bone tools, 12 pieces of bone tube manufacture debris, and 9098 bone specimens.

The buried stone circle, the major feature in the excavated area, consisted of approximately 28 sandstone slabs arranged in a horseshoe-shaped pattern. Its interior dimensions were approximately 1.9 x 2.2 m. It was probably the remains of a small hide- or brush-covered habitation shelter located on the lee side of the dune. The alignment of the rocks indicates that its opening faced southeast, away from the prevailing winds. The remains of the central, domestic hearth (Feature 12) occurred just in front of the structure opening.

The excavation block contained two distinct areas of cultural activity defined by overlapping concentrations of different classes of remains associated with cultural features (Smith et al. 1995) (Figure 4). One of the areas encompassed the stone circle (Feature 5) and adjacent work areas. This locality containing the stone circle represents a family unit's nuclear use area or household area (Yellen 1977; O'Connell et al. 1991), which included a sheltered sleeping area and a generalized, central domestic work area. The other distinct area was north of the household activity area and was adjacent to the group of basin-shaped features (Features 1, 7, 8, and 9) and included associated concentrations of bone, heat-altered rock, and debitage located in an area of generalized stained sediment. This specialized area was used for activities such as the butchering and processing of animals (Yellen 1977; O'Connell 1987). Other tasks represented in the area included arrowpoint manufacture and bone bead production.

The prehistoric inhabitants occupied the residential camp at least during the late fall (November and December) and the late spring (late April-early June), as indicated by the analysis of the animal remains. Evidence of intensive activities within the sheltered area also suggests a cold weather or winter occupation. Site use may have consisted of a series of short visits throughout the winter and spring or fewer, longer-term occupations over that same time frame. Regardless, the various occupations were at least of sufficient length or intensity to motivate the site inhabitants to clear and remove refuse from within the shelter, as well as for a wide diversity of remains to accumulate at the site. The site area was probably redundantly reused over a period of years, decades, or longer. The presence of a shelter in a relatively protected area would have focused this reuse and made the location an ideal place for repeated occupations.

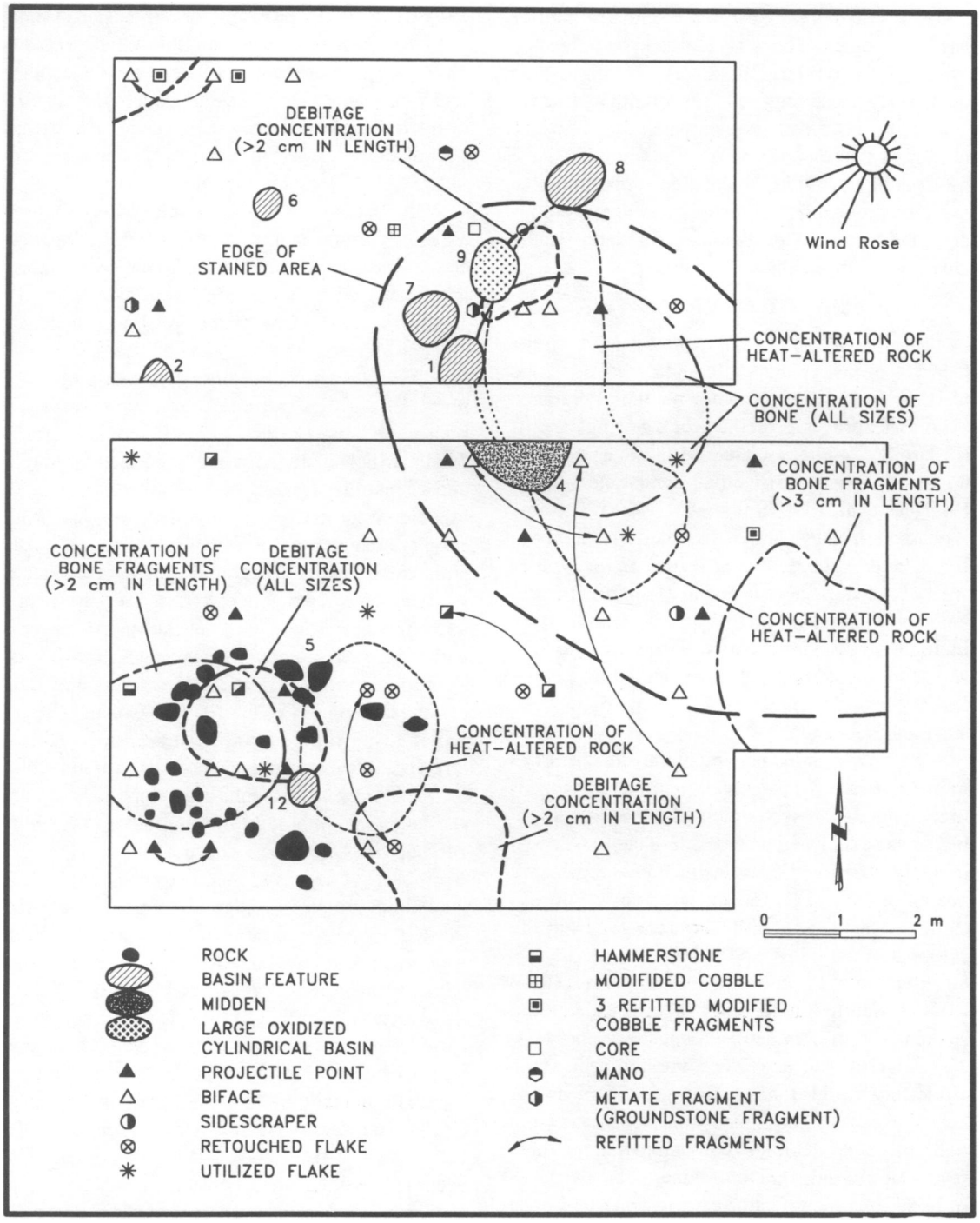

Figure 4. Spatial distribution of remains recovered within excavation block showing the two activity areas, 48SW270.

BONE ASSEMBLAGE

In total, 9098 bone and tooth specimens were recovered during excavations at 48SW270. Of these, 110 very small and small animal specimens were excluded as intrusive. Of the 8988 non-intrusive specimens, 41% were classified as large (larger than deer) or medium (deer to larger than coyote) mammal while only 3.0% were grouped as small (coyote to larger than cottontail) or very small (cottontail and smaller) mammal (Figure 5). Three fragments were identified as bird. The remaining fragments were assignable only to more general animal size taxa, with 24.7% falling within the broad category of small-large mammal and 31.3% being too fragmentary to allow classification to even a general animal size category.

The 41% (3649 specimens) identified as large or medium mammal probably represent bison or pronghorn, which were the only medium and large mammal species identified in the assemblage (Table 1). Of this total, 112 specimens (3.1%) were identified as bison, 61 (1.7%) as bison-size, and 431 (11.8%) as large mammal, for a total of 604 specimens (16.6%) (Figure 5). Nine specimens (0.2%) were classified as pronghorn, eight (0.2%) as pronghorn-size, and 146 (4.0%) as medium mammal, for a total of 163 specimens (4.5%). The remaining 2882 specimens (79.0%) were included in the medium-large mammal category.

The 112 specimens identified as bison incorporated elements from all major skeletal units, including cranial, axial, forelimb, hindlimb, and foot (McNees et al. 1992). Excluding unidentifiable tooth enamel fragments, cranial fragments represent 24.2% of the specimens identified to element, axial fragments total 29.1%, and appendicular elements equal 46.7%. The only complete bone elements were two first phalanges, three second phalanges, two carpals, a tarsal, a sesamoid, and 11 teeth. The few other identified articular end fragments were a proximal and a distal portion of a radius, two metacarpal distal fragments, fragments from a proximal end of a femur and a tibia, a fragment of the distal end of tibia, and two metatarsal distal portions. The sample included 47 specimens classified as long bone shaft fragments and 19 distal ends of phalanges. A left tibia fragment with disarticulation cut marks, and six bone fragments containing green bone breaks provided evidence of bone processing. Additionally, 3.1% of the specimens identified as bison were charred or calcined.

The nine specimens identified as pronghorn, the eight classified as pronghorn-size, and the 146 grouped as medium mammal included cranial fragments, portions of the axial skeleton (vertebra, ribs, pelvis), and portions of the forelimbs. The

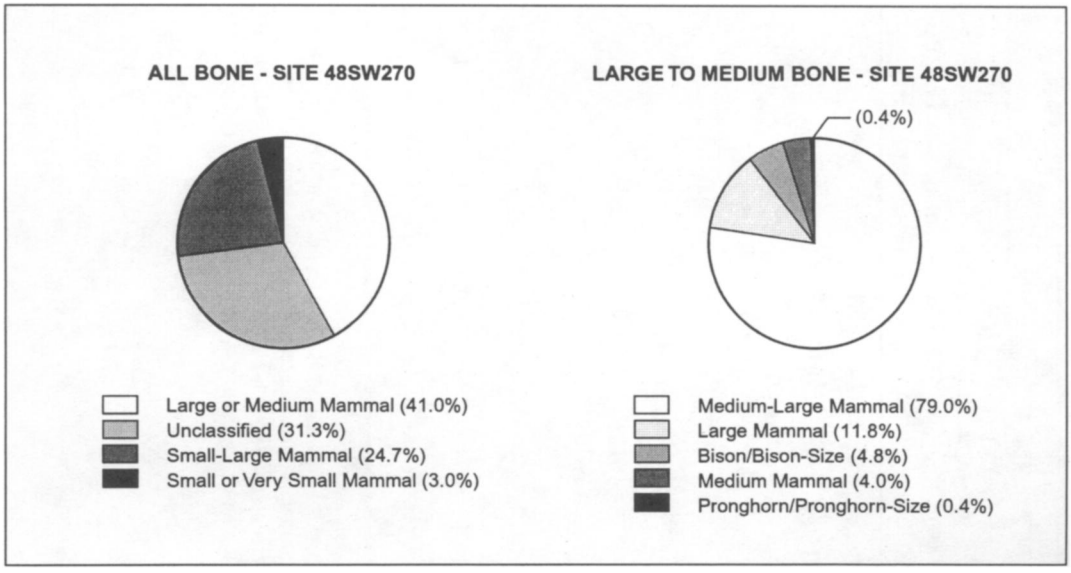

Figure 5. Percentage of all bone by category and percentage of large-to-medium bone by category, 48SW270.

Table 1. Summary of non-intrusive large and medium mammal faunal specimens by taxon and element, Site 48SW270.

	Total		Bone Elements[4]										
Faunal Taxon[1]	No.[2]	%[3]	Bone Fragments	Long Bone Fragments	Cranial	Vertebra	Rib	Pelvis	Forelimb	Hindlimb	Foot	Fetal	Tooth Enamel
Bison	112	3.1		1	38	16	8		10	18	10		11
Bison-size	61	1.7		17	7	10	20		1				6
Lg-m	431	11.8	1	29	4	2	10		1		18		366
	(19)				(1)						(18)		
Md/lg-m	2882	79.0	1434		45	3	147	2	1			6	1244
	(232)		(207)		(3)	(1)	(19)						(2)
Pronghorn	9	0.2			1	3	2	1		2			
Pronghorn-size	8	0.2	5		2							1	
Md-m	146	4.0	62		7	1	55						21
	(26)		(4)				(22)						
Total	649	100.0	1502	47	104	35	242	3	13	20	28	7	1648
	(277)		(211)		(4)	(1)	(41)				(18)		(2)

1 Lg-m = Large mammal (>deer), md-m = medium mammal (deer to >coyote).
2 Numbers in parentheses indicate the number of burned and/or calcined specimens in each category.
3 Percentage of total bone specimens falling into each taxon.
4 Number of specimens identifiable to each element.

only identifiable limb elements were a right metatarsal and a right tibia, although 54 unidentifiable long-bone shaft fragments were also present. Both the metatarsal and the tibia were bone shafts that lacked articular ends. Fifty-two rib fragments, a high density, high utility element, were also included in sample. The only complete element was a vertebra. One long-bone fragment had a cut mark, and the tibia shaft fragment, metatarsal shaft fragment, and one rib fragment exhibited green bone breaks. The cut mark is of a type consistent with fleshing rather than carcass dismemberment. In total 16.5% of the identifiable specimens were charred or calcined.

Represented bison skeletal parts included both high utility (e.g., rib and femur) and low utility (e.g., atlas, axis, metacarpal, metatarsal, phalanx, and astragalus) elements, as well as both high density (e.g., mandible, metacarpal, metatarsal, distal tibia, distal humerus, and distal radius) and low density (e.g., atlas, axis, and sacrum) elements (Binford 1978; Lyman 1985, 1994). Absent in the collection were the high utility and low density pelvis remains. The limited identifiable pronghorn bone also exhibited both low density (e.g., pelvis) and high density (e.g., metatarsal and tibia) elements, as well as low utility (e.g., metatarsal) and high utility (e.g., rib and pelvis) elements (Binford 1978; Lyman 1985, 1994). The distribution of identifiable skeletal elements of both species is more a function of the fragmentary nature of the collection apparently from intensive processing, and less the result of forager transport decisions and differential preservation (Marshall and Pilgram 1991).

Although limited in quantity, bone from a wide range of smaller animal species was used at the site in addition to the large game species. Only 231 non-intrusive small and very small mammal and bird remains were recovered. The sample included jackrabbit or jackrabbit-size (n=3), cottontail (n=60), rabbit-size (n=98), ground squirrel or ground squirrel-size (n=3), vole (n=1), rodent-size (n=16), large bird (n=2), and small bird (n=1). Three cottontail specimens, 30 rabbit and rabbit-size specimens, one ground squirrel-size specimen, one rodent-size specimen, and a bird specimen were burned.

NUMBER OF BISON AND PRONGHORN

Animal age patterning indicates that at least two, and probably three, bison and at least two pronghorn are represented in the 48SW270 assemblage. Two individual bison are indicated by the presence of both a thoracic vertebra of a near-term fetal or newborn individual and a mandibular second molar of an animal 2.0-2.2 years of age. Bison generally breed at an age greater than two years (Clark and Stomberg 1987), suggesting that the newborn or fetal individual and the 2-year-old animal are unrelated. The presence of both a newborn or fetal individual and a 2.0-2.2 year old individual indicates a late spring occupation. Bison normally calve from April to June (Clark and Stomberg 1987), with most calving in April or May (Bamforth 1988). A third individual is also probably represented by seven fragmentary elements of a mature bison (or bison-size mammal), including a maxilla fragment, a right femur fragment, three mandibular molars, and two maxillary premolars or second or third molars.

The age distribution of the elements indicates that the pronghorn and pronghorn-size bone also represent at least two individuals. A thoracic vertebra of a 4- to 7-month-old animal and a tibia and a metatarsal of a 6- to 7-month-old animal were probably from a single immature animal while a lumbar vertebra and a rib were from a fetal or possibly newborn individual (McNees et al. 1992). A mature pronghorn was probably also part of the assemblage, as indicated by the abundance of bone classified as medium mammal. The identification of possible fetal pronghorn bone, which would imply the procurement of an adult pronghorn, also suggests the presence of a mature animal. The presence of the two individuals strongly suggests two different seasons of occupation. The newborn or fetal animal was probably killed in the late spring, the same season indicated by the bison bone. Pronghorn normally give birth from mid-May to early June (Clark and Stromberg 1987). The specimens representing the other individual suggest a late fall (November or December) site occupation. The identifiable bone fragments from that individual were spiral-fractured, suggesting that the presence of the bone at the site was the result of human activity.

HUNTING AND CARCASS TRANSPORT

The presence of remains of possibly three bison and two pronghorn in the butchering area of 48SW270 indicates that the prehistoric site inhabitants hunted both. The hunters probably selected either type depending on what was encountered within the foraging radius from the residential camp. The site inhabitants probably hunted and killed each large mammal as single individuals non-communally. There is no evidence for a mass kill of all the represented mammals during a single incident. The recovered bone may have accumulated over a series of visits and events, as evidenced by the presence of bone from animals that were killed during different seasons. Each animal, then, probably represents separate and distinct search and kill events spanning seasons and perhaps years. The kind of animal taken during each hunt depended on what was encountered.

The hunting radius for the inhabitants of 48SW270 appears to have been the distance that the entire carcass of these large mammals could be economically transported back to camp. The recovery of most skeletal elements from the excavated portion of the site, including both low and high utility elements, suggests that the entire carcasses were carried from the kill location back to the camp for most butchering. According to cost-benefit models, hunters would have transported only those portions of the animal that maximizes net nutritional benefit compared to transport costs. Hunters often initially butcher the animal at the kill location and only carry the high or moderate utility elements (those providing the most meat, marrow, or grease) back to the residential camp for final processing (Binford 1978; Lyman 1994). Ethnographic observations of the Hadza in northern Tanzania indicate that what is brought back to the residential camps is variable and depends on distance to camp, number in carrying party, amount of initial consumption at the kill site, and species of the acquired animal (O'Connell et al. 1988, 1990). Therefore, the kill locations of the large animals represented in the site assemblage were most likely relatively near the camp. Only limited immediate consumption and dismemberment apparently occurred at the kill location. Stressed conditions in the marginal environment also may have motivated the hunter-gatherers to intensively process all elements of any animals procured, necessitating the transport of the entire carcass back to camp regardless of costs.

BONE PROCESSING

After the hunters brought a carcass back to the residential camp, it was intensively processed, especially for bone marrow and grease, in the specialized work area north of the shelter. This area contained concentrations of heat-altered rock, large amounts of fragmented bone, bone dump areas, and hearths and pit features within an area of general charcoal stained sediment measuring approximately 35 m^2. Any bone processing within the household activity area associated with the shelter was probably only for immediate meals. Recovered bone within the interior of the shelter included only fragments less than 2 cm in length. Ethnoarchaeological studies have noted that bone remains from the consumption of meals are often left in the back of the shelter (Bartram et al. 1991).

The sample of medium and large mammal bone displayed a relatively high degree of overall fragmentation (Figure 6). The only complete bison and bison-size large mammal bone elements were two carpals, a tarsal, five phalanges, a sesamoid, and 11 teeth. A single vertebra was the only complete pronghorn and pronghorn-size medium mammal bone element. Even excluding the large number of small and very small unclassifiable bone fragments (55.9% of total sample), nearly 50% of the bison bone specimens were less than 4 cm in length, and more than 84% of the pronghorn remains are less than 3 cm in length. Although some of the bone fragmentation probably resulted from natural forces, much of it appears to be the consequence of intentional bone reduction by the prehistoric hunter-gatherers. Evidence for intensive, deliberate fragmentation comes from the relatively extensive fragmentation of high density bones including phalanges (elements usually preserved complete without intentional breakage), the relative absence of articular ends and articular end fragments (typically the densest portion of an element), bone fragments exhibiting green bone breaks or evidence of burning, and dense concentrations or

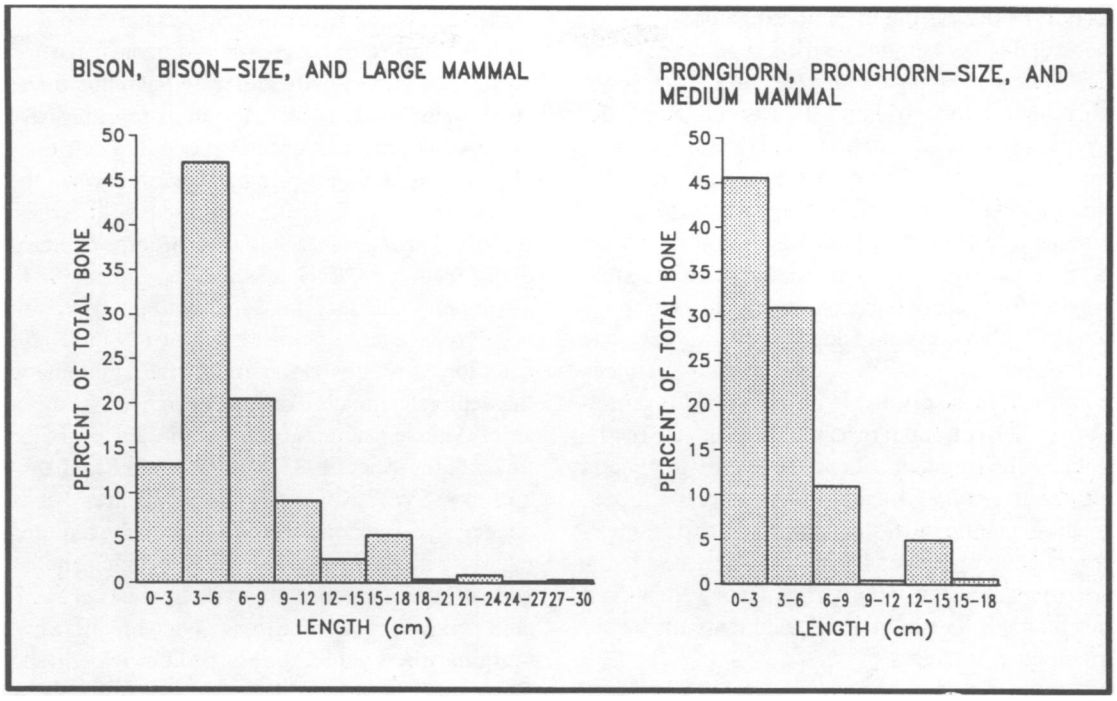

Figure 6. Distribution of fragments by size for large mammal and medium mammal, 48SW270.

dumps of small fragments of pulverized bone.

Bone processing among hunter-gatherer groups typically involved cracking long bones to remove marrow, as evidenced by the presence of large quantities of shaft fragments and other broken elements. At 48SW270, the site inhabitants even applied this procedure to the low utility phalanges that contain only small amounts of marrow; most of the recovered bison phalanges from the site were broken, apparently as a result of the extraction of the marrow. Binford (1978) suggests that the use of such low yield bones as phalanges indicates stress conditions for the forager population. The inhabitants of the Lost Terrace site on the upper Missouri River employed similar drastic efforts following communal pronghorn kills (Davis and Fisher 1990). The Oyster Ridge site, another site in the southwest Wyoming area, also evidences the extensive processing of phalanges of the few pronghorn killed in the late spring (Zier 1982).

Following marrow extraction, the inhabitants of 48SW270 apparently further reduced the fragmented bone to prepare bone grease. The considerable work of rendering bone grease consisted of crushing and pulverizing the bone, boiling the fragments, and skimming off the grease (Leechman 1951; Vehik 1977; Binford 1978; Davis and Fisher 1990). The product was then typically poured into a bladder bag for storage of up to two or three years. Bone was often saved until enough was accumulated to maximize the efficiency of the process, which usually occurred during the winter months (Wilson 1924; Davis and Fisher 1990). Bone grease mixed with fat and berries formed pemmican, a vital food for the inhabitants of the Plains (Reeves 1990). The best grease came from the articular ends of long bones, though other bones such as vertebrae and ribs were also important (Binford 1978). This preferential selection of articular ends may explain the paucity of these elements in the collection from 48SW270.

The large oxidized cylindrical basin (Feature 9) encountered in the specialized work area probably functioned as a hearth for heating rock. Adjacent pits may have been lined with hides and served

as boiling pits during the rendering, the exhausted bone and rocks being discarded in adjacent areas. The bone processing midden (Feature 4) was probably one of those dumps. It was a discrete but irregularly shaped patch of mottled stained sediment and charcoal fragments containing a jumbled mix of 91 pieces of heat-altered sandstone, a tool fragment, 12 pieces of debitage, and 431 bone fragments (Figure 7). The midden area probably originally measured approximately 120 cm in diameter with a maximum depth of 19 cm. The bone specimens within the midden included specimens classified as bison or bison-size (n=16), pronghorn (n=1), cottontail (n=5), and rabbit-size (n=1). Among the fragments identifiable only to general size taxa were 95 medium-large mammal, three medium mammal, 10 small mammal, and 300 very fragmented specimens that could not be identified to mammal size. Forty fragments were burned or calcined, and numerous fragments displayed green bone fractures.

ECONOMIC STRESS

The extensive labor expended in maximizing the use of each procured bison and pronghorn—including hauling the entire animal back to camp, extracting marrow from even the low utility elements, and generating bone grease—indicates that the prehistoric hunter-gatherers were operating under stress conditions. At 48SW270, this stress may have been partly seasonal, occurring over the nutritionally poor winter and spring, the periods when the site was occupied. During this season, the lean bison and pronghorn would have become depleted of fat (Speth 1983, 1987; Speth and Spielmann 1983). To obtain necessary fat, an important source of non-protein energy, prehistoric hunters would have been forced to rely on the limited fat remaining in the depleted animals. The last deposit of fat in severely stressed animals occurs in the marrow of the lower limbs (Speth 1983). The focus of the inhabitants of 48SW270 on bone marrow and grease may have been a desperate effort to acquire the required fat when other sources were unavailable. The ingestion of fat and especially carbohydrates, if available, serves to reduce the loss of body protein when marginal diets include only protein (Speth and Spielmann 1983).

The intensive utilization of carcasses at 48SW270 and other sites in southwest Wyoming, especially during the Uinta phase, was also appar-

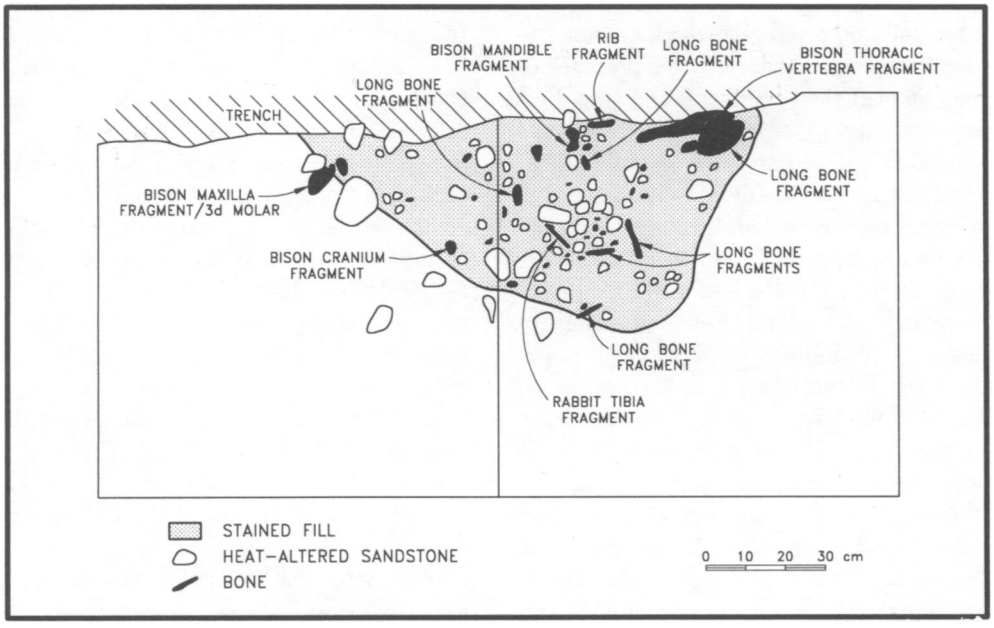

Figure 7. Bone processing midden (Feature 4), 48SW270.

ently more long-term in nature and probably reflected the relatively marginal environment of the high basins of the area. Bone from the preponderance of excavated Uinta phase sites and other sites in southwest Wyoming is highly fragmentary, suggesting intensive processing of pronghorn and bison for marrow and bone grease, regardless of interpreted season of occupation. Some of the bone in this condition may be the result of postdeposition natural agencies; however, the strength and consistency of the pattern, and ancillary evidence of bone processing, strongly suggest that it reflects the standard type of behavior of the Uinta phase and perhaps earlier hunter-gatherers of the region. This behavior apparently applied as much to pronghorn as to bison. A time of drier conditions than present with reduced forage and probably large animals is postulated for the time between 1800 and 1000 years ago, corresponding to the Uinta phase (Eckerle 1997). A shortage of food resources may have forced hunter-gatherer groups to maximally exploit any bison and pronghorn game they happened to kill. An increase in population during this time also may have reduced ranges and available animals.

DISCUSSION

The predominance of bison and pronghorn in regional campsite bone assemblages, as exemplified at 48UT270, indicates that the mobility, hunting strategies, and technologies of the prehistoric inhabitants of the region were geared toward the procurement of individual animals of these two species, especially during the Uinta phase. These two species were probably the predominant large-animal resources present in the catchments exploited by the prehistoric inhabitants of southwest Wyoming, and both appear to have been taken depending on what was available. Incidences of mass kills of large numbers of a single species are rare, at least during the Uinta phase, despite the presence of a few sites with dramatic evidence of such events. Most of the apparent pronghorn mass kills in southwest Wyoming occurred during the past 700 years, well after the Uinta phase (Lubinski 1997).

Heuristic models such as diet breadth provide a means to explore the differential use of various taxa by foragers. Diet breadth models assume that foragers will take more profitable or higher-ranked prey and will ignore unprofitable or low-ranked resources regardless of how common they are in the environment (Simms 1984; Kelly 1995). The use of low-ranked prey, therefore, depends on the abundance of the higher-ranked resources. As abundance decreases and search time increases for higher ranked resources, lower-ranked ones are added to the diet sequentially in order of decreasing rank (Broughton 1994). Researchers usually heuristically rank animals according to their size: the larger the animal, the higher its ranking (Broughton 1995), although transport, final butchering, and distribution costs will result in a rearrangement of these rankings at times (Kornfeld 1994).

Bison ranks the higher of the two large mammals most often used at hunter-gatherer campsites in southwest Wyoming, assuming that body size correlates with rank. According to the diet breadth model, if bison were abundant within the foraging range, bison would be hunted to the exclusion of other, smaller animals, including pronghorn.

The exploitation of both bison and pronghorn at 48SW270 and other sites in southwest Wyoming suggests that bison were rare at times, at least during some of the hunting forays. The diet breadth of the prehistoric inhabitants fluctuated over time, possibly between seasons, alternately expanding and contracting to include and exclude pronghorn. Pronghorn were probably specifically targeted at stands or by using decoys when encounters with bison were unexpected.

Most likely, both mammals were scarce in the environment during the Uinta phase and were taken when encountered. Because of their rarity and probable stress conditions, the hunters processed each animal obtained to the maximum possible extent. Even low utility elements were processed for their bone marrow and grease. Probably in response to these stress conditions, the prehistoric hunter-gatherers also broadened their diet to include lower-ranked resources such as small animals and plants. At some locations, the hunter-gatherers collected large quantities of seeds of weedy species during the fall (Smith 1988), and they probably focused on the baking of roots where available in the spring (Smith et al. 2000). These lower-ranked plant foods served as a means of minimizing risk in the variable environment and in-

creased the diversification of the subsistence base (Halstead and O'Shea 1989; Cashdan 1990). They also provided important nutrients not available from lean meat of large mammals during the winter and early spring (Speth and Spielmann 1983).

The apparent procurement of individual animals, even though both bison and pronghorn were probably usually encountered in groups, suggests that single or small groups of hunters were the typical pattern and that these small groups were able to kill only one or a few animals during any single event. Killing one or a few animals may also have served as a conservation mechanism. Evidence from 48SW270 suggests that single pronghorn were procured in November (when herds are near their maximum size) and in April (when herd size is near its annual minimum), regardless of season and probable herd size (Byers 1997). Either the small prehistoric hunting parties focused on single animals or large herds were not available during this period of reduced forage. However, the seasonal grouping patterns appear to be independent of range conditions (Bayless 1969; Ryder and Irwin 1987; Byers 1997). This suggests that the procurement of individual animals from the herd accounts for the pattern, regardless of whether herds were at seasonally maximal sizes of 30 or more animals or seasonally minimal sizes of nine or fewer animals. Communal hunting of large numbers of animals from a herd during a single event was rare. It is unclear whether exploitation of single animals reflects the technology and organization of the prehistoric groups or possibly a strategy oriented toward conserving the resource base of a marginal context.

One issue that is also typically overlooked in subsistence studies is the possibility that the presence of bison and pronghorn bone at individual campsites may represent the transport of portions of animals from one site to another, and not necessarily the procurement of separate animals at each campsite. During the winter months (a period indicated for the intermittent occupation of 48SW270), limbs or other carcass portions could have been stored frozen and then transported (Morlan 1994). The transport of carcass portions between campsites is indicated by the limited total quantities of bison and pronghorn bone often recovered from excavated Uinta phase sites. The recovered bone usually composes only a small fraction of the total possible skeleton, suggesting that unconsumed parts could have been transported among campsites. If this is the case, the presence of bison and pronghorn bone at any individual campsite may not represent the procurement and consumption of whole animals, but rather the processing of only a portion of a carcass that was stored and transported.

This study concentrated on bison and pronghorn procurement during the 800-year period that corresponds to the Uinta phase. A more diachronic examination of this use may reveal other important patterns that need to be considered. For example, the proportion of archaeological components from the Black Butte project that contained identified pronghorn bone peaked during the period between 3000 and 2000 years ago (Deadman Wash phase) and declined during the last 2000 years (Uinta and Firehole phases) (McNees et al. 1992) (Figure 8). In contrast, the proportion of components with bison steadily increased over the last 3000 years. However, Lubinski's (2000) study using a larger sample from southwest Wyoming indicates that a slightly higher percentage of sites contained bison remains from 3000-2000 years ago compared to 2000-1000 years ago. Both the Black Butte and Lubinski samples provide evidence of a higher percentage of sites with bison remains during the last 1000 years. The last 2000 years of the Black Butte sample also includes deer and mountain sheep remains, perhaps indicating an expansion of diet breadth to include other large and medium mammals.

CONCLUSION

The example of bison and pronghorn use at 48SW270 probably typifies how Uinta phase hunter-gatherers throughout southwest Wyoming exploited these two large species. The hunter-gatherers apparently hunted both bison and pronghorn interchangeably, depending on their availability. Because of their larger size and higher return rates, bison would have been the preferred animal when available. In some cases, when both species were absent in the environment, the prehistoric hunters would have been forced to focus on smaller animals. They probably hunted bison and pronghorn as single animals, while the remains of multiple individuals of each at some sites repre-

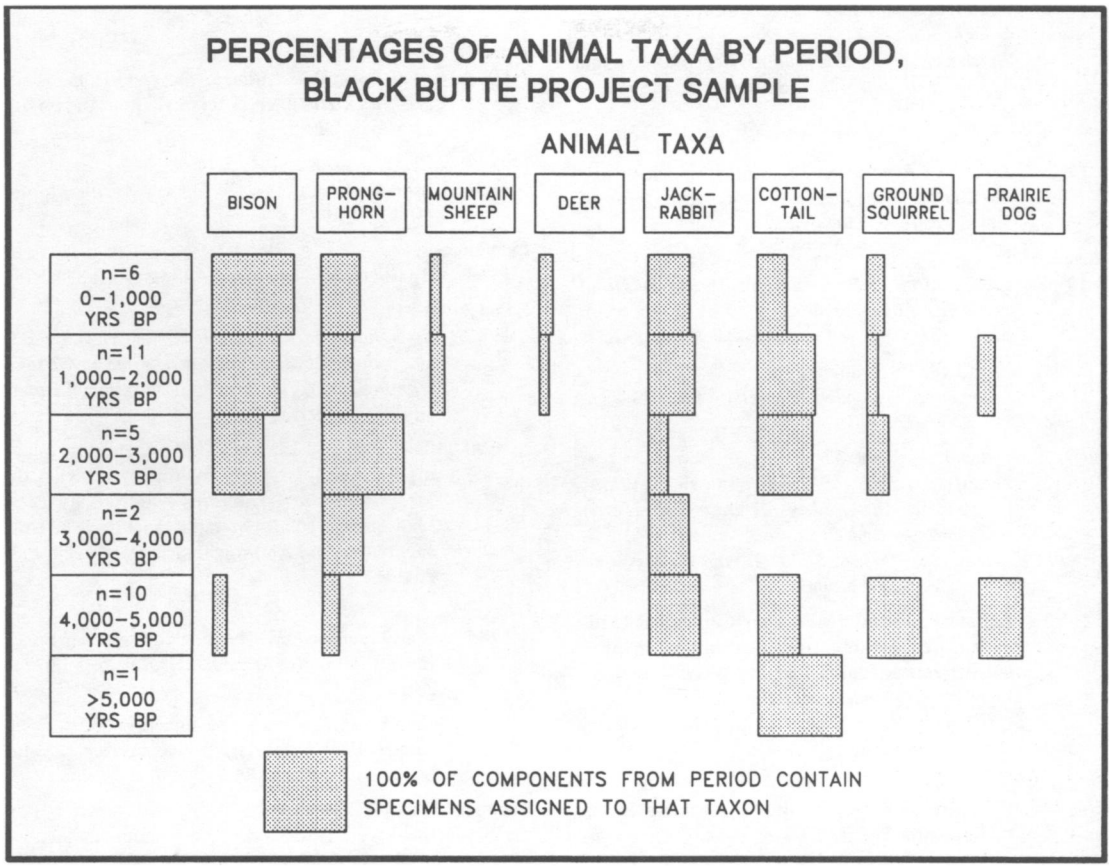

Figure 8. Percentage of components containing each animal taxon by thousand year period, Black Butte Project sample.

sent an accumulation of debris from many events. Many residential camps during the Uinta phase appear to be locations of redundant use where hunter-gatherers regularly returned to intensively process animals and other resources. Larger mass kills of either bison or pronghorn occurred only rarely.

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