University of Nevada, Reno

The *Kammidɨkadɨ* of Little Steamboat Point-1 Rockshelter: Terminal Early Holocene and Early Late Holocene Leporid Processing in Northern Warner Valley, Oregon

A thesis submitted in partial fulfillment of the requirements for the degree of Master of Arts in Anthropology

by

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Dr. Geoffrey M. Smith/Thesis Advisor

May, 2014

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Evan J. Pellegrini

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MASTER OF ARTS

Dr. Geoffrey M. Smith, Advisor

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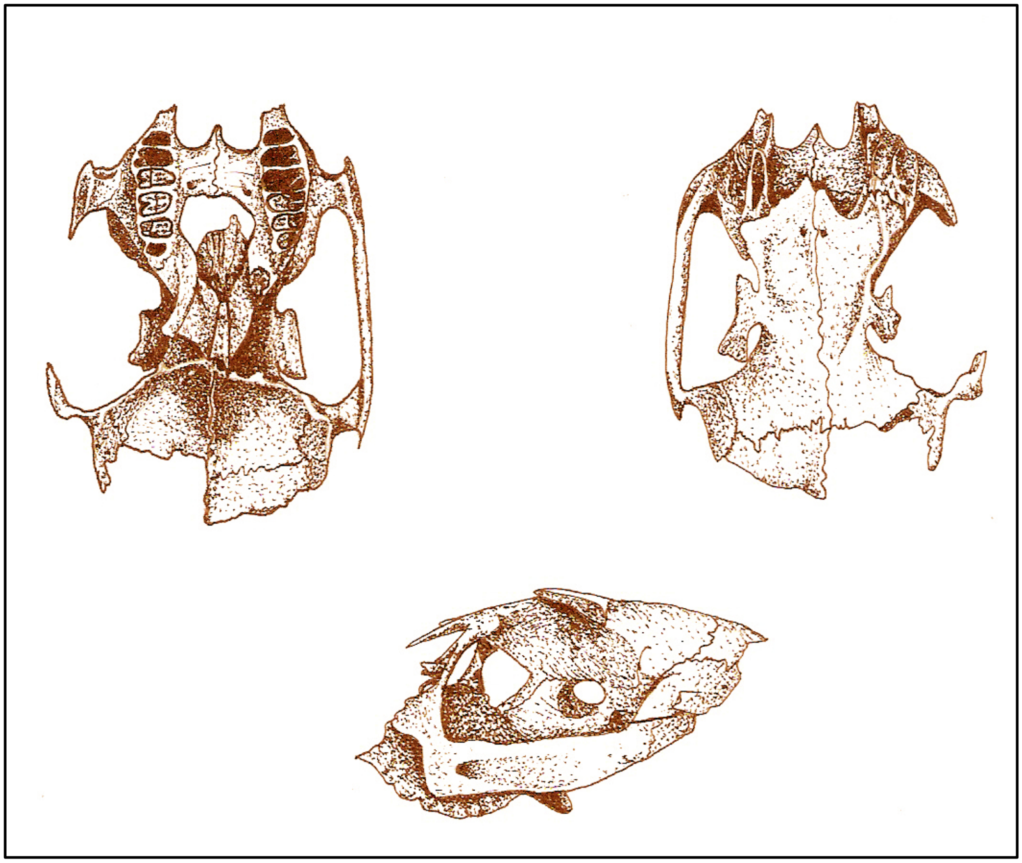
Abstract

The terminal Early Holocene was a time of climatic upheaval in the Great Basin. Archaeofauna from this period are dominated by small game. Many Great Basin sites were abandoned during the Middle Holocene as aridity intensified and human populations focused their settlement systems around remaining sources of water. Following the Middle Holocene, human populations appear to have expanded as conditions improved during the Late Holocene, with many sites being reoccupied after hiatuses.

At the Little Steamboat Point-1 Rockshelter, a stratified site containing terminal Early Holocene and Late Holocene deposits in southern Oregon, an extensive archaeofaunal assemblage has been recovered. The assemblage is composed primarily of leporids, the majority of which are jackrabbits (*Lepus* spp.). The taphonomic analysis presented here strongly suggests that the archaeofauna were deposited by human agents and that the faunal assemblage may represent seasonal usage of the site primarily to hunt leporids.

Dedication

To Marjorie Loraine Glock-Pellegrini



Acknowledgments

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All of the drawings and photographs in this thesis are by Evan Pellegrini. LSP-1 planviews and stratigraphic profiles were rendered by Dr. Geoff Smith.

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Chapter 1: Introduction

The Early Holocene is often characterized as being mesic with foragers utilizing a wide range of food resources with a focus on small game, fish, and insects with large game playing a lesser role in subsistence (Hockett 2007; Jones and Beck 2012; Pinson 2007). The period is regarded by some researchers (e.g., Grayson 2011; Hockett 2007; Pinson 2007) as being “good times” for foragers, as a result of lacustrine and wetland resources fostering an abundance of game. Desertification at the onset of the Middle Holocene ~8,900 calendar years ago (cal B.P.) appears to have prompted lower hunter-gatherer population densities and heavier use of seed resources in the Great Basin, so much so that the period is often characterized as having been “hard times” for foragers (Antevs 1948; Elston 1982; Grayson 2011; Hockett 2007). People remained in the northern Great Basin during this period, although occupations appear to have been short in many locations with groups relocating to reliable water sources (Helzer 2004; Jenkins et al. 2000). Communal hunting, especially mass rabbit drives (likely a result of xeric conditions fostering elevated black-tailed jackrabbit [*Lepus californicus*] populations), became more prevalent in the Great Basin, along with increased artiodactyl hunting at some sites, and intensive seed processing across much of the region (Byers and Broughton 2004; Grayson 2011; Hockett 2007; Hockett et al. 2012; Janetski et al. 2012; Schmitt et al. 2002). The Late Holocene saw a return to more mesic conditions with human populations greatly increasing (Grayson 2011; Louderback et al. 2010). Foragers exploited large game more intensely than during previous periods with small game playing a smaller role in subsistence (Grayson; Hockett 2007; Pinson 2007).

Our understanding of Great Basin prehistory is largely aided by faunal remains from stratified dry caves and rockshelters (Durrant 1970; Grayson 2006a; Hockett 2007; Schmitt and Lupo 2005). Studies of such assemblages are critical to understanding broad trends in human behavior and how such behavior was influenced by climatic shifts. This thesis presents the results of my analysis of a sample of fauna from Little Steamboat Point-1 (LSP-1), a small rockshelter in northern Warner Valley, Oregon (Figure 1.1). LSP-1 contains a well-preserved record of terminal Early Holocene and Late Holocene human behavior including abundant subsistence residues. This dataset is used to address questions about both human behavior (e.g., which taxa humans targeted, how such taxa were processed, during what season the site was occupied, etc.) and the environment (e.g., what the presence/absence of various taxa can tell us about local conditions during the terminal Early Holocene and early Late Holocene). Furthermore, it is used to contribute to broader questions about Great Basin prehistory; for example, does the LSP-1 record support models that portray the onset of the Middle Holocene as "bad times"? In the remainder of this chapter, I outline the natural and cultural history of the Great Basin, with a particular emphasis on the northern part of the region during the onset of the Middle Holocene and initial onset of the Late Holocene.

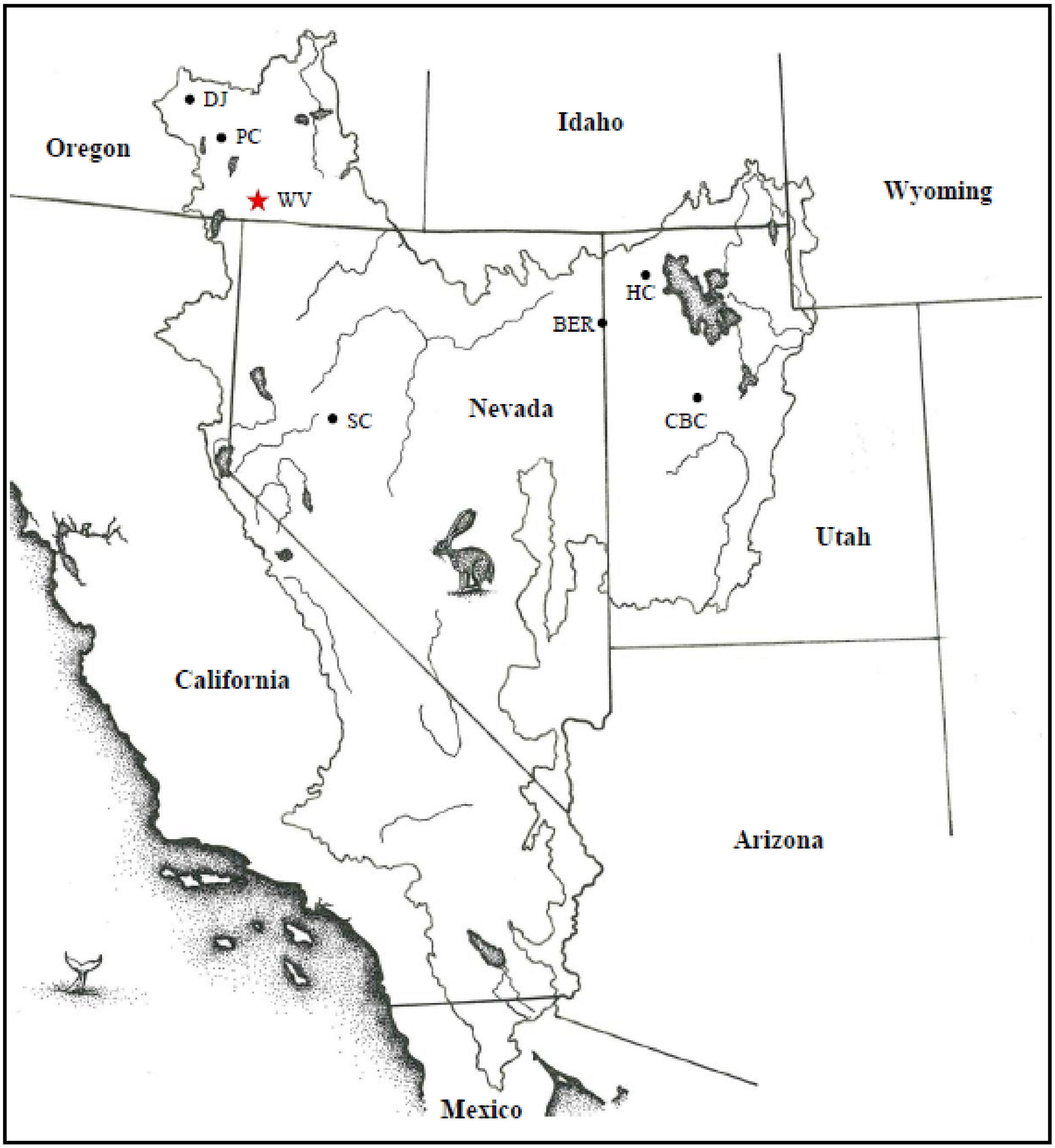


Figure 1.1. The Great Basin with some key sites mentioned in the text: WV = Warner Valley; DJ = DJ Ranch; PC = Paisley Caves; SC = Spirit Cave; BER = Bonneville Estates Rockshelter; HC = Hogup Cave; and CBC = Camels Back Cave.

Climate and Environment

The Terminal Pleistocene (15,000-11,600 cal B.P.)

The Terminal Pleistocene was characterized by cooler temperatures and greater precipitation than present, which resulted in expansive pluvial lakes and wetlands (Elston 1982; Grayson 2008). Vegetation communities were mesic adapted and controlled more by extreme cold than moisture and the climate was conducive to the expansion of forests/woodlands (Wigand and Rhode 2002:315). Conifers such as limber pine (*Pinus flexilis*) occupied lower elevations, gradually retreating up slope as conditions warmed and winter precipitation decreased (Madsen 2007:12). Mid-elevation zones were colonized by sagebrush (*Artemisia* spp.) and grassland steppe (Goebel et al. 2011; Nowak et al. 1994). Wigand and Rhode (2002) note that pollen recovered from a woodrat midden near Pyramid Lake showed a spike in whitebark pine (*Pinus albicaulis*) at the end of the Terminal Pleistocene. *Pinus albicaulis* is a high elevation pine now restricted to the northern Rockies, Sierra Nevada, and Cascades; outlying populations in the Great Basin are found in the Ruby Mountains, Independence Mountains, East Humboldt Mountains, and in the Pine Forest Range (Lanner 1984:19). Sagebrush pollen and the emergence of mountain mahogany (*Cercocarpus* spp.) macrofossils also suggest that the

Terminal Pleistocene was cold with increased precipitation (Wigand and Rhode 2002:320).

The Terminal Pleistocene saw the extinction of megafauna such as *Mammuthus* (mammoth), *Mammut* (mastodon), *Camelops* (camel), *Nothrotheriops* (ground sloth), and *Equus* (horse), as well as smaller fauna including *Aztlanolagus agilis* (Aztlan rabbit) and avifauna including *Teratornis merriami* (raptor), *Polyborus plancus* (caracara), *Corvus neomexicanus* (corvid), and *Bubo sinclairi* (great-horned owl sub-species) (Emslie and Heaton 1987; Grayson 2011; Wells 1983). At the end of the Pleistocene only one species of leporid – the Aztlan rabbit – went extinct (Grayson 2011:70). *Aztlanolagus agilis* is closely related to *Nekrolagus* from Blancan-Rancholabrean deposits (mid-Pliocene to early Pleistocene) in the western United States (Winkler and Tomida 1988:391). Both *Aztlanolagus* and *Nekrolagus* have been found in the Great Basin (White 1991:76). Both species were responsible for major leporid radiation in North America (Winkler and Tomida 1988:391). Extant leporids often show characteristics in their dentition that are evolutionary throwbacks to *Nekrolagus* (White 1991:76). It is possible that the disappearance of the Aztlan rabbit at the end of the Terminal Pleistocene may have been the result of extreme seasonality and changing vegetation (Grayson 2007:188).

Artiodactyl population densities were likely disrupted by extreme seasonality during the Terminal Pleistocene (Broughton et al. 2008:1917). Artiodactyls are sensitive to fluctuations in the growing season and the quality and abundance of forage it provides (Broughton et al. 2008; Byers and Broughton 2004). Artiodactyl population density data recovered from well-preserved deposits in the Bonneville Basin show that this depression continued well into the Early/Middle Holocene before Late Holocene conditions became more favorable (Broughton et al. 2008). In the northern Great Basin, artiodactyl remains are less common than smaller game such as leporids, waterfowl, and insects in several Terminal Pleistocene/Early Holocene assemblages (Pinson 2007:195).

Evidence suggests that humans first colonized the Great Basin ~14,000 cal B.P. (Jenkins et al. 2012). Early sites cluster around what would have been margins of receding pluvial lakes and expanding marshlands, suggesting that early groups relied heavily on lacustrine resources (Beck and Jones 2010; Jenkins et al. 2012; Jones et al. 2003; Smith 2010). Direct subsistence evidence from the Terminal Pleistocene is scant but foragers likely exploited a broad spectrum of prey including artiodactyls, leporids, insects, and waterfowl (Beck and Jones 1997; Byers and Ugan 2005; Grayson 2011). Toolkits during this period consisted of edge-ground fluted and unfluted concave-base projectile points, edge-ground stemmed points, crescents, and small flake tools (Beck and Jones 1997, 2008; Goebel et al. 2011). Other tools included bone awls and needles, suggesting that basketry and other textiles (e.g., sandals, nets, bags) were important to Terminal Pleistocene people (Jones and Beck 2012).

The Early Holocene (11,600-8,900 cal B.P.)

During the Early Holocene, desiccation of pluvial lakes resulted in vast marsh-wetlands that would have been attractive to early people: these were likely “good times” for Great Basin foragers (Beck and Jones 1997; Elston 1982; Grayson 2011; Jenkins et al 2004). Plant communities were diverse, consisting of Pleistocene holdovers from the cooler glacial period and new arrivals adapted to warmer, drier climates (Wigand and

Rhode 2002:321). Summer temperatures were cool and most likely responsible for preventing single-leaf pinyon (*Pinus monophylla*) from entering the Great Basin prior to ~7,000 cal B.P. (Grayson 2011; Jenkins et al. 2004). Pollen records from woodrat middens suggest that sagebrush steppe had become treeless with abundant grasses; russet buffaloberry (*Shepherdia canadensis*) was common and juniper (*Juniperus* spp.) was present (Wigand and Rhode 2002; Grayson 2011). Pollen recovered from Bicycle Pond near Warner Valley, Oregon suggests that Hart Mountain was dominated by sagebrush and grass steppe with infrequent juniper (Wigand and Rhode 2002:321). Pollen records indicate that ~11,500-8,900 cal B.P., warming conditions resulted in ideal conditions for open forests and steppe ecosystems to develop at higher elevations in the northern Great Basin (Minckley et al. 2007:2180).

Early Holocene deposits from the Connley Caves in the Fort Rock Basin contain avian remains dated to ~11,200-7,200 cal B.P. (Grayson 1979, 1993). The majority of those are grebes, ducks, and shorebirds, suggesting the presence of wetlands at the Pleistocene-Holocene transition (Grayson 2011; Jenkins et al. 2004); however, after ~7,200 cal B.P., waterfowl rapidly decreased as wetlands began to desiccate, leaving in their wake vast windblown playas (Grayson 2011; Rhode 2008). Shallow lakes elsewhere in the northern Great Basin persisted throughout the Early Holocene, finally drying ~7,600 cal B.P. (Pinson 2004:53). People likely moved from one lake basin to another as resources were depleted (Pinson 2004:53). Small game dominate assemblages (e.g., Bonneville Estates Rockshelter, Connley Caves, North Creek Shelter, Sudden Shelter) dating to this time period throughout the Great Basin with large game remaining relatively rare (Grayson 1979; Janetski et al. 2012; Jones and Beck 2012; Hockett 2007;

Pinson 2004). Leporid hunting was important to some Early Holocene foragers, as evidenced at Buffalo Flat, Oregon. The Buffalo Flat sites produced evidence for communal leporid hunting like that observed during the ethnographic period. For example, Site 35LK1881 contained a pit feature with a dense concentration of charcoal and calcined leporid bones (Oetting 1994:166). This site is important in that it provides evidence that communal leporid hunting have been practiced since the Early Holocene. Early Holocene toolkits consist of edge-ground stemmed points (Cougar Mountain, Parman, and Haskett types), foliate (i.e., Cascade) points, crescents, and small flake tools (Connolly and Baxter 1986; Elston 1982). Assemblages also include seed processing equipment (e.g., manos, metates, seed beaters, winnowing trays, and baskets) for the first time, suggesting that seeds entered the diet in a significant way during the Early Holocene (Elston 1982:187).

The Middle Holocene (8,900-5,200 cal B.P.)

The Middle Holocene saw warmer and drier conditions than the Early Holocene (Schmitt et al. 2002:88). It has been characterized as “bad times” for foragers despite greater subsistence intensity in the form of leporid hunting at some Great Basin sites and increased seed consumption (Elston 1982:194). Winter precipitation decreased and there was a shift to summer rainfall as temperatures increased, causing the Truckee River to cease flowing out of Lake Tahoe, in turn causing a drop in Pyramid Lake (Elston 1982; Lindström 1990). Glaciers also vanished from the Sierra Nevada (Elston 1982:193). The expansion of sagebrush and grass steppe stopped and the retreat of juniper halted

(Wigand and Rhode 2002:325). A decrease in grass pollen is interpreted to reflect the beginning of intense droughts that characterized the Middle Holocene (Wigand and Rhode 2002:325). Single-leaf pinyon (*Pinus monophylla*) first arrived in much of the Great Basin during the Middle Holocene, reaching the White Mountains by ~8,800 cal B.P. (Grayson 2011:253). Ernst Antevs (1948) coined the term “Altithermal” to describe the harsh conditions of the period, theorizing that human populations either left or substantially declined in the Great Basin.

During the Early/Middle Holocene transition, the distributions of many fauna shifted. Bushy-tailed woodrats (*Neotoma cinerea*) declined in and around Pyramid Lake, reflected by a hiatus in midden records spanning ~8,600-4,000 cal B.P. (Grayson 2011:247). White-tailed jackrabbits (*Lepus townsendii*) moved to higher elevations as black-tailed jackrabbits (*Lepus californicus*) expanded their range northward within the Great Basin, likely because *Lepus townsendii* is more adapted to cooler and moister conditions than *Lepus californicus* (Grayson 1977; Hall 1946; Lim 1987). Grayson (1977) points out that this trend may have started slightly before desertification in the region. Studies of artiodactyl populations in the Great Basin show that black-tailed mule deer (*Odocoileus hemionus*), pronghorn (*Antilocapra americana*), desert bighorn sheep (*Ovis canadensis*), elk (*Cervus canadensis*), and bison (*Bison bison*) populations were either low or not targeted at certain sites (e.g., Camels Back Cave, Pie Creek Shelter, O’Malley Shelter), while at other sites artiodactyl remains suggest that populations were relatively high (e.g., Hogup Cave, Sudden Shelter, Bonneville Estates Rockshelter) (Aikens 1970; Broughton et al. 2008; Byers and Broughton 2004; Carpenter 2004; Hockett 2008; Schmitt and Madsen 2005).

Despite some oversimplification, Antevs (1948) seems to have been generally correct about his “Altithermal Abandonment” of at least portions of the Great Basin during the Middle Holocene (Beck and Jones 2008:48). Human populations appear to have been negatively impacted by warmer, drier conditions during that time. Louderback et al.’s (2010) study of radiocarbon date frequencies suggest that human populations reached their lowest points during the period. Middle Holocene sites, camps and villages in particular, tended to be located close to springs, rivers, and lakes more than they had been previously, suggesting that this was a response to prolonged drought (Elston 1982:194). Some sites were occupied for the first time during the Middle Holocene (e.g., the Bowling Dune, the Bergen Site, the DJ Ranch Site, Connley Caves, Hogup Cave, Gatecliff Shelter), while others (e.g., Bonneville Estates Rockshelter) initially occupied during the Terminal Pleistocene/Early Holocene were largely abandoned during the Middle Holocene (Aikens and Jenkins 1994; Grayson 2011; Hockett 2007; Jenkins et al. 2004). Just prior to ~8,000 cal B.P., Camels Back Cave in western Utah was first occupied as desertification began to intensify (Schmitt et al. 2005:25). Hogup Cave, also in western Utah, was likewise first occupied during the early Middle Holocene (Aikens 1970:195).

Foragers appear to have remained in the northern Great Basin throughout the duration of the Middle Holocene. Sites during this period were generally ephemeral as foragers moved from patch to patch in pursuit of seasonal food items; however, there are some exceptions (Figure 1.2). For example, the Bergen and DJ Ranch sites appear to represent longer term occupations. At those sites, foragers procured artiodactyls and dried fish for later use (O’Grady 2004:207). Similarly, evidence from the Locality III and the Bowling Dune sites suggests that people cached items such as dried fish (O’Grady 2004:208). These four sites span thousands of years of repeated use (O’Grady 2004:207). The Bergen Site was an ideal location for foragers who utilized receding pluvial Lake Beasley and associated marshes (Helzer 2004:92).

Middle Holocene toolkits included seed processing equipment (e.g., manos, metates, seed beaters, winnowing trays, and baskets) and projectile points consisting of Pinto, Humboldt, and Northern Side-notched types that were hafted onto darts and propelled with atlatls (Elston 1982:187).

The Late Holocene (~5,200 cal B.P.-Present)

Conditions during the Late Holocene were generally more mesic than the Middle Holocene and are thus often characterized as a return to “good times” (Elston 1982:194); however, the period did see substantial climatic shifts. Many mountain ranges saw expansions of alpine glaciers (Grayson 2011; Wright 1983). Pollen records from woodrat middens in central Nevada show an increase in *Juniperus* and *Artemisia*, suggesting a cooler and wetter climate ~2,000 cal B.P. (Wigand and Rhode 2002:341). Bristlecone pine (*Pinus longaeva*) records indicate that between ~1,100 and 600 cal B.P. severe droughts occurred in the western Great Basin (a period often referred to as the warm-dry Medieval Climatic Anomaly) (Bettinger 1999:68). During the Medieval Climatic Anomaly, northern Great Basin pollen records indicate an increase in grasses, which coincide with an increase of bison (Grayson 2011; Wigand and Rhode 2002). Jeffrey Pine (*Pinus jeffreyi*) stumps still visible in the west fork of the Walker River indicate that it either nearly or completely dried up, and rooted trees submerged 130 feet below the natural lake level indicate that Walker Lake desiccated significantly as well (Grayson 2011:263). The Medieval Climatic Anomaly was followed by the Little Ice Age ~500 to 150 cal B.P. (Bettinger 1999:68). Not since the Terminal Pleistocene has the Great Basin seen conditions colder and wetter than it did during the Little Ice Age (Bettinger 1999). Pinyon pine pollen increased between ~1,900 and 900 cal B.P. in the northeastern Great Basin as a result of increased summer rainfall (Wigand and Rhode 2002:330). The Little Ice Age initiated the reexpansion of juniper woodland in the northern Great Basin and based on pollen records, pinyon thrived in the central and southern Great Basin due to more mesic conditions (Wigand and Rhode 2002:331). The pollen record suggests that following the end of the Little Ice Age, an increase in aridity occurred, prompting retreating juniper woodland and advancing sagebrush steppe, decreasing grass, and lower water tables in the northern Great Basin (Wigand and Rhode 2002:331).

The Late Holocene saw a major technological change in the introduction of the bow-and-arrow, which ultimately replaced the dart-and-atlatl. Bow-and-arrow technology first arrived in the Great Basin sometime between ~1,800 and 1,300 cal B.P. (Bettinger 1999; Grayson 2011). In addition to the atlatl and, later, the bow-and-arrow, Late Holocene toolkits consisted of seed processing equipment (e.g., manos, metates, seed beaters, winnowing trays, and baskets), Elko and Rosegate series projectile points, nets, digging sticks, snares, bone and horn tools, piercing tools, and duck decoys (Elston 1982; Kelly 1997).

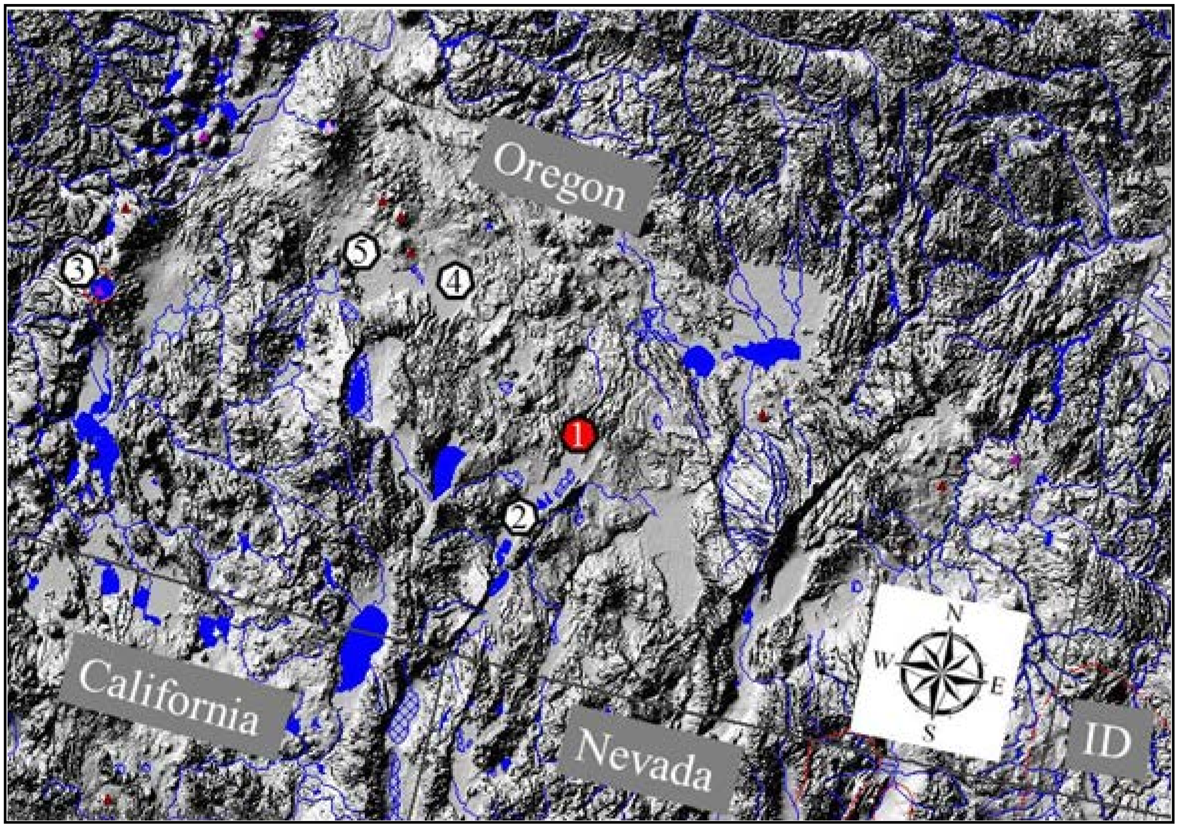


Figure 1.2. Northern Great Basin sites discussed in the text: 1 = LSP-1; 2 = Warner Valley; 3 = Mazama Caldera; 4 = Buffalo Flat Sites; and 5 = the Fort Rock Basin.

The Role of Zooarchaeology in Reconstructing the Past

Treatments of Great Basin prehistory like that outlined above are based on a variety of data sources including lithic and perishable artifacts, macro-and microbotanical plant remains, and faunal assemblages. Regarding the latter, zooarchaeologists employ various methods to quantify and qualify the types and number of taxa present in faunal collections. In this section, I outline how researchers approach analyses of fauna, and some of the questions that may be addressed using such approaches.

The number of identified specimens (NISP) and minimum number of individuals (MNI) are the two most common methods of quantifying taxonomic abundance (Morlan 1983:61; Reitz and Wing 2008). Such approaches, which are described in greater detail later in this thesis, identify the types and abundances of taxa in an assemblage and can be used to reconstruct subsistence economies, predation patterns, age distribution and mortality profiles, the paleoecology of a site, and the taphonomic processes that led to their deposition (Byers and Hill 2009; Grayson 1979; Morlan 1983).

Other zooarchaeological units of measure include minimum number of elements (MNE) and minimum number of animal units (MAU). MNE is used to understand the minimum number of a single element or portion of a taxon recovered from an assemblage (Lyman 1994:40). The measure is based on the minimum numbers of long-bone ends and isolated long-bone shafts still attached to proximal and distal ends. MAU is used when considering individual body parts and their frequencies. MAUs are calculated by taking the MNE of an element recovered from a site and dividing it by how many times that element occurs in the body. For example, if the MNE for *Lepus* femora is 30 then the MAU would be 15 (Grayson 2004). These measures are useful when working, for example, with heavily fragmented assemblages (Lyman 1994; Yoshiko et al. 2002). MAUs, like MNI, are not observational units of measure but rather analytical units of measure (Lyman 1994:51).

Relative abundances of prey remains in an archaeological site can reveal mortality patterns. “Attritional” or “normal” mortality based on other types of faunal analysis explained in more detail later can help distinguish between communal hunting events (such as that seen at Buffalo Flat) and “natural death” events at a site (Lyman 1987a; Oetting 1994). Old individuals as well as young individuals are both over-represented in situations of natural mortality (Lyman 1987a:126). In contrast, humans hunting animals such as leporids and artiodactyls more often harvest reproductively fit members of the population along with some older individuals (Hockett 1991; Steele 2003). Very young individuals are usually not harvested, at least to any great extent, due to seasonality (Hittman 1984; Hockett 1995a, 1991; Lyman 1987a). Therefore, they are not recovered in archaeological contexts based upon varying mortality rates between age and classes (Lyman 1987b; Steele 2003).

Faunal studies often use measures of relative taxonomic abundance to consider issues related to changing environment, resource depression, and changes in human subsistence strategies. For example, the Artiodactyl Index measures the ratio of artiodactyl to lagomorph remains recovered from archaeological sites (Badenhorst and Driver 2009:1839). Values range from 0 to 1, with higher values reflecting greater numbers of artiodactyls relative to lagomorphs. The Small Game Index is used to show the opposite, small game in relation to artiodactyls (Hockett 2007). Decreases in large game such as artiodactyls may reflect naturally or culturally induced resource depression (Janetski 1997:1075). Resource depression may be due to game depletion caused by a number of factors such as increases in site-use intensity and/or intense hunting within the vicinity of residential camp “central places” (Broughton 2002; Dean 2007; Janetski 1997). During the Late Holocene there were increases in both human and artiodactyl populations (Byers and Broughton 2004; Grayson 2011; Hockett et al. 2012). Artiodactyl herds were heavily preyed upon due to intensive hunting strategies and technological changes (e.g., the bow-and-arrow, increased use of communal hunting traps) (Hockett et al. 2012).

The Lagomorph Index is another measure of relative taxonomic abundance similar to the Artiodactyl Index. The Lagomorph Index calculates the relative proportions of *Lepus* to *Sylvilagus* found within archaeological contexts (Dean 2007:7). Vegetation, prehistoric dietary needs, and hunting methods are all factors that could affect Lagomorph Index values and like all measures of relative taxonomic abundance, it is only useful if researchers can identify which factors (e.g., climate, hunting strategies, etc.) influence the values observed (Dean 2007; Fisher 2012). For example, *Lepus* are more easily hunted than *Sylvilagus* and *Brachylagus* (pygmy rabbit) because they elude predators by running over open spaces, which allows humans to harvest them in mass during communal hunting events (Dean 2007; Downs 1966; Larrucea and Brussard 2008; Lim 1987; Steward 1938). Conversely, *Sylvilagus* and *Brachylagus* elude predators by hiding in thick brush and escaping down burrows (Schmitt et al. 2002:89). Bow-and-arrow encounter hunting and snares were the most typical methods of hunting *Sylvilagus* (Dean 2007; Gilmore 1953). Based on these hunting methods, the Lagomorph Index should be greatly biased in favor of *Lepus* over *Sylvilagus* if communal hunting was common.

Many questions can be addressed once those taxa present at a site are identified; for example, the seasonality of occupation of a site. Humans predominantly kill adult (reproductively fit) prey seasonally (Hockett 1991:668). As an example, leporids were commonly communally hunted during fall rabbit drives when their pelts were in prime condition and the animals were fat (Fowler 1992:77). Leporids taken during fall drives were adults or adult-sized sub-adults born during the spring (Hittman 1984:11). Therefore, if predominantly adult leporid remains are recovered from an archaeological site in large numbers, then it is likely that they were harvested during fall rabbit drives. Possible inferences may be made based on the ratio of *Lepus* to *Sylvilagus* found in these contexts. Conversely, avifaunal remains such as greater sage grouse (*Centrocercus urophasianus*) present at a site would suggest early spring hunting by foragers, as at least during ethnographic times greater sage grouse (*Centrocercus urophasianus*) were typically hunted in March because they were fat then and easily hunted as they were congregated on leks (Fowler 2006; Pope 1983, Marlin Thompson, personal communication 2010).

Differentiating osteological remains deposited by human and non-human agents is essential when conducting zooarchaeological analysis (Hockett and Haws 2002; Lyman 1987a). There are many non-human agents that modify osteological material, especially those of smaller game, many of which mimic culturally modified bone. Non-human agents that can modify bone include sedimentary abrasion, rodent gnawing, carnivore gnawing, weathering, root etching, and trampling (Haynes 2002:60). These non-cultural agents are often mistaken for cutmarks produced when an animal is killed and butchered. There are certain similarities and differences between culturally and non-culturally produced modifications to bone that analysts look for (Fisher 1995:17). For example, sedimentary abrasion and culturally-produced cutmarks can produce low frequencies of marks that can be difficult to differentiate. Furthermore, broken elements do not allow researchers to know how many marks are present on such bones, making determinations more tentative (Fisher 1995:35). Weathering processes as well as animal gnawing and polishing created by large predators licking bone can also cause exfoliation of bone, which may erase striations and cutmarks, thus producing a different interpretation of those elements' taphonomic histories (Fisher 1995:35). Fortunately, striations produced by trampling as well as sedimentary abrasion vary in size and depth and their orientation on the element also varies considerably, whereas the orientation of the cutmarks tends to be more uniform (Fisher 1995:35).

Carnivore modification and rodent gnawing can mimic sedimentary abrasion and trampling (which can produce marks that mimic hammerstone strikes [Thompson et al. 2008:350]) as well as culturally produced modifications that also produce striations, conchoidal flaking, punctures, furrowing, and polishing (Fisher 1995:36). For example, elements digested by carnivores and deposited in scat are subjected to corrosive attrition (e.g. pitting, polishing, and staining) (Schmitt and Juell 1994:252).

Gastric juice modification is also produced by both nocturnal and diurnal raptors. Nocturnal raptors have weaker gastric juices than those of diurnal raptors (Hockett 1991:669). Bones digested by raptors become pitted, scoured, and polished before they are deposited in castings at roost sites (Hockett 1991, 1995a, 1995b, 1998). If no castings are available, it can be difficult to distinguish raptor-modified bone from those produced by coyotes (*Canis latrans*) based solely on polishing and fragmentation of elements (Hockett 1991; Schmitt et al 2002). Golden eagle (*Aquila chrysaetos*) castings tend to preserve bone fragments in a higher frequency of identifiable portions than do those recovered from coyote scats (Hockett 1995b:590).

Bones modified by raptors exhibit beak and talon punctures predominantly on one side (Hockett 1995b:224). Triangular-shaped marks found on bones may be produced by raptors as they use their beaks during feeding (Thompson et al. 2008:357). Innominates recovered from raptor contexts often display puncture marks immediately behind the acetabular fossa (Hockett 1995b:224). In addition to punctures, innominates and femora show evidence of shearing (Hockett 1995b:224). Based on my personal observations of raptors kept for falconry, they typically hold down leporid hindlimbs while twisting the proximal or distal ends with their beak and pulling up rapidly to shear the ends off. They then swallow the bone and any meat/tendons that they can remove. Raptors typically digest more forelimbs than hindlimbs since forelimbs tend to be smaller in size (Hockett 1995b:224). As a result, fragmented hindlimb elements can be found under feeding perches, where they were discarded after the meat/tendons were removed. Hockett (1991, 1995b) noted that this sometimes produces diaphysis cylinders similar to those that are produced via cultural processes. Finally, raptor accumulated assemblages tend to contain more sub-adult remains than adults. This differs from culturally-accumulated assemblages, which should predominantly contain adult animals (Hockett 1995b:224). As outlined above, mortality profiles can help differentiate assemblages-in particular, those dominated by smaller game-deposited by raptors and other carnivores versus those deposited by humans.

Culturally-modified leporid bones differ from raptor-modified bones in some regards. While both raptors and humans produce long-bone diaphysis cylinders as noted by Hockett (1991, 1995a), raptors tend to kill predominantly sub-adult animals whereas humans seasonally hunt and harvest adult animals. Additionally, culturally-modified

Lepus and *Sylvilagus* long-bone diaphysis cylinders may possess sawed, cut, snapped, or charred ends (Hockett 1991:674). Assemblages deposited by humans also contain bones that may exhibit cutmarks, pry marks, burning, hammerstone percussion marks, pot polish, and/or modification into tools. Type of tools used and the material tools were made of can be determined based on cutmark morphology. Cutmark analysis is valuable in distinguishing culturally-modified bone from non-culturally modified bone as well as reconstructing human hunting practices. For example, Yoshiko et al. (2002) suggest that by understanding natural processes that modify bone, the range of marks produced by humans can be better understood as well. Furthermore, by studying ethnographic butchering practices, how people discard animal remains on the landscape, and monitoring how discarded remains become scattered and weathered, analysts can gain a basic idea of how similar sites were formed in prehistory (Yoshiko et al. 2002:660). Along with this type of study, cutmarks made during ethnographic and experimental butchering events can be compared to those recovered from archaeological sites (Yoshiko et al. 2002:660). Marks left on bone during skinning and butchering provide information about the different classes of tools used and their specific tasks; for example, work angle, force, and the direction of the movement of the tool during the cutting event (Walker and Long 1977:606).

Burnt or calcined bone may be diagnostic of cultural activity when associated in large numbers in archaeological contexts; however, natural burning (e.g., wildfire events; burning of cave/rockshelter deposits), must also be taken into consideration. When bone is subjected to burning it becomes dehydrated, forming polygonal fractures at temperatures of 285 to 440˚C (Shipman et al. 1984:314). Bone surfaces become more glassy and smooth than when subjected to lower temperature burning, thus imparting a distinctive polygonal cracking pattern (Shipman et al. 1984:314).

Smaller animals are easily transported back to campsites as opposed to larger animals such as artiodactyls (Dansie 1991:99). As a result, all elements get brought back to camp whereas artiodactyl carcasses get partitioned and only choice cuts are brought back to camp while the rest is left behind at the kill site (Dansie 1991:99). In contrast to raptor-accumulated assemblages, certain elements are typically missing from culturally accumulated assemblages in archaeological sites (Dansie 1991:99). Pre-fractured spongy portions of some elements caused by humans are ideal for some carnivores to scavenge from residential, settings creating “selective deletion” from assemblages (Stiner 2002:985); however, during periods of stress or “hard times” certain elements (e.g., vertebrae and ribs) were ground up to make bone meal (Downs 1966:27). This bone meal was then mixed with dried scraps of meat and eaten (Dansie 1991:99). This could explain low MNE counts of certain elements from campsites. Elements of this nature are oftentimes missing from archaeological sites in the Great Basin, suggesting that prehistoric groups commonly processed leporids in this manner (Dansie 1991:99). Faunal remains deposited by humans tend to be highly fragmented (Stiner 2002: 979). Conversely, bone density affecting survivorship can create bias in patterns and variability (Lyman 1984a:260). Humans and carnivores select portions of elements that are structurally weak due to higher concentrations of marrow; these portions are subsequently chewed or smashed for their contents (Lyman 1984a:279). Therefore, the least dense portions will be destroyed first leaving behind portions with higher densities, which affect MNI values used to determine which element is likely the most abundant in an assemblage (Lyman 1984a). In addition, *in-situ* attrition is poorly understood relating to bone destruction processes and how they relate to degradation in identifiability in assemblages (Stiner 2002:988).

Summary

Since humans first colonized the Great Basin during the Terminal Pleistocene, behavior seems to have changed in response to environmental, technological, and social factors. The archaeological record of the region is largely dominated by open-air-lithic scatters not conducive to organic preservation. Our understanding of such changes is therefore largely derived from cave and rockshelter faunal assemblages. Understanding how and when these assemblages were deposited is critical to accurate interpretations of the past. In the following chapters, I outline an assemblage that holds the promise to inform our understanding of terminal Early and early Late Holocene lifeways in the northern Great Basin, present the methods used to analyze the assemblage, highlight the results of my analysis, situate them within the broader context of Great Basin research, and point the direction towards future research.

Chapter 2: Materials

The Little Steamboat Point-1 Rockshelter

LSP-1 is a small rockshelter located beneath a welded tuff formation capped by basalt overlooking northern Warner Valley, Oregon (Figures 2.1-2.3). LSP-1 was formed by the wave action of Pleistocene Lake Warner when it was near or at its peak during the Terminal Pleistocene (Smith et al. 2014). Once Lake Warner receded following its highstand, the shelter would have been available for occupation; however, several thousand years apparently passed before people first used it. Habitable space within LSP-1 is approximately 50 m^2 behind the dripline (Smith et al. 2011:15).

In 2010 Bill Cannon, archaeologist for the Lakeview BLM, directed a crew from the Great Basin Paleoindian Research Unit (GBPRU) of the University Of Nevada, Reno (UNR) to determine if the site contained stratified cultural deposits. Excavations that summer consisted of a 1-m^2 test unit placed in the back of the rockshelter that reached a maximum depth of 176 cm below datum (cmbd) (~169 cm below surface) before being terminated due to decreased cultural material at that depth. Excavation was conducted using trowels and proceeded in 10-cm arbitrary levels; sediment was passed through $^1/_8$th -inch mesh (Smith et al. 2011:13). Sediment samples from features were collected for later analysis, and numerous charcoal samples were collected for radiocarbon dating (Smith et al. 2011:13). Lithic tools were point plotted *in-situ* when encountered; bones, debitage, and other artifacts recovered in the screen were bagged by 10-cm level.

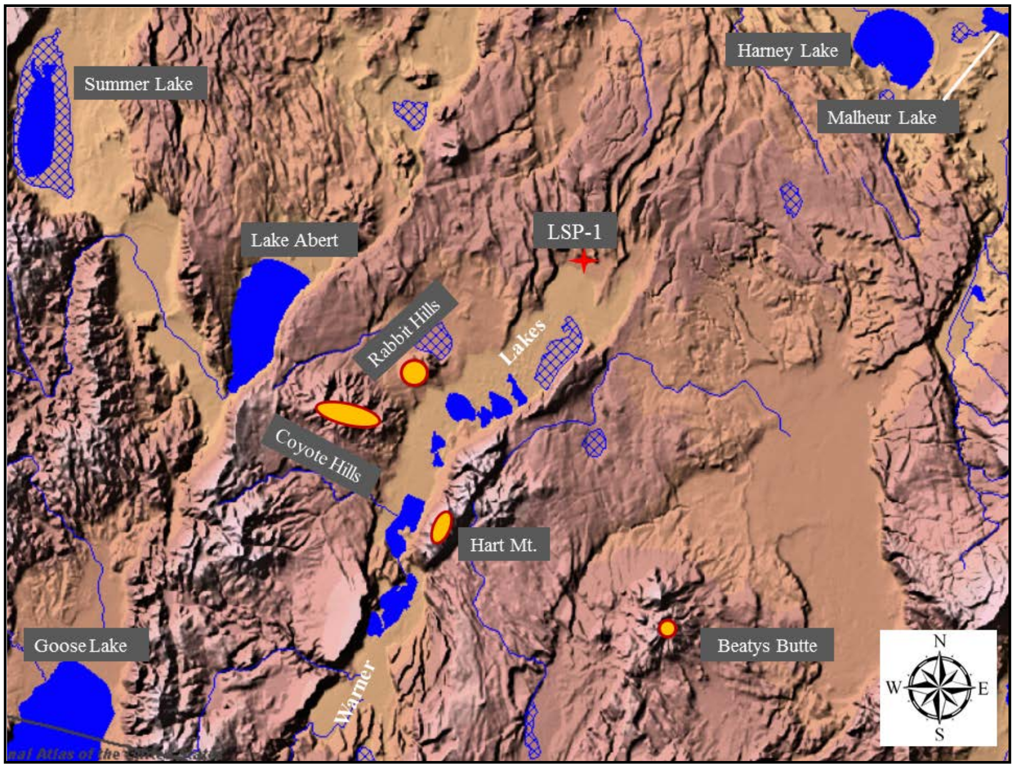


Figure 2.1. Location of LSP-1 in Warner Valley, OR.

Figure 2.2. Overview of LSP-1 exterior, view north.

Figure 2.3. Overview of LSP-1 interior at conclusion of 2013 field season, view northeast.

Thirteen stratigraphic units were identified in the initial test pit with cultural material recovered through Stratum 10 (Smith et al. 2011:17). Two carbon samples were submitted for Accelerator Mass Spectrometer (AMS) radiocarbon dating to bracket the age of two Cascade projectile points recovered between 106-116 cmbd (Smith et al. 2011:17). The samples provided mean dates of ~9,430 and 9,270 cal B.P. (~8,400-8,250 ^{14}C B.P.), placing the initial occupation of the site during the Early/Middle Holocene transition (Smith et al. 2011:17). A third charcoal fragment recovered from 60 cmbd returned a date of 807 cal B.P. (880 ^{14}C B.P.) (Smith et al. 2011:17).

The GBPRU returned to LSP-1 during the summer of 2011 to resume excavations. An additional three 1-m^2 units were opened and excavated to a depth of 125 cmbd (Smith et al. 2012a:19). When combined with the initial test pit (renamed

N105E99), these excavation units formed a 1-x-4m^2 trench which became known as the E99 trench (Figure 2.4). Excavations stopped in 2011 due to decreased cultural material at the bottom of the units; however, extensive looting took place at the site in the spring of 2012, which resulted in ~50 percent of the remaining upper deposits being destroyed (Smith et al. 2012b:2). This event warranted extensive salvage work at LSP-1. In the summers of 2012 and 2013, fieldwork at LSP-1 continued and to date, ~14.5-m^2 has been excavated at the site (Figure 2.5).

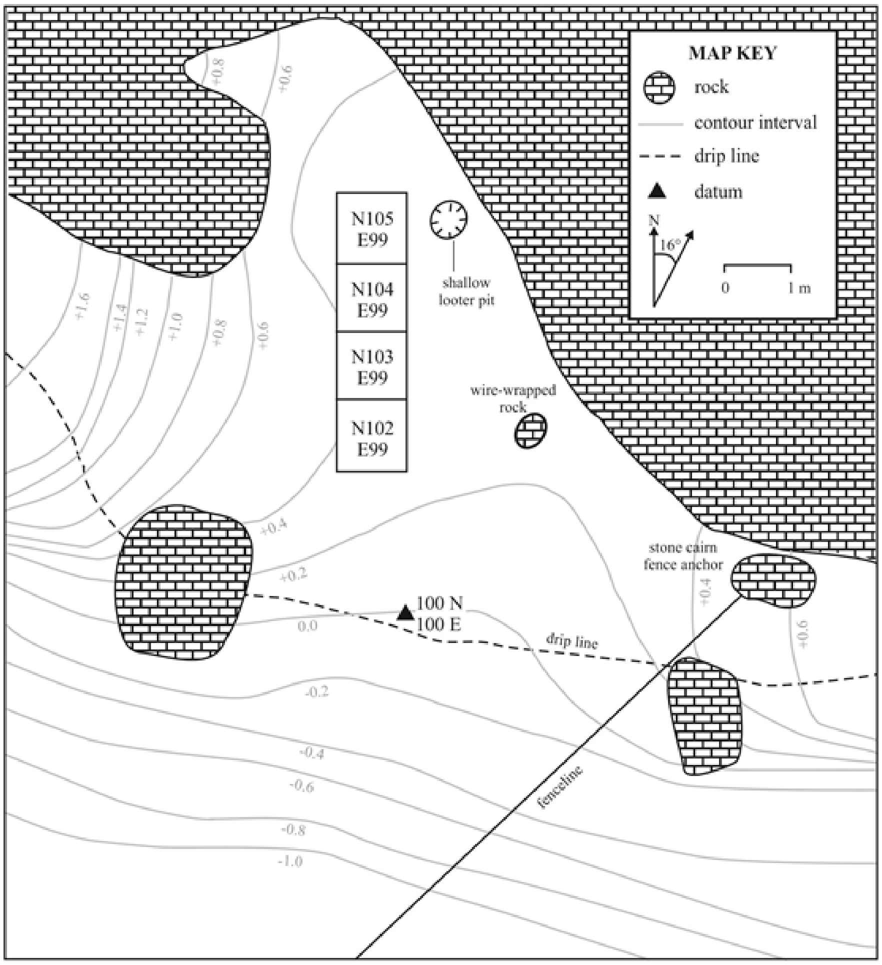


Figure 2.4. Location of the 2011 1-x-4 m^2 trench (i.e., the E99 trench).

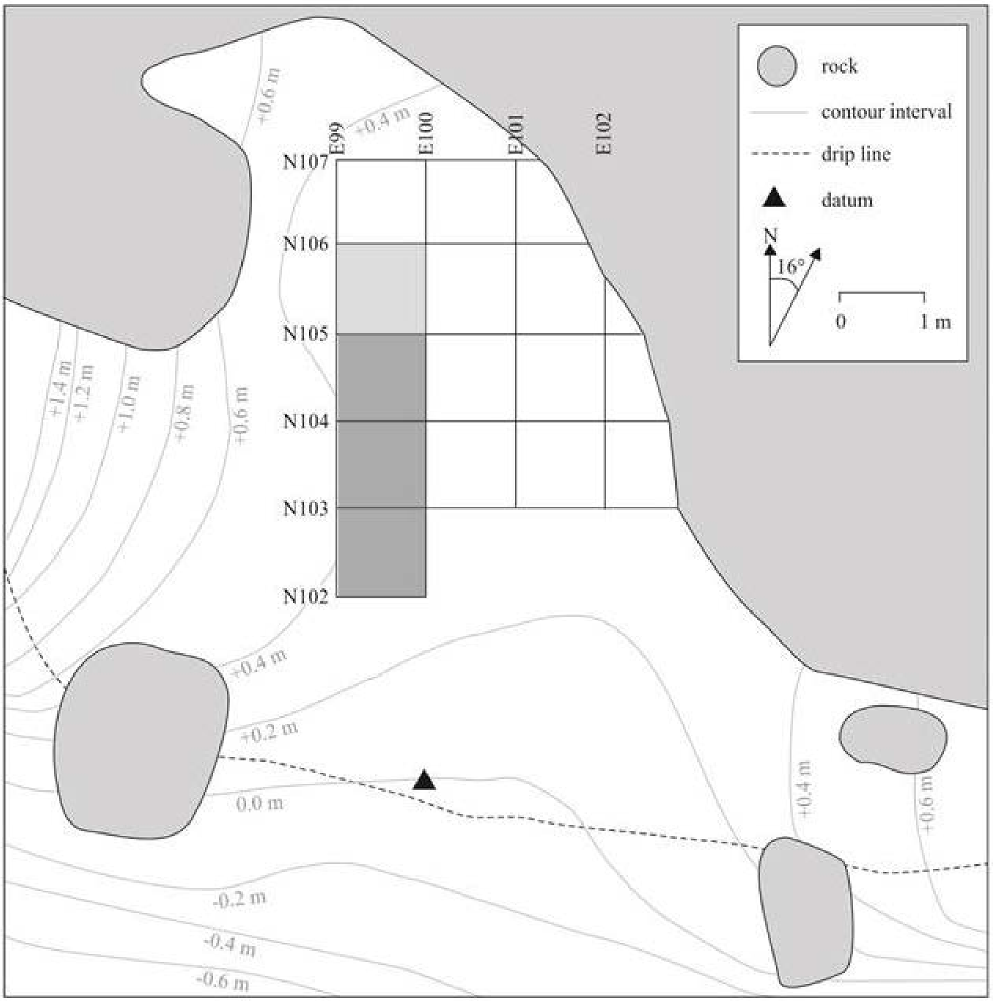


Figure 2.5. Extent of excavations in LSP-1 after the 2013 field season. Dark gray units indicate locations where all fauna were analyzed; light gray unit indicates location where some fauna were analyzed.

In 2013, Dr. Judson Finley (Utah State University) joined the project team to help describe and profile the site's deposits, best illustrated by the west wall of the E99 trench (Figure 2.6). Based on Finley and Smith's reassessment of the larger exposure of deposits, the stratigraphy of LSP-1 was redescribed and 10 distinct strata reflecting aeolian and alluvial deposition intermixed with *éboulis* (rock fall) were characterized (Smith et al. 2014). These 10 strata are grouped into three major sediment packages

(Smith et al. 2014). The upper package within the E99 trench consists of strata I-IV and has been dated by four radiocarbon dates: 880±20, 1850±25, 2490±25, and 6550±20 ^{14}CB.P. (~807, 1784, 2593, and 7454 cal B.P.), the latter of which has been rejected due to its substantial disagreement with the other three dates (Table 2.1) (Smith et al. 2014). Two additional radiocarbon dates, 3140±25 and 2910±30 ^{14}C B.P. (~3369 and 3056 cal B.P.), provide an age estimate for the contact between the upper and middle packages. The middle sediment package contains two strata (V and VI). Stratum V consists of poorly-sorted fan gravels from a small alluvial fan that formed adjacent to the rockshelter accompanied by fine to very fine sand (Smith et al. 2014). Stratum VI consists of very fine aeolian silt sand deposits. Mazama tephra (Franklin Foit, personal communication, 2013) was noted in small pockets midway through Stratum V at 100-110 cmbd (Smith et al. 2014).

Six radiocarbon dates, 4010±20, 4030±20, 8290±40, 8340±40, 8400±50, and 8670±40 ^{14}C B.P., have been obtained on hearth charcoal and/or isolated charcoal fragments from strata V/VI in the E99 trench. At this time, we suspect that the 4030±20 ^{14}C B.P. date may represent a portion of a hearth dated to 4010±20 ^{14}C B.P. ~17 cm above it that was transported downward by rodent burrowing, given that the two samples are virtually the same age and associated closely along the horizontal axis but separated on the vertical axis (see Figure 2.6). Similarly, because the dates of 8340±40 and 8670±40 ^{14}C B.P. are vertically situated above Mazama tephra (~6,850 ^{14}C B.P.) we do not believe they are in a primary context. The remaining three dates suggest that strata V/VI began accumulating sometime after ~9,700-9,100 cal B.P. (Smith et al. 2012a:19). Based on radiocarbon dates from strata V/VI and the dates from the upper/middle package contact described above, the middle package started to accumulate after 9,700 cal B.P. and ceased to accumulate sometime ~ 3,000 cal B.P., indicating that: (1) the middle sediment package spans from the terminal Early Holocene to the middle Late Holocene; and (2) the upper sediment package dates to the latter half of the Late Holocene. Stratum V in the middle sediment package contains most of the chipped and ground stone artifacts at LSP-1 as well as a rich and well-preserved faunal assemblage that forms the basis of this thesis.

Finally, the lower sediment package is comprised of strata VII-X (Smith et al. 2014). Strata VII and IX are composed of coarse gravel and strata VIII and X are composed of black sand. Stratum X likely marks the initial sedimentation of LSP-1 after Pleistocene Lake Warner retreated below the shelter's entrance. A *Sylvilagus* humerus radiocarbon dated to 9100±30 ^{14}C B.P. (~10,200 cal B.P.) marks the boundary of strata VII and IX and indicates that the lower sediment packaged continued to accumulate into the Early Holocene (Smith et al. 2014). A second date of 7310±40 ^{14}C BP (~8,105 cal B.P.) obtained on isolated charcoal from 142 cmbd in N105 E99 does not correspond well with other dates obtained for strata V/VI. Since it postdates the four middle package dates by almost a thousand years but is found well below them, Smith et al. (2012a) do not feel that the sample provides an accurate age for the sediment from which it was recovered. Three additional radiocarbon dates obtained from charcoal within the lower package date to 2070±25, 8300±20, and 8700±30 ^{14}C BP (~2042, 9333, and 9637 cal B.P. The 2070±25 date was recovered from within what is now thought to be a rodent burrow in Stratum VII and has been rejected. The other two dates, 8700±30 and 8300±20, were recovered at the contact between Stratum V and Stratum VII.

Table 2.1. Radiocarbon Dates from Three Stratigraphic Packages Within the E99 Trench at LSP-1.

Sediment Package	**Material Dated**	**Unit**	**Stratum**	**cmbd**	**N**	**E**	**^{14}C Date**	**Notes**	**μ cal Date**	**2σ cal Range**
Upper	Unidentified charcoal	N105E99	III/IV Contact	61	105.75	99.00	6550±20	Date rejected	7454	7425-7492
	Unidentified charcoal	N105E99	IV	62	106.00	99.95	880±40		807	725-915
	Unidentified charcoal	N102E99	III	49	102.92	99.00	1850±25		1784	1715-1865
	Unidentified hearth charcoal	N104E99	IV	73	104.10	99.00	2490±25	Feature 11-5	2593	2466-2720
Middle	Unidentified charcoal	N105E99	V	103	106.00	99.58	8340±40	Above Mazama tephra; date rejected	9362	9260-9470
	Unidentified hearth charcoal	N104E99	IV/V Contact	72	104.30	99.80	2910±30	Feature 11-19	3056	2957-3200
	Unidentified charcoal	N102E99	V	97	102.90	100.00	8670±40	Above Mazama tephra; date rejected	9621	9540-9732
	cf. *Rhus trilobata* charcoal	N105E99	V/IV Contact	83	105.33	99.00	3140±25		3369	3271-3443
	cf. *Rhus trilobata* charcoal	N105E99	V/VII Contact	122	105.27	99.00	8300±20		9333	9155-9422
	Unidentified hearth charcoal	N102E99	V	84	102.87	99.00	4010±20	Unnumbered feature	4476	4424-4522
	Unidentified charcoal	N102E99	V	101	103.12	99.00	4030±20	Possible charcoal from same featured dated to 4010±30 transported downward by rodent burrow	4484	4427-4567
Lower	Unidentified charcoal	N105E99	VI/VII	120	106.00	99.93	8290±40	Average of two runs: 8380±60 and 8250+40	9299	9137-9427
	Unidentified charcoal	N105E99	VII/VIII	142	105.06	99.29	7310±40	Date rejected	8108	8020-8185
	Artemisia tridentata charcoal	N105E99	VII/VIII Contact	139	105.18	99.00	2070±25	Intrusive silt lens possibly representing infilled burrow. Date rejected.	2042	1951-2121
	Unidentified charcoal	N105E99	VI/VII	131	106.00	99.79	8400±50		9417	9301-9520
	Sylvilagus humerus	N105E99	VIII/IX	196	105.10	99.00	9100±30	Bioapetite; non-cultural	10,247	10,200-10,367

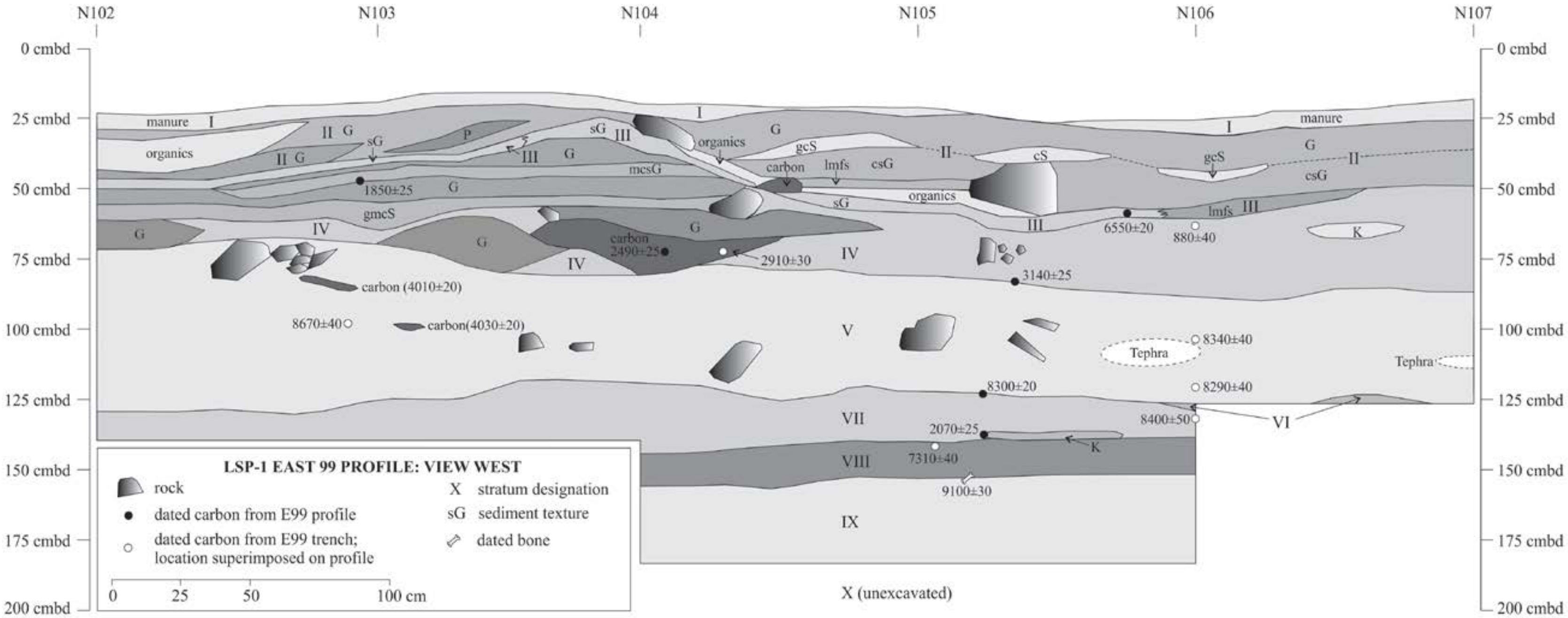


Figure 2.6. E99 trench profile with locations of radiocarbon-dated samples (Courtesy of Geoff Smith, 2014).

There is a clear lack of samples dated to the Middle Holocene in the E99 trench (see Table 2.1). Figure 2.7 shows the relationship between the vertical distribution of dated samples and the calendar age of those samples. Given that our samples are distributed fairly evenly through the deposits, this gap is unlikely to be a function of sampling bias. There is no sign of a stratigraphic unconformity in the Stratum V deposits suggesting that Middle Holocene sediment is missing from the site (Judson Finley, personal communication 2014); the presence of Mazama tephra (~6850 ^{14}C B.P.) supports this interpretation. Instead, as Figure 2.7 suggests, there may have been a hiatus in human occupation corresponding with the Middle Holocene. Two pulses of occupation – one occurring at the very end of the early Holocene, and one occurring during the late Holocene – appear to have occurred at LSP-1. This possibility has only recently been acknowledged (Geoff Smith, personal communication, 2014) and is currently being rigorously evaluated with additional radiocarbon dating and obsidian hydration analysis. Unfortunately, based on some dated samples that are clearly out of sequence and the vertical distribution of debitage and faunal remains in the E99 trench (Figure 2.8), there appears to have been some mixing of the two occupations – there is no clear bimodal distribution of occupation debris that would be expected if we had two spatially and temporally discrete occupations. In Chapter 3, I outline how I deal with this potential issue.

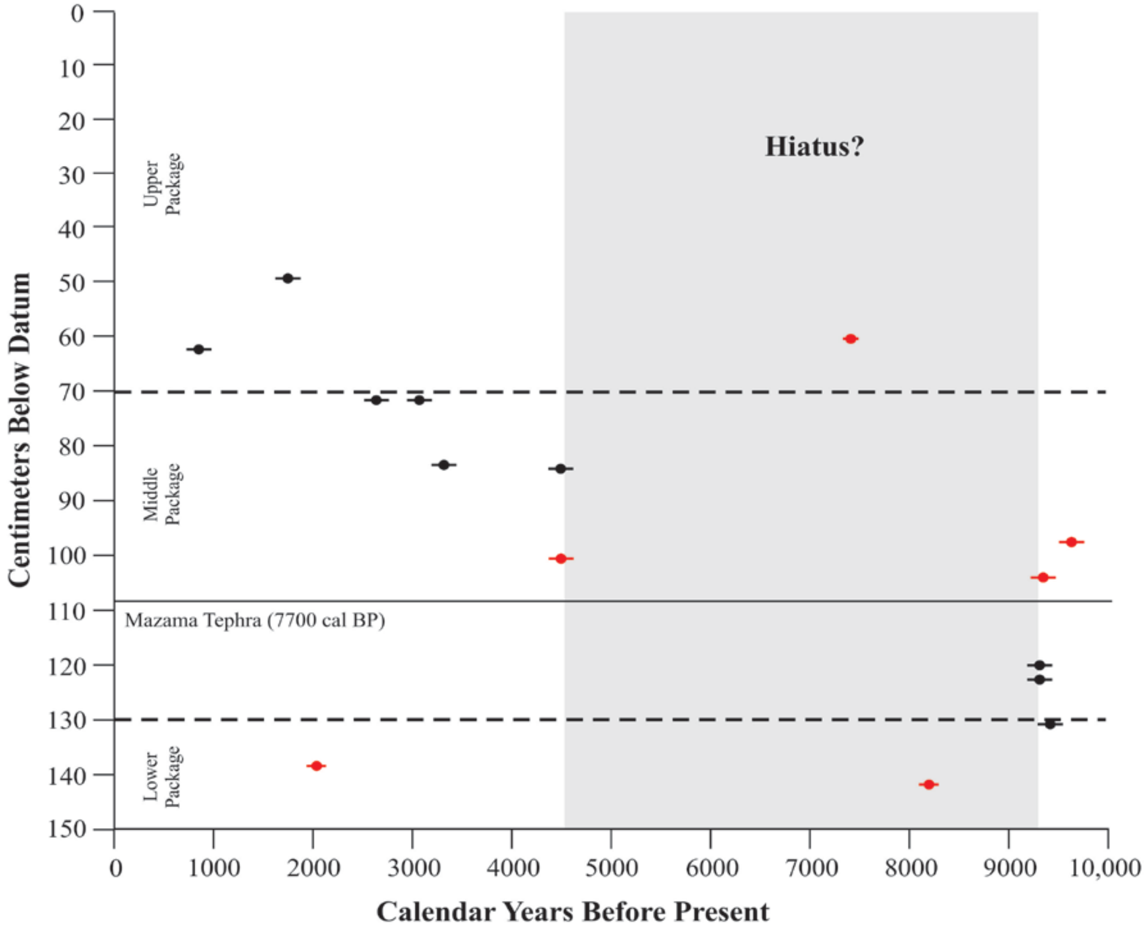


Figure 2.7. The relationship between the vertical distribution and calendar ages of dated samples in the E99 trench. Dates shown in red are clearly out of sequence and as such are suspect.

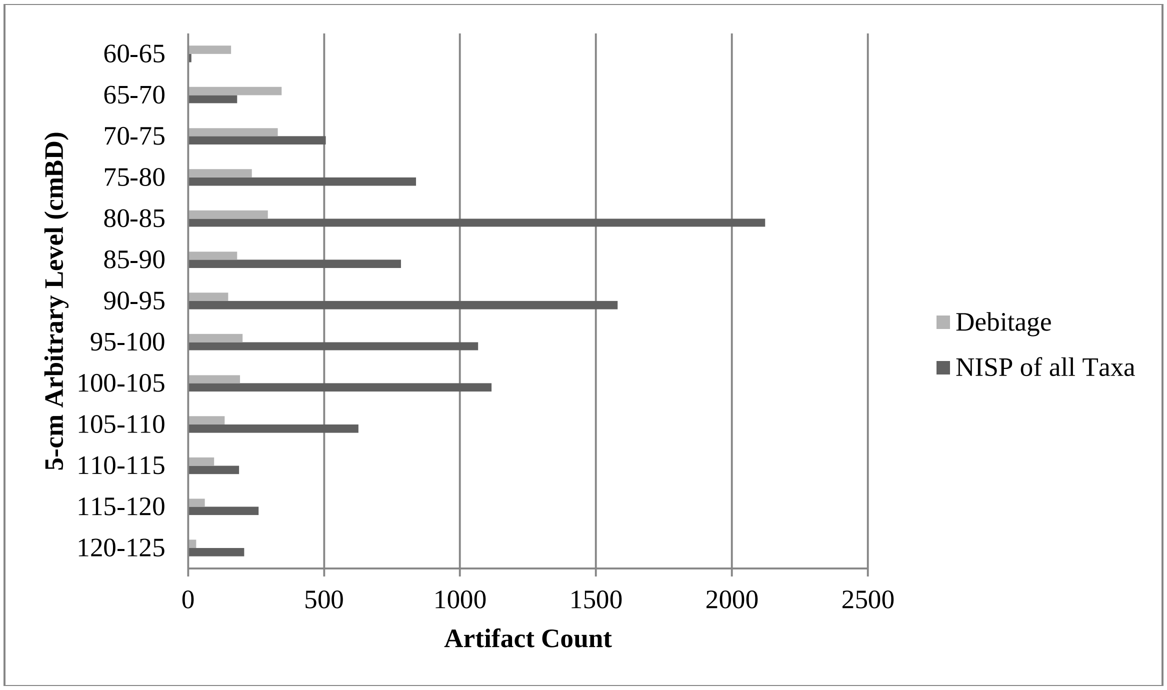


Figure 2.8. The vertical distribution of faunal specimens and debitage by 5-cm arbitrary level.

Diagnostic projectile points from LSP-1 provide support for our interpretation that there is a gap in human occupation during the Middle Holocene. Sixteen Great Basin Stemmed and foliate (i.e., Cascade) projectile points were recovered along with one crescent (Figures 2.9-2.11). Cascade projectile points were manufactured in the northern Great Basin during the Early Holocene (~10,000-8,300 ^{14}C B.P.) and Middle Holocene (~8,300-5,000 ^{14}C B.P.) (Oetting 1994b). Great Basin Stemmed projectile points and crescents were manufactured in the Great Basin during both the Terminal Pleistocene and Early Holocene (Beck and Jones 2009). At LSP-1, these two types overlap considerably when plotted by vertical depth, suggesting that they were used coevally at the site rather than sequentially with stemmed points marking a terminal Early Holocene occupation and Cascade points marking a Middle Holocene occupation. Definitive Middle Holocene point types – specifically Northern Side-notched and Pinto points – are absent at the site and exceedingly rare in surface assemblages on the valley floor below (Pattee 2014).

Together, radiocarbon dates and diagnostic artifacts at the site suggest that LSP-1 was unoccupied during much or all of the Middle Holocene – a common finding at Great Basin sites (Grayson 2011; Louderback et al. 2010). Grayson (1993:247-248) has suggested that during that period, people living outside of the Bonneville Basin including the northern Great Basin used caves and rockshelters less than earlier or later times. At LSP-1, this seems to have been the case as well. As he notes, this may be a function of the fact that most caves and rockshelters are located near shallow water, and during the Middle Holocene, that water was gone (Grayson 1993:248). In northern Warner Valley, this was definitely the case (Wriston and Smith 2012).

In addition to projectile points, a modest flaked stone assemblage dominated by small retouch flakes, later stage bifaces, a variety of unifaces, and ground stone artifacts was also recovered from Stratum V (Smith et al. 2014). LSP-1 is important in this regard because it provides a well-dated, stratified record of human occupation dated to the terminal Early Holocene and Late Holocene in a region dominated by open-air lithic scatters that lack organic preservation. The bulk of the fauna analyzed for this thesis was recovered from Stratum V deposits in the following units, which in large part comprise the E99 trench: N102E99, N103E99, and N104E99. Additional fauna were analyzed from N105E99 to supplement this sample. Fauna were recovered both *in situ* and using $^{1}/_{8}{}^{th}$-inch mesh screens. Deposits from which this sample was collected include strata V and VI, which span the period from ~3,200 to 9,300 cal B.P.

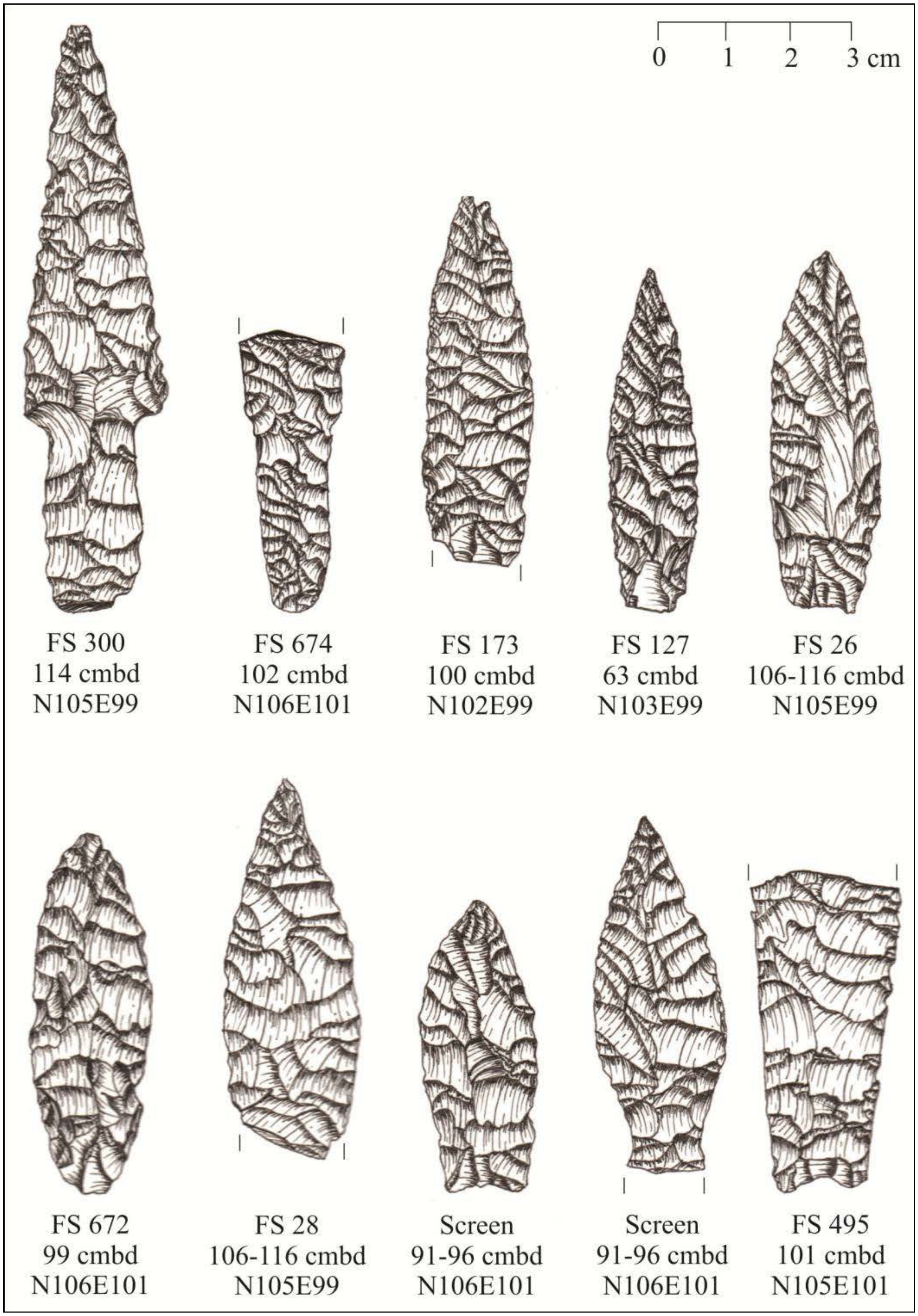


Figure 2.9. Great Basin Stemmed and foliate points from middle sediment package.

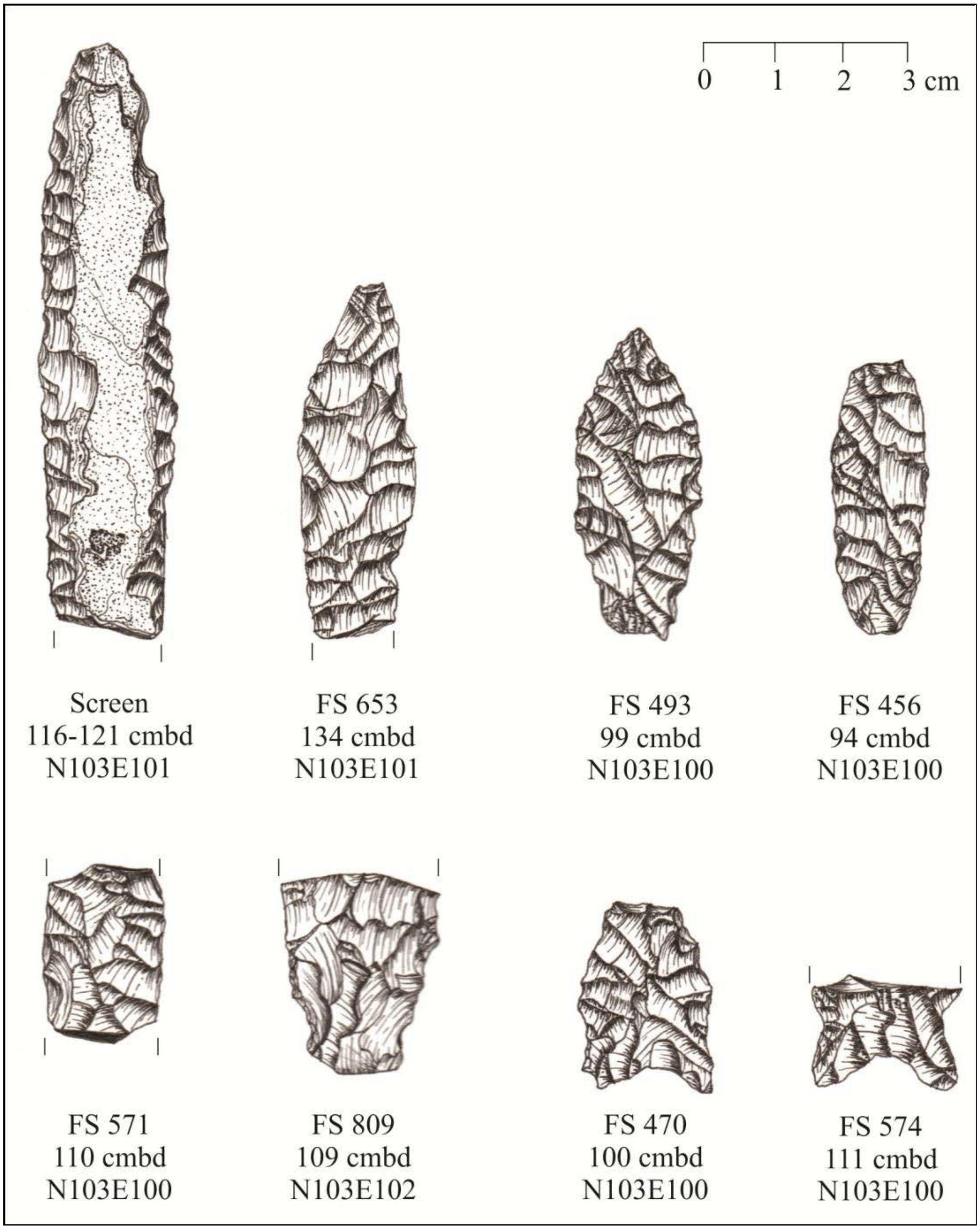


Figure 2.10. Additional projectile points from the middle sediment package.

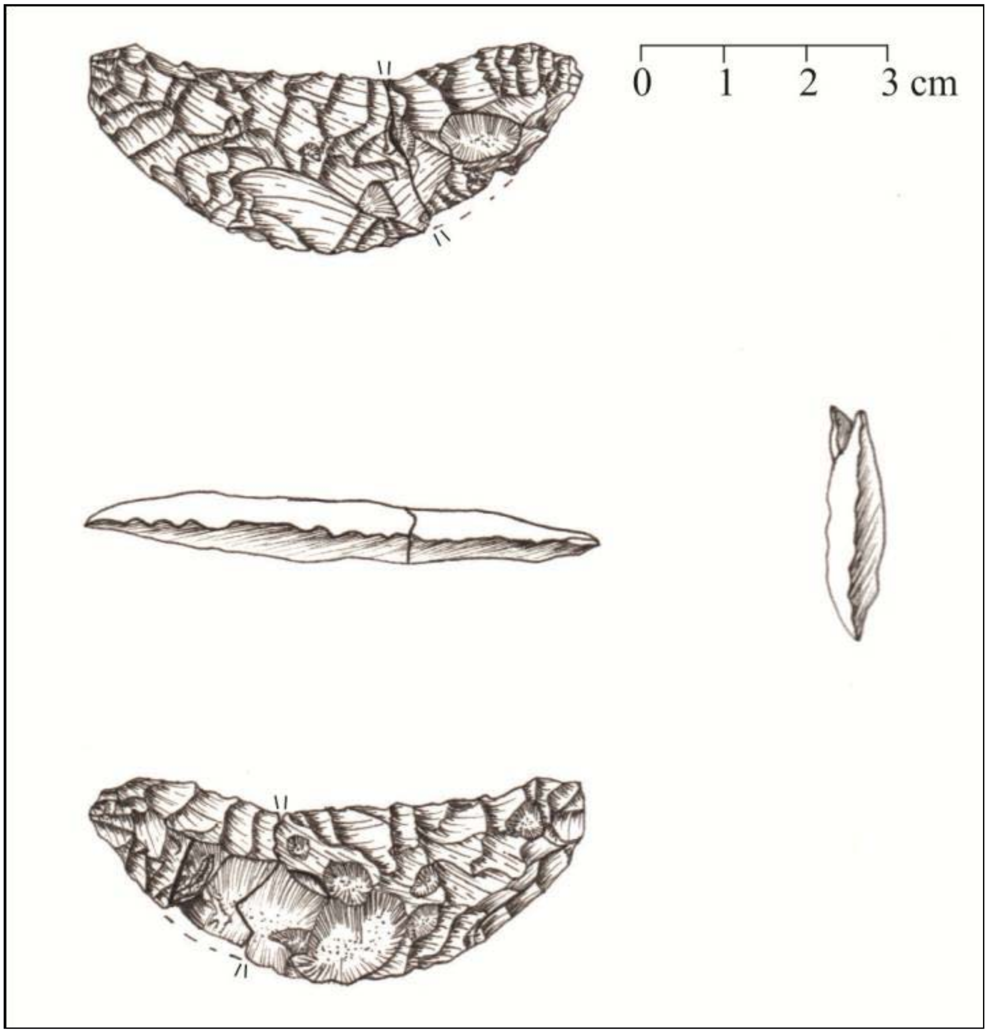


Figure 2.11. The LSP-1 crescent.

Chapter 3: Methods

Throughout the excavation of LSP-1 a large faunal assemblage was recovered. 100 percent of faunal specimens were collected either *in situ* (such was the case for large mammal bones) or from the screens (such was the case for most other bones) and sent to the Prehistoric Laboratory at UNR where they were catalogued and accessioned. Each screen bag of faunal remains was initially sorted by element. Once this was accomplished, each element pile was further separated according to identifiable taxon.

This dataset is used to address questions about human behavior (e.g., which taxa were targeted by humans, how such taxa were processed, during what season the site was occupied, etc.). Furthermore, it is used to contribute to broader questions about Great Basin prehistory; for example, does the LSP-1 record support models that suggest foragers curated axial portions of leporids for when times got harsh?

Which Taxa are Represented in the LSP-1 Faunal Sample?

Taxonomic determinations made during my analysis were based on numerous measurements using several reference manuals alongside comparative collections. I attempted to identify all specimens to the genus and species level when they matched specimens in the comparative collections. In terms of reference manuals, Hall's (1946) *Mammals of Nevada* was an invaluable source of information, along with Elbroch's (2006) *Animal Skulls: A Guide to North American Species*, Gehr's (1995) *Bones: A Field and Laboratory Guide for Identification of the Postcranial Bones of the Mammalian*

Skeleton, Olsen's (2006, 2009) *Osteology for the Archaeologist and Mammal Remains From Archaeological Sites*, Bensley's (2012) reprint of *Practical Anatomy of the Rabbit An Elementary Laboratory Textbook In Mammalian Anatomy*, Wingerd's (1985) *Rabbit Dissection Manual*, Adams and Crabtree's (2012) *Comparative Osteology: A Laboratory and Field Guide of Common North American Animals*, and Gilbert et al.'s (2006) *Avian Osteology*. Elements recovered from LSP-1 were measured and compared to measurements provided by these sources. Once this was completed, elements were cross-referenced with comparative collections supplied by Dr. Bryan Hockett (BLM Archaeologist and UNR Anthropology Adjunct Faculty Member), Dr. Gary Haynes (UNR Anthropology Department), and Dr. Stephen Vander Wall (UNR Biology Department).

Using these comparative collections and manuals, osteological elements were sided when possible after taxonomic identification. Long-bones (e.g., tibiae, femora, humeri, radii, metapodials) were recorded as diaphysis cylinders/diaphysis cylinder fragments or proximal/distal ends. Determinations were based on how much of the element was present. For tibiae, if elements contained the fibula or a portion thereof, they were recorded as diaphysis cylinders. If tibiae lacked the fibula altogether, they were recorded as diaphysis cylinder fragments. I did this so that it would reduce the chance of counting the same element twice in measures of taxonomic abundance (see below). Other long-bone elements were recorded as diaphysis cylinders if they were still in a tube form. Elements broken vertically were recorded as diaphysis cylinder fragments. Proximal and distal ends of all long-bone elements were not recorded as diaphysis cylinder fragments, although most are likely diaphysis cylinder byproducts.

I used minimum number of complete skeletal elements (MNE) to account for all identifiable specimens in the LSP-1 faunal assemblage. Minimum number of individuals (MNI) was used to account for all faunal remains in this assemblage. Number of identifiable specimens per taxon (NISP) was also used to measure the abundances of taxa represented in the faunal assemblage. If NISP is greater than MNE, then this indicates that some elements are fragmentary and there is limited overlap of specimens (Lyman 1994:292). Lyman (1994) also states that if NISP is equal to MNE, then all of the elements in the assemblage are either complete or all of the skeletal elements overlap and thus represent the same portion of the element (e.g., proximal tibia). This is useful for my analysis because the LSP-1 assemblage is very fragmentary.

Data derived from identifiable elements were entered into a Microsoft Excel spreadsheet using the following categories: accession number, excavation unit, stratum, depth, element, portion, diaphysis cylinder, diaphysis cylinder fragment, side, burning, polishing, cutting, non-cultural modification, genus, and age. Unidentified elements were recorded in a separate Excel spreadsheet using the following categories: accession number, unit, stratum, and depth. These were assigned to the following categories: small burned, small unburned, large burned, large unburned, small polished, small unpolished, large polished, large unpolished, small cut, and large cut, and when possible assigned to body size classes using Schmitt and Lupo's (1995) categories (Table 3.1). Finally, these bone fragments were recorded as either diaphysis cylinder fragments or not.

Table 3.1. Body Size Classes (Adapted from Schmitt and Lupo [1995]).

Class	Body Weight	Representative Taxa
I	<100g	Mice, voles
II	100-700g	Squirrels, gophers
III	0.75-5kg	Leporids, marmots
IV	5-25kg	Coyote, badgers
V	25-84kg	Deer, sheep, pronghorn
VI	>84kg	Bison, elk

Differentiating Elements Deposited by Human and Non-Human Agents

Numerous cultural and non-cultural agents can introduce faunal remains into cave and rockshelter settings. To determine whether the LSP-1 faunal assemblage was deposited by human agents or non-human (i.e., natural death, predators, etc.) agents I examined several things. First, I looked for burning on faunal material as indications of cultural modification. Burning on bones in archaeological contexts is typically interpreted as the byproduct of human subsistence patterns; however, wildfire events and accidental burning could also be responsible (Lloveras et al. 2009:195). When encountering burning in archaeological contexts, it is important to look for additional evidence of human activity such as the presence of cutmarks (explained in more detail below). A high frequency of diaphysis cylinders also provides evidence of cultural behavior (Figure 3.1). The faunal assemblage recovered from LSP-1 contains a high number of long-bone diaphysis cylinders that provided a starting point for analysis.

Figure 3.1. Lepus tibia diaphysis cylinders (TDCs). Culturally produced TDC exhibits a high degree of shine compared to the TDC at right, which was collected from a raptor roost.

Second, I looked for differences in the bones' surface textures. Bones from comparative collections generally display a matte finish (natural shine on bone), whereas some of the bones from LSP-1 exhibit a glossy finish, reflecting some sort of alteration. Obvious culturally modified bones (e.g., tibia diaphysis cylinders that include cutmarks) exhibit this high gloss finish, which may represent "pot polish" (see Figure 3.1). While observing bones collected from the casting material of diurnal raptors used in falconry, I noticed that the cancellous bone on the epiphyses, both proximal and distal, is more prone to pitting whereas the cortical bone displays a high degree of polishing (high gloss) (Figure 3.2). Also, younger animals display more attrition to elements than adults due to varying degrees of bone density during growth (bone survivorship) (Lyman 1994:46). Different degrees of polishing may also occur between birds and mammals due to varying degrees of bone density. Bone density varies from element to element, affecting the degree in which polishing would modify certain elements.

Figure 3.2. Coturnix quail (*Coturnix japonica*) humerus consumed by a captive red-tailed hawk (*Buteo jamaicensis*) (top) compared to a western kingbird (*Tyrannus verticalis*) humerus in a natural setting. Note the pitting on the proximal end of the quail humerus.

In addition to culturally modified bone, based on Hockett's (1991, 1993, 1995b) analysis of raptor modification to leporid bones I also looked for evidence of carnivore and raptor modification of bones from LSP-1. Hockett (1995b) notes that puncture marks located behind the acetabulum should be evident when prey is consumed by raptors (Figure 3.3). In his comparative raptor-accumulated collection, there are substantial numbers of leporid remains consumed by diurnal raptors. His collection contains several tibia diaphysis cylinders that show different kinds of modification than those found on culturally produced diaphysis cylinders, which exhibit more polish. Additionally, the degree of weathering observed on the bones from the raptor-accumulated assemblage is much greater than on those recovered from LSP-1 and other archaeological sites.

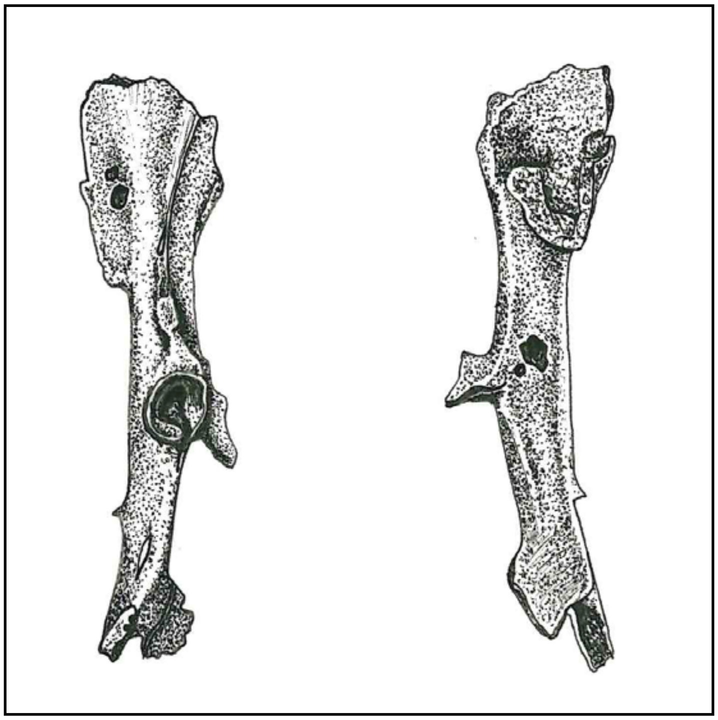


Figure 3.3. Two raptor produced puncture marks on the ilium (left) and two punctures behind the acetabular fossa (right), note the shearing on the ilium, ischium and pubis. *Lepus* right innominate collected in the Pinegrove Range, NV.

Third, I looked for cutmarks to determine if there was evidence for butchering. All elements in the faunal collection were examined under a hand lens (10X power) for cutmarks and evidence of basket polishing (rounding on broken surfaces discussed later in this chapter). If cutmarks were not obvious, then the bones were examined using a microscope (300X power) to reveal whether cutmarks were present. The skill of the butcher influences the frequency of cutmarks left on bone; for example, a skilled butcher will avoid contact with bone more regularly than an unskilled butcher (Lloveras et al. 2009:193). To better understand how and where cutmarks might accumulate on leporid (the main taxa represented in the LSP-1 faunal assemblage) skeletons, I butchered a *Sylvilagus nuttallii grangeri* (nuttall cottontail rabbit) using flakes removed from an obsidian cobble. The rabbit was first skinned and then placed on a grill over a fire and cooked. Cooked meat was then removed. I initially snapped both the proximal and distal ends of the long-bones by hand; however, the sharp ends of the bones tended to jab into my fingers. I then used a mano and metate to break the proximal and distal ends off of the long-bones, which saved considerable time and effort. Jagged edges produced by this method mimic what I observed on diaphysis cylinders from LSP-1 (see Chapter 4). The bones were then placed into a pot of boiling water for grease rendering after the marrow was removed. The bones were then examined under a 300X power microscope for cutmarks (Figure 3.4). Cutmarks displayed a classic V-shape with parallel cuts consistent with those observed in the LSP-1 assemblage (see Chapter 4). Shallower cutmarks paralleling a deep, well-defined cutmark are interpreted as being diagnostic of cultural modification (Fisher 1995:12). There were also some “feathering” marks on my experimental bones (Figure 3.5), which may be produced by cortex on the stone tool used during butchering (Jenkins et al. 2012). Some observed cutmarks also have “rippling” marks (microscopic circular patterns) on both sides of well-defined cutmarks, which are produced when a stone tool chips as it cuts (Fisher 1995; Bryan Hockett, personal communication 2012). Coarse bifacial stone tools typically produce shallow grooves on bone whereas finer bifacial tools tend to produce narrow grooves (Walker and Long

1977:609). Other experimental butchering events have revealed that cutmarks can occur in high frequencies. For example, Lloveras et al. (2009) noted the average number of cutmarks produced from skinning rabbits is 2.5 while this number increases to 16.6 for disarticulation of a carcass and 34 cutmarks from defleshed leporids. When cutmarks were noted on the LSP-1 elements via hand lens and microscopic examination, I plotted their locations on illustrations of various elements. Elements such as the mandible were drawn with the missing portions darkened to show what proportions were most commonly recovered, and where cutmarks occurred. I expected cutmarks to show up with some degree of consistency in terms of their location. Specifically, on mandibles I expected that cutmarks should be present just below the dentition as a removal of soft tissue in that region is tough to remove (see below for discussion on skinning).

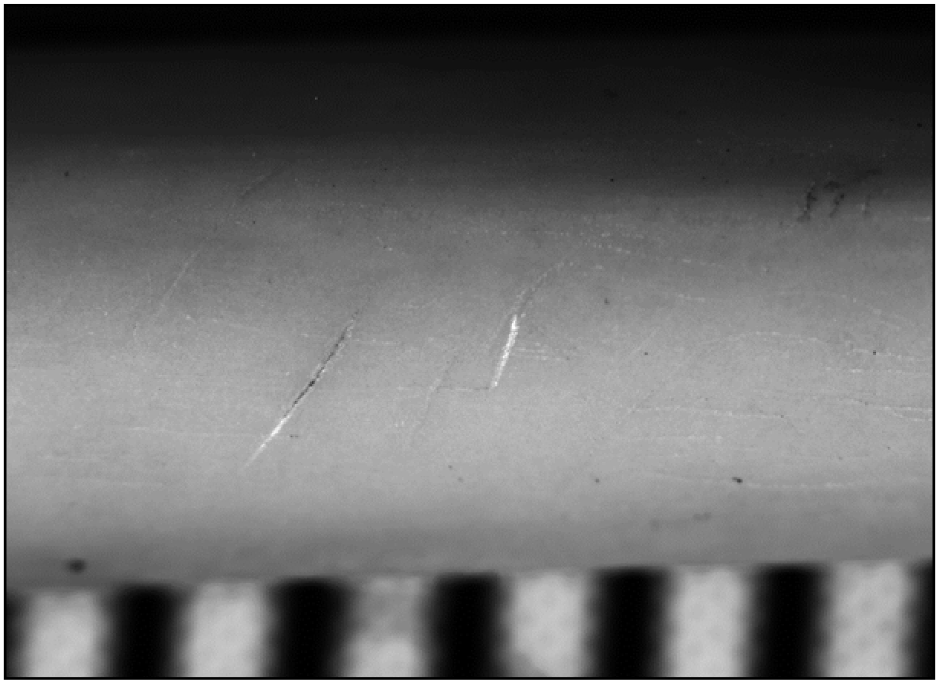


Figure 3.4. Experimentally-butchered *Sylvilagus* tibia with cutmarks.

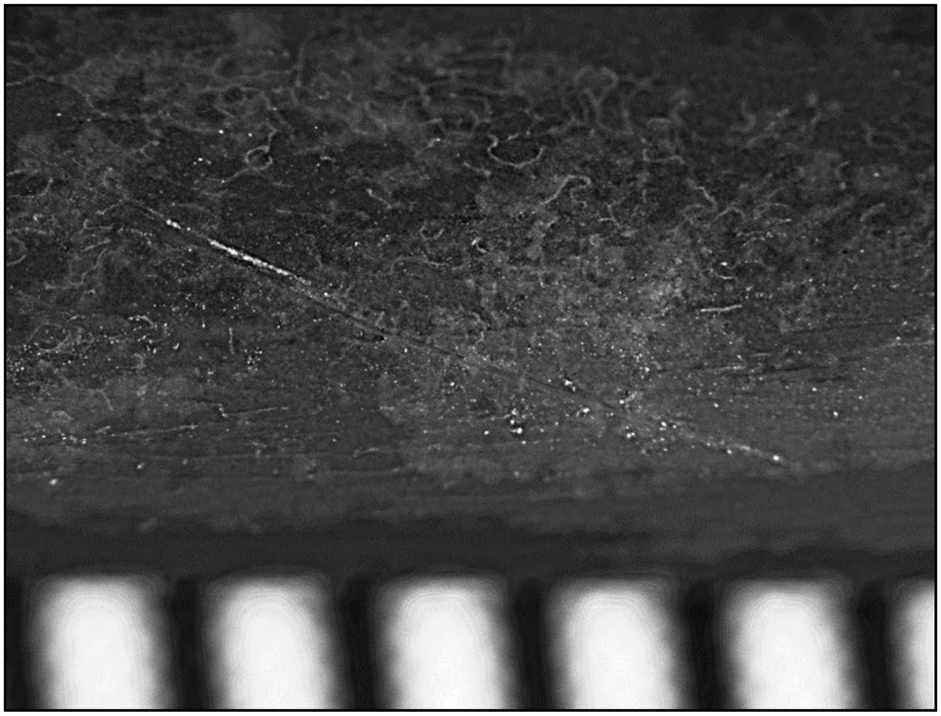


Figure 3.5. Experimentally-butchered *Sylvilagus* femur with "feathering" on top left of well-defined cutmark.

Fourth, I looked for evidence of basket polishing found on bone, which consists of beveled abrasion and polishing at the tips of elements. Polishing of broken element ends is associated with microscopic striae produced during cooking in ceramic vessels, first observed at sites in the Southwest (White 1992:121). Although pottery was absent or rare in the Great Basin throughout much of prehistory, baskets displaying a wide range of manufacture techniques were abundant during the Early Holocene and likely earlier (Grayson 2011; Hattori and Fowler 2009). Ethnographically, most cooking in the Great Basin was accomplished by adding heated stones to boil water in baskets and this practice likely extended back far in time (D'Azevedo 1986:474). When elements are placed into a cooking vessel (e.g., a pot or basket), the proximal and distal ends rub and grind against the walls as they are stirred, producing polishing and beveled ends (White 1992:123).

Reconstructing Human Activity at LSP-1

Reconstructing human activity at LSP-1 can be accomplished using several methods. Mortality profiles for certain species may be used to determine the season in which humans occupied the site. Identifying element or carcass transport away from a site as well as cooking, butchering, and processing damage can be used to identify particular behaviors at the site and address larger issues such as whether site occupants were experiencing “good” or “bad” times in terms of subsistence and nutrition. I outline such approaches in detail below.

Seasonality

Seasonal mortality can be caused by natural agents (e.g., floods, severe storms) or human activity (e.g., seasonally restricted communal hunting) (Klein and Cruz-Uribe 1984:45). The offspring of many taxa are born during the same season each year; therefore, their mortality (e.g., predation on taxa relatively all the same age) is largely a seasonal event as well (Klein and Cruz-Uribe 1984:60). For example, leporids give birth to their young in the Great Basin from early spring to early September (Hall 1946:605, 611) and typically have a high juvenile mortality rate (Hockett 1991:668). Ethnographically, communal rabbit drives were primarily conducted during the late fall and winter when fur coats and body condition were in prime shape (Hittman 1984:9). Due to high juvenile mortality rates, communal hunting events tend to produce few juveniles (Hockett 1991:668). In contrast, non-human agents responsible for depositing leporid remains (e.g., raptors, carnivores) target all ages, not just adults (Hockett 1991:668). Thus, if a site contains an assemblage of human-deposited leporid bones that are primarily from adults, then it can be inferred that they were likely harvested during the fall/winter.

Capture

Capturing methods varied for *Lepus* and *Sylvilagus*, the former being easily driven as they are prone to running, as opposed to hiding or running down burrows like *Sylvilagus*. Ethnographic accounts of rabbit drives indicate that they generally proceeded in a set manner. First, a rabbit boss (*kammɨ pohinabi*) or shaman sent runners out to other camps announcing an upcoming drive and its location (Fowler 1992; Knack and Stewart 1984; Steward 1938). Every participating man contributed his net and together they were extended across a desert valley (Knack and Stewart 1984:21). Fowler (1992) mentions that rabbits caught in any one individual's personal section of the net were his property. Second, after the nets had been set up a traditional round dance (*kammɨ nɨga*) was held to celebrate the coming drive (Fowler 1992; Knack and Stewart 1984; Steward 1938). Third, the rabbit boss conducted the drive the next day and men chased leporids out of the brush towards the waiting nets (Knack and Stewart 1984; Steward 1938). Fourth, once the animals became entangled in the nets they were clubbed or shot with arrows

(Inter-Tribal Council of NV 1976; Pope 1983). Ethnographic accounts report that 400-500 leporids could be killed in a single day using this method (Adovasio et al. 2009; Fowler 1992; Pope 1983). Fifth, leporids were immediately skinned and the meat prepared for drying if it was not consumed on the spot, fur being singed off in some cases rather than being removed during skinning (Downs 1966; Fowler 1986; Knack and Stewart 1984). Pelts were cut into long thin spirals and twisted around a string core to make a long rope (Wheat 1967:76). Once this process was complete the ropes were woven into square blankets (Knack and Stewart 1984:21). I used these accounts to develop expectations for what I might see in the LSP-1 assemblage if leporids were collected in a similar fashion; for example, I expect to see clusters of facial cutmarks reflecting skinning and mortality profiles dominated by adults suggesting late fall/early winter drives if such behavior occurred at LSP-1.

Butchering and Processing

Patterns of intensive butchering and processing can be used as evidence of “bad” times. Bones from sites where people were stressed for calories often exhibit massive breakage of most elements likely reflecting hammerstone blows, high percentages of burning to elements after butchering, high frequencies of cutmarks on butchered elements reflecting the removal of all consumable tissue, low numbers of bone tools present, a lack of vertebrae, and nearly complete disarticulation of elements (White 1992:39). The majority of sites where leporid bones are found show breakage patterns associated with marrow extraction suggesting that humans often harvested marrow from these animals.

However, at sites where certain elements (i.e., vertebrae) are missing, inferences may be made about possible nutritional stress. Examples of sites where people were starving or nearly so exhibit the patterns described above; for instance, the Donner Party of 1846-47. In Georgia Donner's diary she wrote that "hides were boiled down and the bones burned down and eaten" (Dixon et al. 2010:630). Osteological material from Alder Creek (a Donner Party camp) is highly fragmented and bones exhibit exfoliation from prolonged burning, high frequencies of cutmarks, chop marks, saw marks, percussion pits produced from blunt force impacts, and pot polish (Dixon et al. 2010:641). As outlined above, pot polish occurs when elements are boiled in vessels for grease rendering, which produces rounding and beveling on otherwise jagged edges (White 1992:121). Experiments have shown that pot polish will develop at variable rates depending on how long the elements are stirred and the roughness of the vessel used for grease rendering (Dixon et al. 2010:644). Grease rendering is a laborious task and is usually a last resort during periods of nutritional stress (Dixon et al. 2010:648). This process provides calories in the form of lipids, grease, trace vitamins, and minerals (Dixon et al. 2010:648). Because it is also the most destructive processing activity, grease rendering usually erases other traces of processing techniques such as bone marrow extraction (Dixon et al. 2010; White 1992).

Cooking

Ethnographically, leporids were processed by women after they were dispatched during communal hunting events (Fowler 1992:78). Sometimes animals were gutted, split lengthwise, and hung on racks to dry, while other times they were roasted in the ashes of cooking fires (Fowler 1992:78). Leporids were often cooked or roasted whole in their skins over hot coals, resulting in burned bones (Fowler 1992; Hockett 1993). Other small mammals such as marmots and woodrats were also cooked in this fashion (Fowler 1992:78). Bones were often discarded into fires after use, resulting in a higher frequency of burned elements than produced the original cooking event (Hockett 1993:61). Both *Lepus* and *Sylvilagus* diaphysis cylinders produced during bone marrow extraction by humans tend to consist primarily of adult specimens (Dansie 1991; Hockett 1995b:224). Leporid diaphysis cylinders were produced during bone marrow extraction when the distal and proximal epiphyses were removed (Hockett 1991, 1993).

Carcass or Element Transport Away From Sites

The leporid assemblage recovered from Camels Back Cave shows evidence that some parts of the prey were transported away from that site. Body parts commonly found at the site include heads, forelegs, and lower hind legs (Schmitt et al. 2002:92). Metapodials are underrepresented, suggesting that they were either discarded elsewhere or consumed prior to the prey's arrival at the site (Schmitt et al. 2002:93). Proximal femora, innominates, and vertebrae are also underrepresented, suggesting that they were also discarded or processed at another location away from Camels Back Cave (Schmitt et al. 2002:93). Together, these patterns suggest that the cave was likely not a habitation site but instead served as a stopover place to gather, possibly after rabbit drives (Schmitt et al. 2002:93). Schmitt et al. (2002) suggest that as conditions turned "bad" in the Great Basin during Middle Holocene desertification, leporid hunting actually improved greatly due to changes in rabbit and hare habitat. Thus, sites like Camels Back Cave may indicate that people were doing well in certain places at certain times, even during the warm and dry Middle Holocene. This conclusion is based on the fact that at places like Camels Back Cave, people did not process game as intensely as they would be expected to if they were suffering from nutritional stress. Ethnographically, the Washoe dried the axial skeleton of leporids and curated them for “hard times” when winters were harsh (Dansie 1991:99). These curated elements, including lower utility ribs and vertebrae, were ground up into bone meal (Dansie 1991; Downs 1966). The bone meal was then mixed with grease and leftover meat or pinenuts (Dansie 1991; Downs 1966). Such behavior might explain low numbers of leporid axial elements recovered from archaeological sites within the Great Basin (e.g., Camels Back Cave, Hogup Cave); however, bone survivorship could also explain low frequencies of certain elements in faunal assemblages (Aikens 1970; Hockett 1993; Schmitt and Lupo 1995). Variables such as moisture, temperature, and acidic soil/sediment can also affect bone survivorship at a site (Dixon et al. 2010; White and Folkens 2005) because these factors accelerate bone deterioration (White and Folkens 2005:52). Conditions ideal for bone preservation include environments that are either dry or very cold (Cucina and Tiesler 2008; White and Folkens 2005). Warm, dry deserts preserve and mummify organic material: this is why caves and rockshelters in Great Basin are natural preservers of organic material (Aikens 1970; Burns 2007). Bone survivorship at LSP-1 is likely high due to aridity of the site.

Understanding Human Subsistence at LSP-1 during the Terminal Early Holocene and Early Late Holocene and How it Can Contribute to Broader Questions of Great Basin Prehistory

Evidence for artiodactyl use during the Early Holocene is generally rare compared to later periods within the northern Great Basin (Pinson 2007:195). Foragers utilized a wide spectrum of small game consisting of fish, leporids, and insects as well as plant foods (Hockett 2007; Pinson 2007). As mentioned in Chapter 2, it appears that there was a hiatus at LSP-1 during the Middle Holocene. Archaeologists have long debated the nature of human lifeways during the Middle Holocene. Many researchers (e.g., Aikens 1970; Elston 1982; Grayson 2011; Hockett 1991, 1993, 2007; Pinson 2007; Schmitt and Madsen 2005; Schmitt et al. 2002) suggest that "hard times" were common and during these periods, prey selection was highly variable between locations.

One way to consider large and small game's contributions to prehistoric diet is to calculate Artiodactyl Index values, which can be used to compare sites across both time and space. As noted in Chapter 1, the index is calculated as follows: $\sum$ artiodactyls/$\sum$ artiodactyls + $\sum$ lagomorphs (Broughton et al. 2008:1926). The Artiodactyl Index is useful for considering how "good" and "bad" times may have varied throughout the region. At locations where people were experiencing the former, we might expect to see higher artiodactyl index values whereas at locations where people were experiencing dietary stress, we might expect to see lower artiodactyl index values. Having said that, as Schmitt et al. (2002) have argued, groups may have done quite well even in situations where artiodactyls were not heavily targeted. An alternative method to the artiodactyl index is the small game index, which is the method used in this analysis. The small game index is calculated as follows: ∑ small game/∑ large game + ∑ small game (Hockett 2007). The small game index is useful for sites where small game is diverse (e.g., leporids, birds, insects, and fish). The artiodactyl index only calculates leporids and artiodactyls at sites, therefore, at sites with diverse small game represented (e.g., Bonneville Estates Rockshelter, Pie Creek Shelter, the Tucker Site, Fort Rock Cave, Connley Caves, and the Paisley Caves) the artiodactyl index is severely biased toward leporids and artiodactyls (Bryan Hockett, personal communication, 2014). I calculated small game indices for select northern Great Basin sites to compare their values with that of LSP-1 to place these sites into context with each other.

Summary

LSP-1 has yielded a robust faunal assemblage which has the potential to help us understand human subsistence and behavior during the terminal Early Holocene and early Late Holocene. Analysis of taxa and the potential agents responsible for their deposition can reveal human subsistence behavior in the northern Great Basin. In applying the methods described in this chapter, I developed a set of expectations related to the following research questions outlined in Chapter 1: (1) which taxa are represented in the LSP-1 faunal sample?; (2) which agents were responsible for their deposition (i.e., was the assemblage primarily a function of cultural or natural events)?; and (3) what types of human behavior can we reconstruct based on the results of my faunal analysis? These questions, my expectations, and the materials and methods used to evaluate those expectations are summarized in Table 3.2. In the next chapter, I present the results of my analysis of the LSP-1 faunal sample.

Table 3.2. Summary of Research Questions, Methods, and Expectations.

Research Question	Materials and Methods	Expectations
Which taxa are represented at LSP-1 and in what abundances do they occur?	Manuals and comparative collections; calculating NISP, MNI, MNE, MAU	n/a
Are the LSP-1 fauna products of human or non-human agents?	Constructing mortality profiles; element representation; element modification	Cultural assemblage: High frequency of diaphysis cylinders with polish, burning and cutmarks. Predominantly adult specimens present. Natural assemblage: Pitting on distal and proximal ends of elements, shearing, and puncture marks from talons, beaks. Assemblages contain all life stages of taxa.
What types of human behavior occurred at LSP-1?	Seasonality: constructing mortality profiles; Capture: constructing mortality profiles; Processing: identifying frequencies and locations of cutmarks, pot polish, and broken bones Prey Transport: element representations	Seasonality: High frequency of adult leporids indicates a fall/winter hunt based on ethnographic accounts. Capture: High frequency of *Lepus* indicate capture was accomplished using fiber nets. *Sylvilagus* hide and run into burrows and are not usually taken during drives. Processing: High frequency of cutmarks could indicate over processing of elements during periods of nutritional stress. Rounding/beveling to otherwise sharp bones suggest grease rending in a cooking vessel. Highly fragmented elements suggest intensification of marrow/grease collection. Prey Transport: Missing elements could indicate that certain portions were discarded or eaten away from the site. Missing elements could also indicate that they were ground up and eaten.
Does the LSP-1 faunal assemblage reflect "good" or "bad" times?	Calculating artiodactyl index and small game index; element processing intensity	Good Times: High AI value and low SGI value relative to other Great Basin sites, minimally processed skeletons Bad Times: Low AI values and high SGI values; heavily processed skeletons.

Chapter 4: Results

Faunal material is abundant and well preserved at LSP-1. In this chapter, I provide a descriptive summary of the entire assemblage, focusing on elements that are burned, polished, cut, and/or represent diaphysis cylinders. Additionally, I provide estimated numbers of Minimal Animal Units (MAU), which are used to define the number of taxa required to supply the counted specimens (Lyman 1994). Most of this chapter focuses on leporid remains because they are by and far the most numerous taxa in the LSP-1 assemblage.

The LSP-1 Taxa

The faunal sample from Stratum V in units N102E99, N103E99, N104E99 (and select elements from N105E99) consists of ~9,500 specimens (Table 4.1). At least 23 different species including three birds and 20 mammals are represented (Table 4.2). These taxa are briefly described below.

Table 4.1. Numbers of Identified Specimens by Taxon/Size Class from Stratum V.

Taxon	**NISP**	**% of Assemblage**
Bison spp.	1	0.01%
Bubo virginianus	1	0.01%
Canis latrans	5	0.05%
c.f. *Canis lupus*	2	0.02%
c.f. *Cervus canadensis*	1	0.01%
Dipodomys merriami	1	0.01%
Lagurus curtatus	1	0.01%
Lepus	2,701	28.5%

Figure 4.1. Numbers of Identified Specimens by Taxon/Size Class from Stratum V.

Leporid	29	0.31%
Lynx rufus	2	0.02%
Marmota flaviventris	1	0.01%
Marmota spp.	1	0.01%
Mustela spp.	1	0.01%
Neotoma cinerea	6	0.06%
Neotoma fuscipes	1	0.01%
Neotoma lepida	1	0.01%
Neotoma spp.	1	0.01%
Odocoileus hemionus	13	0.14%
c.f. *Odocoileus hemionus*	6	0.06%
Passeriformes	1	0.01%
Perognathus longimembris	1	0.01%
Peromyscus spp.	2	0.02%
Rodent	2	0.02%
Spilogale gracilis	1	0.01%
Sylvilagus	983	10.4%
Vulpes macrotis	1	0.01%
Artiodactyl	13	0.14%
Avian	1	0.01%
Large mammal (VI)	38	0.40%
Large mammal (V)	242	2.5%
Small mammal (IV)	18	0.19%
Small mammal (III)	5,415	57.0%
Small mammal (II)	2	0.02%
Small Mammal (I)	2	0.02%
Total	**9,496**	**100.00%**

The most common type of taxa (~57% of the entire sample) in Stratum V is unidentified size class III small mammal remains (Figure 4.1). Although they could not be positively identified, most are likely leporids. Among identified taxa, *Lepus* is the most well-represented (n=2,701; 28.5%) (Table 4.2). The next most common identified taxa, *Sylvilagus*, is represented by 983 bones (10.4%) (Table 4.2).

Figure 4.1. Unidentified small mammal bones from Stratum V (scale is in centimeters).

Table 4.2. NISP by Element and Taxon

	Taxa																		
Element	*Lepus*	*Sylvilagus*	Leporid	*Odocoileus*	c.f. *Odocoileus*	Artiodactyl	*Neotoma cinerea*	*Canis latrans*	c.f. *Canis lupus*	*Lynx rufus*	*Peromyscus spp.*	Rodent	*Bubo virginianus*	c.f. *Cervus*	*Dipodomys*	*Lagurus curtatus*	*M. flaviventris*	*Marmota* spp.	*Mustela* spp.
Astragalus	6	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Acetabulum	10	12	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Angular Process	2	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Axis	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Basisphenoid	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Bulla	19	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Calcaneus	10	5	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cervical Vertebra	2	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-
Condyloid Process	46	6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Coronoid Process	11	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cranium Fragment	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Exoccipital	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Femur	326	187	-	9	6	-	-	-	-	-	1	-	-	1	-	-	-	-	-
Fibula	8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Fur	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1
Humerus	109	68	-	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ilium	4	15	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Incisive	55	18	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Incisor	50	19	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Innominate	4	6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ischium	6	11	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Table 4.2. NISP by Element and Taxon																			
Lumbar vertebra	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Mandible	243	91	-	-	-	1	3	-	-	1	1	-	-	-	-	1	1	-	-

Maxilla/Maxillary	115	15	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-
Metapodial	230	34	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-
Metatarsal	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Molar	198	12	-	-	-	-	2	-	-	-	-	-	-	-	-	-	-	-	-
Nasal-frontal-orbital	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Palatine	18	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Parietal	8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Phalange	43	11	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Patella		1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Premolar	94	23	3	-	-	-	1	4	1	1	-	-	-	-	-	-	-	-	-
Pubis	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Radius	111	66	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ramus	13	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Rib	47	2	4	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-
Rostral supraorbital process	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Scapula	73	45	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Skull fragment	302	8	9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Squamosal	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Terminal phalanx	4	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-
Thoracic vertebra	7	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Tibia	430	264	-	1	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-
Tooth	3	-	6	-	-	12	-	-	-	-	-	-	-	-	-	-	-	-	-
Ulna	64	44	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-
Vertebra	3	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Zygomatic process	14	8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Needle/Pin Tool	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total	**2,701**	**983**	**29**	**13**	**6**	**13**	**6**	**5**	**2**	**2**	**2**	**2**	**1**	**1**	**1**	**1**	**1**	**1**	**1**

Table 4.2 NISP by Element and Taxon.

	Taxa																		
Element	*Neotoma fuscipes*	*Neotoma lepida*	*Neotoma* spp.	Passeriformes	*Perognathus*	*Spilogale gracilis*	*Vulpes macrotis*	Avian	*Bison* spp.	Large Mammal VI	Large Mammal V	Small Mammal IV	Small Mammal III	Small Mammal II	Small Mammal I	-	-	-	-
Astragalus	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Acetabulum	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Angular Process	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Axis	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Basisphenoid	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Bulla	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Calcaneus	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cervical Vertebra	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Condyloid Process	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Coronoid Process	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cranium Fragment	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-
Exoccipital	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Femur	-		-	-		-	-	-	1	-	-	-	-	-	-	-	-	-	-
Fibula	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Fur	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Humerus	-	1	-	1	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-
Ilium	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Incisive	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Incisor	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Innominate	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ischium	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Lumbar vertebra	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Mandible	-	-	-	-	1	-	1	-	-	-	-	-	-	-	-	-	-	-	-
Table 4.2 NISP by Element and Taxon.																			
Maxilla/Maxillary	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Metapodial	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Metatarsal	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Molar	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Nasal-frontal-orbital	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Palatine	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Parietal	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Phalange	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Patella	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Premolar	-	-	-	-	-	-	-		-	-	-	-	-	-	-	-	-	-	-
Pubis	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Radius	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ramus	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Rib	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Rostral supraorbital process	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Scapula	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Skull fragment	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Squamosal	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Terminal phalanx	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Thoracic vertebra	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Tibia	-	-	1	-	-	-	-	-	-	-	-	-	-	-		-	-	-	-
Tooth	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ulna	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Vertebra	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Zygomatic process	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Needle/Pin Tool	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**38**	**242**	**18**	**5,415**	**2**	**2**	**-**	**-**	**-**	**-**

Figure 4.2. Unidentified large mammal bones from Stratum V.

Below, I summarize each taxa identified in the LSP-1 and the elements that were identified for each.

Class Mammalia: Mammals

Order Artiodactyla: Artiodactyls

Material: Twelve tooth fragments, one mandible fragment = 13 specimens.

Family Bovidae: Bovids

Bison spp: Bison

Material: One femur fragment = one specimen (Figure 4.3).

Remarks: This artifact is a worked bone flake tool which has cutmarks and striae on it consistent with use-wear (see Figure 5.5). Bison were relatively widespread in the eastern and northern Great Basin during the Late Holocene as the result of increased monsoonal storms. They were less abundant prior to the Late Holocene and declined ~700 cal B.P. (Grayson 2006b, 2011). There appear to have been two pulses of expansion in the northern Great Basin by bison. The earliest dates for bison are ~3,100 cal B.P. from the Connelly Caves followed by ~722 cal B.P. from Paisley Cave 2 (Grayson 2011:275). Other dates for bison in the northern Great Basin are relatively late (e.g., 600 cal B.P. from the Peninsula Site, Warner Valley, OR and ~180 cal B.P. from Harney Dune, OR (Grayson 2011:275). Older bison remains have been found adjacent to the northern Great Basin: ~8,700 cal B.P. at Dirty Shame Rockshelter, OR and ~6,300 cal B.P. in Surprise Valley, CA (Grayson 2011:275). An additional bison femur fragment recovered in the eastern portion of LSP-1 (not included in my sample) produced a direct date of ~4,400 cal B.P. (Smith et al. 2014), which is consistent with the first pulse noted from Connelly Caves.

Figure 4.3. *Bison* spp. Femur (flake tool) from Stratum V.

Family Cervidae: Cervids

Odocoileus hemionus: Black-tailed Mule Deer

Material: 15 femur fragments, two humerus fragments, one metatarsal fragment, one tibia fragment = 19 specimens (Figure 4.4).

Remarks: Black-tailed mule deer are presently abundant throughout the western United States and Canada, flourishing above the Lower Sonoran life zone (Hall 1946).

Figure 4.4. Burned *Odocoileus hemionus* humerus fragment from Stratum V.

Cervus canadensis: Wapiti/Elk

Material: One femur fragment = one specimen.

Remarks: Wapiti occupy much of the same range as do black-tailed mule deer with the exception of most of Nevada (Hall 1946); however, Wapiti were probably always uncommon in the Great Basin – only 27 archaeological sites in the Great Basin have provided 131 specimens (Grayson 2011).

Order Carnivora: Carnivores

Family Canidae: dogs, coyotes, foxes, and wolves

Canis latrans: Coyote

Material: One third premolar, one maxilla fragment, three premolar fragments = five specimens.

Remarks: Coyotes are often found in Holocene faunal assemblages (Grayson 2011). Presently they are widespread both east and west of the Rocky Mountains, Canada, and Alaska (Hall 1946).

C.f. *Canis lupus*: Grey Wolf

Material: One premolar fragment, one terminal phalanx = two specimens. Specimens compare favorably with *Canis lupus*.

Remarks: Wolves once occupied northeastern Nevada but are likely now locally extinct (Hall 1946). They once occupied approximately the same territory as the coyote, and are now widespread in parts of Canada and Alaska.

Vulpes macrotis: Kit Fox

Material: One mandible = one specimen.

Remarks: Presently the kit fox is common in the western United States excluding Washington, Idaho, northwestern California, northern Oregon, central, and northeastern Nevada (Hall 1946).

Family Felidae: Cats

Lynx rufus: Bobcat

Material: One mandible fragment, one premolar fragment = two specimens (Figure 4.5).

Remarks: Presently, the bobcat is common throughout North America excluding Canada and Alaska (Hall 1946).

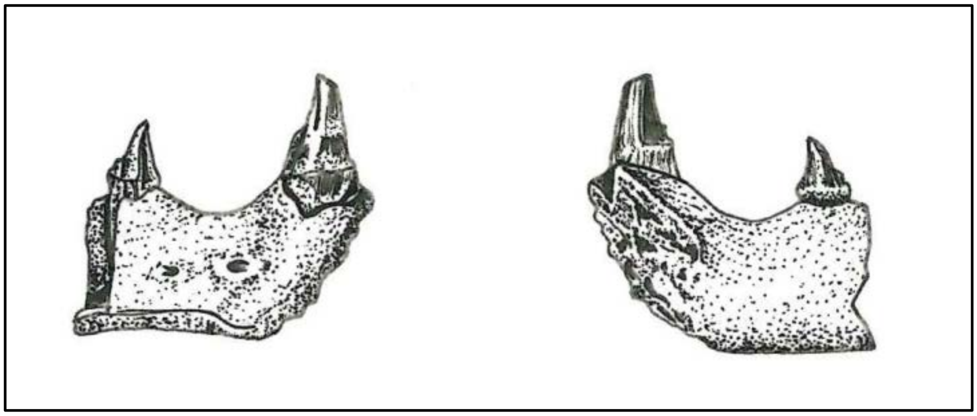


Figure 4.5. *Lynx rufus* mandible fragment recovered from Stratum V.

Family Mustelidae: Weasels, otters, and badgers

C.f. *Mustela* spp.

Material: One sample of matted fur approximately 1.5 x 1 cm = one specimen (Figure 4.6).

Remarks: The fur sample compares favorably with long-tailed weasel (*Mustela frenata*) or mink (*Mustela vison*) based on hair/fur characteristics (Unpublished Guard Hair Key). Both species of mustelid are common throughout North America (Hall 1946).

Figure 4.6. *Mustela* spp. fur from Stratum V.

Family Mephitidae: Skunks

Spilogale gracilis: Western Spotted Skunk

Material: One maxilla/cranium fragment = one specimen (Figures 4.7 and 4.8).

Remarks: The brain case appears to have been eaten away. Major predators of skunks are great-horned owls (Zeveloff and Collett 1988:298, 300). Spotted skunks occur throughout North America and are abundant in rocky terrain.

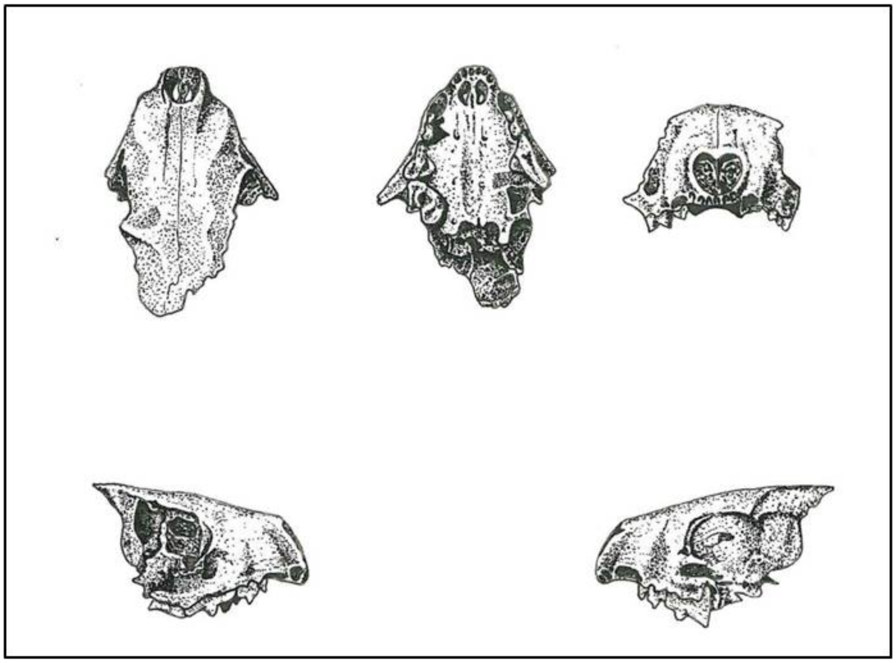


Figure 4.7. ***Spilogale gracilis*** **cranium fragment measuring 3.5 cm recovered from Stratum V.**

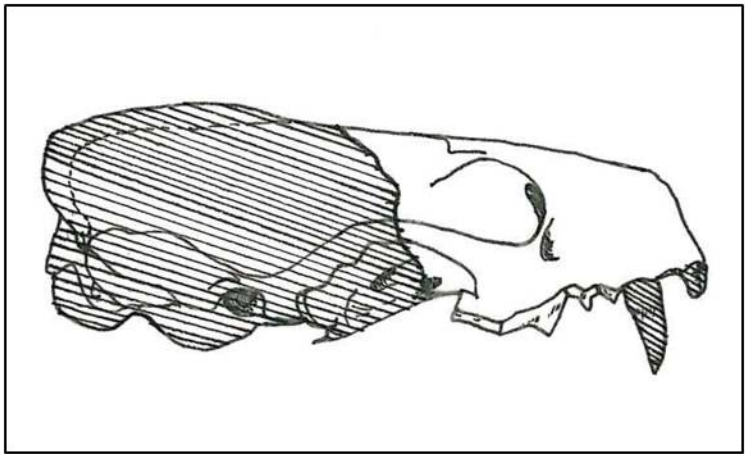


Figure 4.8. ***Spilogale gracilis*** **cranium fragment showing recovered portion in relation to missing portion (stripped).**

Order Rodentia: Rodents

Family Heteromyidae: Pocket Mice and Kangaroo Rats

Dipodomys spp. C.f. *Dipodomys merriami*: Merriam Kangaroo Rat

Material: One tibia = one specimen.

Remarks: Current distribution of the Merriam kangaroo rat includes the Lower Sonoran life zone north to the Quinn River in Humboldt County, Nevada (Hall 1946).

C.f. *Perognathus longimembris*: Little Pocket Mouse

Material: One mandible fragment = one specimen.

Remarks: Common throughout the Great Basin occurring below the pinyon/juniper zone. This species favors sandy soils in valleys and is also found on slopes at valley margins. The little pocket mouse is the smallest rodent in the Great Basin (Hall 1946).

Family Muridae: Rats, Mice, and Voles

Peromyscus spp.: Genus belongs to the deer mouse and the white-footed mouse.

Material: One femur fragment, and one mandible fragment with teeth = two specimens.

Remarks: Abundant throughout the Great Basin. Five species of *Peromyscus* occur in the Great Basin (Hall 1946).

Neotoma spp.: Woodrat

Material: One tibia = one specimen.

Neotoma cinerea: Bushy-tailed Woodrat

Material: Three mandible fragments, one first lower molar, one molar, and one premolar = six specimens (Figure 4.9).

Remarks: Common throughout the western states and portions of Canada. This species increases in size the further north they occur (Hall 1946).

Figure 4.9. ***Neotoma cinerea*** **mandible (left = lateral, middle = enlarged view showing dentition, right = labial views) from Stratum V.**

C.f. *Neotoma fuscipes*: Dusky-footed Woodrat

Material: One scapula = one specimen.

Remarks: This species is common along the coast of California and the west slope of the Sierra Nevada and Cascade ranges. Specimens have been trapped on the western slopes of the Warner Mountains and east of Goose Lake and are also found in Klamath and Lake counties, OR including Warner Valley (Hammer and Maser 1973; Hooper 1938; Murray and Barns 1969).

Neotoma lepida: Desert Woodrat

Material: One humerus = one specimen.

Remarks: Three subspecies of desert woodrat are common throughout Nevada, Oregon, southern Washington, southern California, Arizona, and Utah, western New Mexico, western Colorado and southwestern Wyoming (Hall 1946).

Lagurus curtatus: Sagebrush Vole

Material: One mandible = one specimen.

Remarks: Sagebrush voles are common in Nevada excluding the southern part of the state. They are also found in Oregon, Washington, Idaho, Montana, Wyoming, northwestern Colorado, and portions of Canada (Hall 1946).

Family Sciuridae: Squirrels

Marmota spp.: Marmot

Material: One metapodial = one specimen.

Marmota flaviventris: Yellow-bellied Marmot

Material: One mandible = one specimen.

Remarks: Common throughout the western states and a portion of Canada.

Order Lagomorpha: Lagomorphs

Family Leporidae: Rabbits and Hares

Lepus spp. C.f. *Lepus californicus*: Black-tailed Jackrabbit

Material: Six astragali, 10 acetabulum fragments, two angular processes, one axis, one basisphenoid, 19 bullae, 10 calcanei, two cervical vertebrae, 46 condyloid processes, 11 coronoid processes, one cranium fragment, one exoccipital fragment, 326 femora, eight fibulae, 109 humeri, four ilia, 55 incisive, 50 incisors, four innominates, six ischia, two lumbar vertebrae, 243 mandibles, 115 maxilla/maxillary fragments, 230 metapodials, 198 molars, one nasal-frontal-orbital fragments, 18 palatine fragments, eight parietals, 43 phalanges, 94 premolars, three pubes, 111 radii, thirteen rami, 47 ribs, one rostral supraorbital process, 73 scapulae, 302 skull fragments, two squamosal fragments, four terminal phalanxes, seven thoracic vertebrae, 430 tibiae, three tooth fragments, 64 ulnae, three vertebrae fragments, and 14 zygomatic processes = 2,071 specimens (Figure 4.10).

Remarks: Black-tailed jackrabbits are ubiquitous in the Great Basin, occupying almost every type of habitat (Hall 1946).

Figure 4.10. Selected *Lepus* elements recovered from Stratum V.

Sylvilagus spp.: Cottontail rabbits

Material: 12 acetabulum fragments, three angular processes, three astragali, two bullae, five calcanei, six condyloid processes, 187 femora, 68 humeri, 15 ilia, 18 incisive fragments, 19 incisors, six innominates, 11 ischia fragments, 91 mandibles, 15 maxilla/maxillary fragments, 34 metapodials, 12 molars, two palatine fragments, one patella, 11 phalanges, 23 premolars, 66 radii, two ribs, 45 scapulae, eight skull fragments, two thoracic vertebrae, 264 tibiae, 44 ulnae, and eight zygomatic processes = 983 specimens (Figure 4.11).

Remarks: Two species of this genus occur throughout the Great Basin (Hall 1946).

Figure 4.11. Selected *Sylvilagus* elements from Stratum V.

Order: Strigiformes

Family: Strigidae

Bubo virginianus: Great-horned Owl

Material: One ulna = one specimen.

Remarks: The great-horned owl is the most widespread owl in the Northern Hemisphere, occupying many different habitats and preying on insects up to rabbit-sized animals (Sibley 2000).

Order: Passeriformes

Family: Unknown

Material: One humerus = one specimen.

The Vertical Distribution of the Faunal Sample in the LSP-1 Deposits

NISP by depth of all identifiable taxa and NISP for all unidentified taxa show the vertical distribution of faunal material throughout Stratum V at LSP-1 (Figure 4.12). Although we are still working to better understand the ages of different arbitrary levels within Stratum V – the main artifact bearing stratum, Figure 4.12 suggests that fauna accumulated beginning in the terminal Early Holocene and accelerating during the earliest Late Holocene.

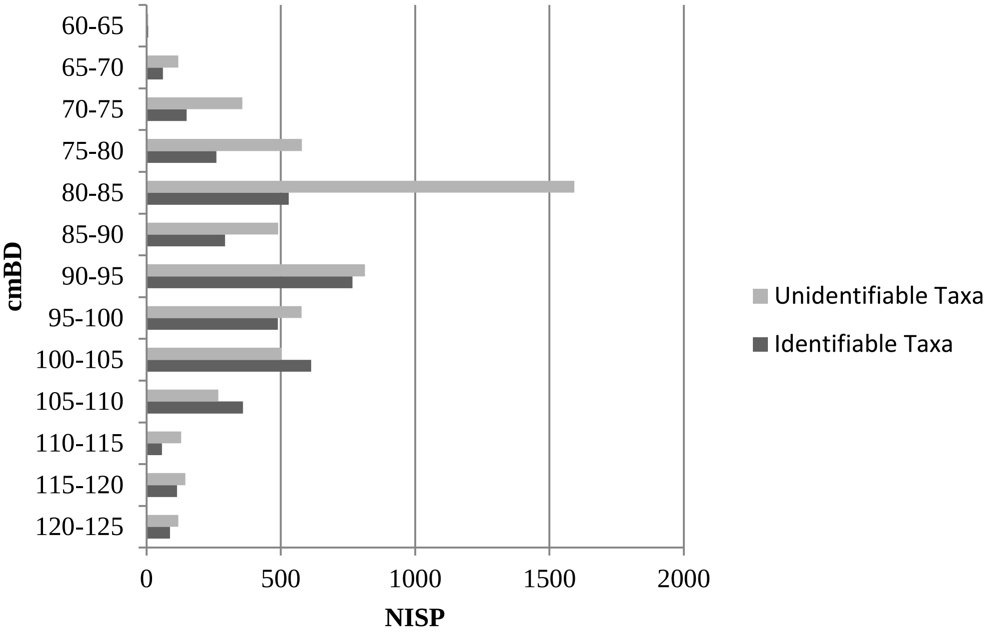


Figure 4.12. NISP of identified and unidentified taxa by depth in Stratum V.

Additional Measures of Taxonomic Abundance

Two additional measures of taxonomic abundance, MNE and MAU/MNI, were calculated to better understand the minimal portion of skeletal elements represented or portion of taxa that are represented (Table 4.3). MNE is based on the minimum number of long-bone proximal and distal ends with the minimum number of long-bone shafts (Lyman 1994). It is the minimum number of skeletal elements required for whole or fragmentary specimens in an assemblage. MAU/MNI is used to determine the body part equivalent of the number of individuals represented (Lyman 1994). *Lepus* tibiae had the highest frequency of minimum elements represented with an MNE value of 60. The highest MNE value for *Sylvilagus* is of tibiae with a value of 46. *Lepus* metapodials were the least represented with an MNE value of 7. *Sylvilagus* radii and scapulae were the least represented with an MNE value of 8 for both. *Lepus* tibiae had the highest frequency of body parts represented with a MAU/MNI value of 30. *Sylvilagus* tibiae had the highest body part represented from the sample. Ulnae for both *Lepus* (MAU/MNI = 7) and *Sylvilagus* (MAU/MNI = 5) had the least number of body parts represented in this sample.

Table 4.3. NISP, MNE, and MAU/MNI of Major *Lepus* and *Sylvilagus* Elements from Stratum V. MNE and MAU/MNI Calculations are Only for Specimens That Were Sided.

Lepus				***Sylvilagus***			
Element	**NISP**	**MNE**	**MAU/MNI**	**Element**	**NISP**	**MNE**	**MAU/MNI**
Femur	326	29	15	Femur	187	25	13
Humerus	109	22	11	Humerus	68	16	8
Mandible	243	26	13	Mandible	91	18	9
Metapodial	230	7	4	Metapodial	-	-	-
Radius	111	26	13	Radius	66	8	4
Scapula	73	11	6	Scapula	45	8	4
Tibia	430	60	30	Tibia	264	46	23
Ulna	64	13	7	Ulna	44	10	5

Note. MNE calculated from elements included in this table are from those that were able to be sided.

Is the LSP-1 Assemblage the Product of Human or Non-Human Agents?

As outlined in Chapter 3, both human and non-human agents can introduce fauna into caves and rockshelters, and researchers must be cautious not to uncritically attribute faunal remains to human behavior. At LSP-1, there is limited evidence that non-human agents played a major role in the formation of the assemblage. Non-human modification consists of six *Lepus*, three *Sylvilagus*, and one *Dipodomys* specimens consisting of only three elements that appear to have been deposited by raptors (Table 4.4). Weathering observed on four of these elements may be the result of woodrats depositing them within

LSP-1 from outside of the shelter – a possibility supported by the fact that all four elements exhibit rodent gnawing. Raptor casting material residue and puncture marks associated with raptors was not noted in the faunal sample from LSP-1.

Table 4.4. Non-Human Modification of Elements.

Taxa	**Age**	**Element**	**Weathering**	**Rodent gnawing**	**Raptor Gastric juice polish**
Lepus	Juvenile	Calcaneus	Yes	-	-
	Adult	Metapodial	-	Yes	-
	Adult	Tibia	Yes	-	-
	Adult	Tibia	-	-	Yes
	Adult	Calcaneus	Yes	-	-
	Adult	Tibia	-	Yes	-
Sylvilagus	Juvenile	Tibia	Yes	-	Yes
	Adult	Tibia	-	Yes	-
	Adult	Tibia	-	Yes	-
Dipodomys merriami	Adult	Tibia	-	-	Yes

Conversely, evidence that humans played a major role in the accumulation of the LSP-1 faunal assemblage is abundant. Elements of numerous taxa exhibit cutmarks produced by stone tools during butchering and or skinning (Table 4.5). *Lepus* had the highest frequency of cutmarks (n=301; 11%) while *Sylvilagus* had the second highest frequency (n=136; 14%), but this is not unexpected given that those taxa are by and far the most abundant in the sample. In many cases, other less common taxa display high frequencies of cutmarks: *Odocoileus hemionus* (n=9; 70%); *Neotoma cinerea* (n=3; 50%); *Cervus canadensis* (n=1; 100%); *Vulpes* macrotis (n=1; 100%); *Bison* spp. (n=1; 100%); *Lynx rufus* (n=1; 50%); and *Marmota flaviventris* (n=1; 50%). One unidentified leporid (3%) bone also displayed cutmarks.

Table 4.5. Total Number of Cutmarks per Taxa from LSP-1.

Taxa	**Cutmarks (n)**	**% of Taxon**
Bison spp.	1	100
C.f. *Cervus canadensis*	1	100
Leporid	1	3
Lepus spp.	301	11
Lynx rufus	1	50
Marmota flaviventris	1	50
Neotoma cinerea	3	50
Odocoileus hemionus	9	70
Sylvilagus spp.	136	14
Vulpes macrotis	1	100

In addition to cutmarks, there are a high number of long bone diaphysis cylinders: 394 *Lepus* diaphysis cylinders and 573 diaphysis cylinder fragments were recovered (Table 4.6). Diaphysis cylinders were counted separately from fragments to reduce the possibility of counting the same element twice. Similarly, 233 *Sylvilagus* diaphysis cylinders and 272 diaphysis cylinder fragments were recovered. As indicated in Chapter 3, diaphysis cylinders are often regarded as the byproduct of bone marrow extraction. Cutmarks sometimes occur on these diaphysis cylinders; for example, 225 *Lepus* diaphysis cylinders/diaphysis cylinder fragments exhibit cutmarks (Table 4.7). *Lepus* metapodial diaphysis cylinders represent the highest number of cutmarks observed on diaphysis cylinders followed by tibiae. Similarly, 108 *Sylvilagus* diaphysis cylinders/diaphysis cylinder fragments contain cutmarks (Table 4.8). *Sylvilagus* tibiae represent the highest number of cutmarks observed on diaphysis cylinders followed by femora. In both taxa, the location of these cutmarks is consistent with marks associated with butchering/skinning behavior.

Table 4.6. NISP of Lepus and Sylvilagus Diaphysis Cylinders and Diaphysis Cylinder Fragments.

Taxa	**Diaphysis Cylinders**	**Diaphysis Cylinder Fragments**	**Total**
Lepus	394 (41%)	573 (60%)	965
Sylvilagus	233 (50%)	272 (54%)	505

Table 4.7. *Lepus* Diaphysis Cylinders/Diaphysis Cylinder Fragments with Cutmarks by Element.

Element	**Diaphysis Cylinder**	**Diaphysis Cylinder Fragment**	**Total**
Femur	14 (14%)	52 (42%)	66
Humerus	13 (13%)	1 (1%)	14
Metapodial	24 (24%)	4 (3%)	28
Radius	21 (21%)	5 (4%)	26
Tibia	23 (23%)	63 (50%)	86
Ulna	5 (5%)	-	5
Total	100	125	225

Table 4.8. *Sylvilagus* Diaphysis Cylinders/Diaphysis Cylinder Fragments with Cutmarks by Element.

Element	**Diaphysis Cylinder**	**Diaphysis Cylinder Fragment**	**Total**
Femur	19 (33%)	27 (54%)	46
Humerus	8 (14%)	2 (4%)	10
Metapodial	5 (10%)	-	5
Radius	5 (10%)	-	5
Tibia	21 (40%)	21 (42%)	42
Total	58	50	108

Other evidence indicating that the majority of the faunal sample was deposited by humans includes burning and polishing on elements (Table 4.9). *Lepus* exhibits the highest frequency of both burned and polished elements, followed by *Sylvilagus*. *Lepus* tibiae exhibit the highest frequency of both burning (n=88; 20%) and polishing (n=291; 70%). Like *Lepus*, *Sylvilagus* tibiae are the most common element exhibiting burning (n=84; 32%) and polishing (n=171; 65%) (Table 4.10).

Table 4.9. NISP of Entire Sample of Cut, Polished, Burned, and Diaphysis Cylinders by Taxon.

Taxa	Cut	Burned	Polished	Diaphysis Cylinder/ Cylinder Fragments	Number of Elements Represented
Avian	-	-	1	1	1
c.f. *Cervus canadensis*	1	1	-	1	1
c.f. *Odocoileus hemionus*	2 (33%)	6 (100%)	-	6 (100%)	6
Leporid	-	-	6 (100%)	-	6
Lepus spp.	301 (23%)	518 (39%)	1,144 (90%)	965 (72%)	1,332
Lynx rufus	1 (50%)	2 (100%)	-	-	2
Marmota spp.	-	1 (100%)	1 (100%)	1 (100%)	1
Neotoma cinerea	1 (33%)	1 (33%)	3 (100%)	-	3
Odocoileus hemionus	1 (20%)	1 (20%)	1 (20%)	6 (100%)	6
Passerine	-	-	1 (100%)	-	1
Peromyscus spp.	1 (100%)	1 (100%)	-	-	1
Sylvilagus spp.	136 (22%)	260 (42%)	531 (90%)	504 (82%)	613
Vulpes macrotis	1 (100%)	-	-	-	1

Table 4.10. NISP of Burned and Polished *Lepus* Elements.

Element	Burned	Polished	Element	Burned	Polished
Acetabulum	2	6	Metapodial	87	168
Astragalus	2	3	Molar	15	-
Bulla	-	3	Palatine	1	2
Calcaneus	2	3	Parietal	1	1
Condyloid	8	17	Phalange	11	23
Cervical Vertebrae	-	1	Premolar	14	-
Coronoid	2	1	Pubis	-	2
Exoccipital	1	-	Radius	34	72
Femur	56	153	Ramus	34	6
Fibula	2	2	Rib	5	10
Humerus	20	40	Scapula	10	31
Ilium	1	2	Skull Fragment	38	28
Incisive	11	26	Terminal Phalanx	1	-
Innominate	-	1	Thoracic Vertebrae	1	2
Incisor	4	-	Tibia	88	291
Ischium	2	5	Ulna	12	39
Mandible	59	138	Zygomatic Process	4	8
Maxilla	23	62			

Table 4.11. NISP of Burned and Polished *Sylvilagus* Elements.

Element	**Burned**	**Polished**
Acetabulum	4	4
Astragalus	1	-
Calcaneus	2	-
Condyloid	-	1
Femur	43	119
Humerus	13	37
Ilium	3	9
Incisive	4	14
Innominate	-	2
Incisor	4	-
Ischium	4	7
Mandible	20	36
Maxilla	3	2
Metapodial	10	20
Molar	6	-
Palatine	-	1
Parietal	-	1
Phalange	4	
Premolar	7	-
Radius	23	44
Scapula	8	18
Skull Fragment	2	1
Tibia	84	171
Ulna	10	25
Zygomatic Process	4	8

As mentioned in Chapter 2, there appear to have been two pulses of occupation at LSP-1, one occurring during the terminal Early Holocene, and one occurring during the early Late Holocene following a possible Middle Holocene hiatus (Geoff Smith, personal communication, 2014). Although this reinterpretation of the site's history occurred late in the production of this thesis – and as such, precludes an in-depth reanalysis of the fauna – fauna recovered from the deepest (i.e., earliest) levels of Stratum V (110-125cmbd) considered separately at a cursory level to determine if there were major changes in fauna across time (Table 4.12). One major difference is the presence of carnivores (e.g., bobcat, kitfox, and skunk) in the earliest deposits; however, canids are present in later periods from Stratum V. Age profiles for taxa represented in the early occupation are predominantly adult individuals with only one juvenile *Sylvilagus* element represented. This matches the age profile data from the rest of the total sample suggesting that the early occupation fauna were also deposited by human agents. The western spotted skunk (*Spilogale gracilis*) is the only specimen from this data subset that bears evidence of non-human deposition. Although the early faunal sample is small compared to the whole sample analyzed it shows the same general trends, diaphysis and diaphysis cylinder fragments are present indicating that terminal Early Holocene occupants extracted marrow, cutmarks are present along with burning and polishing. Axial portions are also represented in low frequencies.

Table 4.12. Fauna from the earliest levels (110-125 cmbd) in Stratum V.

Taxa	**Element**	**Burned**	**Polished**	**Cutmarks**	**Diaphysis Cylinder**	**Diaphysis Cylinder Fragment**	**Total**
Lepus	Astragalus/Talus	1	1	-	-	-	1
	Bulla	-	1	-	-	-	2
	Condyloid Process	-	-	-	-	-	2
	Femur	2	6	-	3	12	19
	Humerus	1	4	1	3	-	6
	Incisive	-	2	1	-	-	5
	Incisor	-	-	-	-	-	2
	Ischium	-	2	-	-	-	2
	Mandible	-	2	-	-	-	10
	Maxilla	-	1	-	-	-	5
	Metapodial	3	10	-	8	1	17
	Molar	1	-	-	-	-	20
	Palatine	-	1	-	-	-	3
	Phalange	-	1	-	-	-	4
	Premolar	1	-	-	-	-	8
	Radius	-	5	-	3	1	6
	Ramus	-	1	-	-	-	1
	Rib	-	-	-	-	-	3
	Scapula	-	-	-	-	-	5
	Skull Fragment	4	6	-	-	-	35
	Tibia	5	12	1	1	18	27
	Ulna	-	-	-	-	-	1
	NISP *Lepus*						184
Sylvilagus	Calcaneus	-	-	-	-	-	1
	Condyloid Process	-	-	-	-	-	1
	Femur	1	10	-	3	14	19
	Humerus	-	5	2	4	1	6
	Incisive	1	1	-	-	-	2

Table 4.12. . Fauna from the earliest levels (110-125 cmbd) in Stratum V.

	Incisor	-	-	-	-	-	2
	Mandible	-	3	-	-	-	10
	Molar	-	-	-	-	-	1
	Phalange	-	1	-	-	-	1
	Radius	5	4	-	5	1	6
	Scapula	1	2	-	-	-	5
	Tibia	2	11	-	5	6	12
	Ulna	-	-	-	-	-	3
	NISP *Sylvilagus*						69
Odocoileus hemionus	Femur	-	-	-	-	2	2
	NISP *Odocoileus*						2
Lynx rufus	Premolar	1	-	-	-	-	1
	Mandible	1	-	1	-	-	1
	NISP *Lynx*						2
Vulpes macrotis	Mandible	-	-	1	-	-	1
	NISP *Vulpes*						1
Spilogale gracilis	Maxilla/cranium	-	-	-	-	-	1
	NISP *Spilogale*						1
Marmota flaviventris	Mandible	-	-	1	-	-	1
	NISP *Marmota*						1
Unidentified Rodent	Rib	-	-	-	-	-	1
	NISP Unidentified Rodent						1
	Total NISP						261

In the entire Stratum V sample, both *Lepus* and *Sylvilagus* hindlimbs are more common than forelimbs (Table4.13). This may reflect the fact that because hindlimbs contain more muscle mass than forelimbs, humans may have tended to harvest more of them. When the frequencies of forelimbs and hindlimbs of both leporid taxa are compared, a chi-square test indicates that *Sylvilagus* hindlimbs are overrepresented and *Sylvilagus* forelimbs are underrepresented relative to *Lepus* hind- and forelimbs (χ^2=10.51, *df*=1, *p*=0.0012). Thus, it appears that humans either: (1) were more selective in the portions of *Sylvilagus* that they brought to LSP-1: (2) the majority of forelimbs were deposited outside the shelter; or: (3) they were deposited in an unexcavated portion of the shelter. As mentioned in Chapter 3, raptors primarily swallow forelimb elements because they are smaller and more easily consumed than hindlimbs. Based on the data presented here, higher abundances of hindlimbs do not correspond with raptor accumulation of elements at LSP-1.

Table 4.13. Total Numbers of Lepus and Sylvilagus Forelimbs and Hindlimbs from LSP-1. Standardized Residuals Shown in Parentheses.

Genus	**Forelimb**	**Hindlimb**
Lepus	146	163
Sylvilagus	71	146

χ^2=10.51, *df*=1, *p*=0.0012

Finally, the mortality profile of the most common taxa at LSP-1 – leporids – strongly suggests that humans were largely responsible for the accumulation of the faunal assemblage. Leporids from Stratum V are overwhelmingly adult specimens (Table 4.14). As mentioned in Chapter 3, humans tend to harvest sexually fit adults, resulting in few juveniles in faunal assemblages, whereas non-human agents deposit taxa of all life stages (i.e., young and old). As Table 4.14 indicates, the latter was likely the case at LSP-1.

Table 4.14. Adult and Juvenile *Lepus* and *Sylvilagus* specimens in the Stratum V Sample.

Taxa	**Adult**	**Juvenile**
Lepus	2,680 (99.8%)	6 (0.2%)
Sylvilagus	951 (97.0%)	29 (3.0%)

Reconstructing Human Behavior at LSP-1

The faunal sample recovered at LSP-1 reveals several aspects of human behavior. High abundances of adult leporids (see Table 4.14) strongly suggest that humans occupied the site during the fall/winter months – the seasons when leporids were typically hunted during ethnographic times (see Chapter 3). Proportions of *Lepus* hind- and forelimbs (see Table 4.13) correspond with processing on site at LSP-1. Sites such as Camels Back Cave (Schmitt and Madsen 2005) show that *Lepus* fore- and hindlimbs are fairly even in the sample, suggesting mass drive events took place near the cave (i.e., whole carcasses were brought to the site and processed). Conversely, disproportionate numbers of *Sylvilagus* fore- and hindlimbs may suggest capture and processing away from the site. As mentioned in Chapter 3, *Sylvilagus* were typically captured during encounter hunting or using snares. High numbers of burned *Lepus* metapodials suggest that those elements were burned during cooking. Ethnographically, feet were often left on the animals when they were roasted or during hair removal by fire (Fowler 1992). Twenty-eight *Lepus* metapodial diaphysis cylinders indicate that humans likely further processed those elements for marrow extraction; many of those elements also exhibit cutmarks and polishing associated with boiling (Table 4.15). One bone needle/pin (Figure 4.13) manufactured from a leporid long bone shaft, which represents one of two bone tools in my sample, indicates that occasionally, fauna provided material for technological goods as well as food.

Table 4.15. NISP of *Lepus* and *Sylvilagus* Diaphysis Cylinders and Diaphysis Cylinder Fragments, Burning, Polishing, and Cutmarks by Element.

Taxa	**Element**	**Diaphysis Cylinder**	**Diaphysis Cylinder Fragment**	**Burn**	**Polish**	**Cut**	**Number of Elements Represented**
Lepus	Acetabulum	-	-	2	6	2	6
	Astragalus	-	-	2	2	1	3
	Axis	-	-	-	1	-	1
	Bulla	-	-	-	3	-	2
	Calcaneus	-	-	2	2	-	4
	Cervical Vertebra	-	-	-	1	-	1
	Condyloid Process	-	-	8	17	1	21
	Exoccipital	-	-	1	-	-	1
	Femur	57	229	56	153	66	178
	Fibula	-	-	2	2	-	2
	Humerus	40	5	20	40	16	54
	Ilium	-	-	1	2	1	3
	Incisive	-	-	11	26	3	27
	Incisor	-	-	4	-	-	4
	Innominate	-	-	-	1	1	2
	Ischium	-	-	2	6	-	6
	Mandible	-	-	59	138	27	152
	Maxilla	-	-	23	62	4	66
	Metapodial	121	28	87	168	32	178
	Molar	-	-	15	-	-	15
	Palatine	-	-	1	2	-	4
	Parietal	-	-	1	1	-	2
	Phalange	-	-	11	23	1	24
	Premolar	-	-	11	-	-	11

Table 4.15. NISP of Lepus and Sylvilagus Diaphysis Cylinders and Diaphysis Cylinder Fragments, Burning, Polishing, and Cutmarks by Element.

	Pubis	-	-	1	2	1	3
	Radius	51	31	34	72	31	85
	Ramus	-	-	3	6	1	6
	Rib	-	-	5	10	3	14
	Scapula	-	-	10	28	6	33
	Skull Fragment	-	-	38	31	1	55
	Terminal Phalanx	-	-	1	-	-	1
	Thoracic Vertebrae	-	-	1	2	-	3
	Tibia	104	280	88	291	92	310
	Ulna	19	-	12	39	8	42
	Zygomatic Process	-	-	4	8	2	9
	Total	**392**	**573**	**516**	**1,145**	**300**	**1,327**
Sylvilagus	Acetabulum	-	-	4	5	1	10
	Angular Process	-	-	-	4	-	4
	Astragalus	-	-	1	1		2
	Calcaneus	-	-	2	-	-	2
	Condyloid Process	-	-	-	1	1	2
	Femur	54	118	31	119	46	368
	Humerus	36	7	5	37	10	95
	Ilium	-	-	3	7	3	13
	Incisive	-	-	5	14	2	21
	Incisor	-	-	4	-	-	4
	Innominate	-	-	-	2	2	4
	Ischium	-	-	4	7	-	11
	Mandible	-	-	20	37	2	59
	Maxilla	-	-	3	1	2	6
	Metapodial	16	-	10	20	6	52
	Molar	-	-	6	-	-	6
	Palatine	-	-	-	1	-	1
	Patella	-	-	-	1	-	1
	Phalange	-	-	4	5	1	10
	Premolar	-	-	7	-	-	7
	Radius	30	10	23	44	9	116
	Scapula	-	-	8	18	4	30

Table 4.15. NISP of Lepus and Sylvilagus Diaphysis Cylinders and Diaphysis Cylinder Fragments, Burning, Polishing, and Cutmarks by Element.

	Skull Fragment	-	-	2	1	-	3
	Tibia	90	139	84	171	41	525
	Ulna	4	-	11	25	3	43
	Zygomatic Process	-	-	4	8	-	12
	Total	**230**	**274**	**241**	**529**	**133**	**1,407**

In terms of reconstructing human diet at LSP-1, the Small Game Index (SGI) value for the site (0.99) indicates that large game played an extremely limited role in subsistence. The high SGI reflects the fact that leporids and unidentified Size Class III mammals (almost certainly predominantly leporids) dominate the faunal sample. When taken individually, small game are not as energetically as profitable as hunting large game (Simms 1987); however, when collected *en masse* rabbits and hares offer exceptionally high return rates. The fact that such taxa dominate the LSP-1 sample and appear to have been processed in a fairly standardized fashion at the site suggests that communal hunting may have been a primary means of capturing leporids on the valley floor below the rockshelter. Today, jackrabbits are abundant in northern Warner Valley, and this may have been the case in prehistory as well.

As indicated by the evidence of intensive processing of leporids at LSP-1 outlined above, it is clear that humans extracted as many nutrients as they could from their prey. The presence of metapodial (low utility elements [Lyman 1977:69]) diaphysis cylinders displaying cutmarks and polishing might suggest that people were nutritionally stressed, hinting at “bad” times, or preparation for anticipated “bad” times during certain periods at

LSP-1, although it is important to note that periods of stress could range in scale from days and weeks to, potentially, decades and centuries.

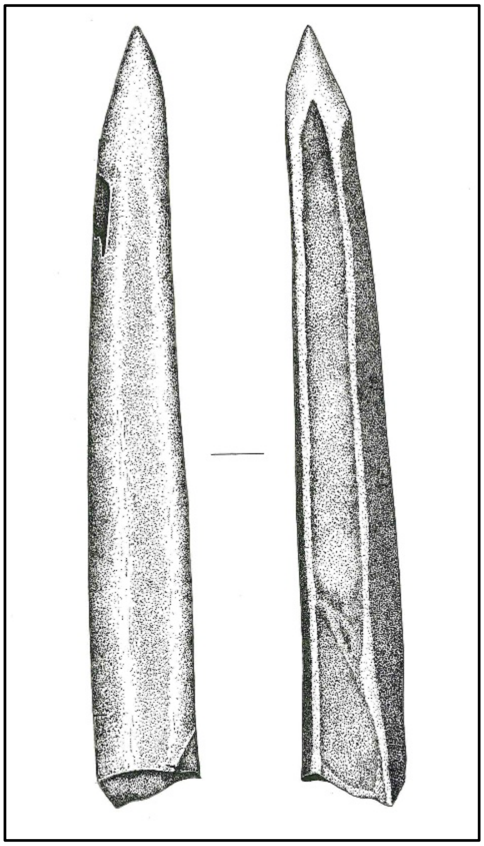


Figure 4.13. Bone needle/pin (2.5 cm long) recovered from Stratum V.

Observed cutmarks are consistent with my expectations for the leporid butchering practices described in Chapter 3. Additional cutmarks including those on the mandible appear to be the result of skinning (Table 4.16), as skin is often very difficult to remove on that part of the animal. A chi-square test shows that there is a significant difference between *Lepus* and *Sylvilagus* mandibles. *Lepus* has the highest frequency of cut mandibles, which is expected if their collection and harvesting was aimed in part at hide procurement. Ethnographically, jackrabbits were the preferred leporid for manufacturing rabbitskin robes, the earliest known example of which comes from the Early Holocene Spirit Cave burial (Tuohy and Dansie 1997:35). In contrast, *Sylvilagus* mandibles show significantly fewer cutmarks (χ^2=5.56, *df*=1, *p*=0.0184), suggesting that either hide procurement was less common for that taxa or that cottontails are easier to skin. Evidence of *Lepus* skinning lends further support that humans occupied LSP-1 during the fall and winter months, as at least during ethnographic times, leporid fur and meat were both at their best (Hittman 1984:9).

Finally, leporid axial elements were recovered in low numbers relative to appendicular elements (Table 4.17). *Lepus* skull fragments recovered were the most numerous (n=683; 25%), followed by ribs (n=47; 8%). The most numerous *Sylvilagus* axial portions recovered were skull fragments (n=118; 12%). The axial skeleton (i.e., vertebrae) is associated with high-utility portions of the carcass due to meat mass; therefore, it is often heavily processed, leading to low frequencies in assemblages (Schmitt and Lupo 2005). Also, as mentioned in Chapter 3, the axial skeletons were sometimes ground into bone meal and consumed during “bad” times, or in preparation of anticipated “hard” times leading to low-frequencies in assemblages (Dansie 1991:99). Carcass transport away from the shelter could be another possible explanation for low representation of axial elements at LSP-1. At Camels Back Cave, Schmitt and Lupo (2005) found evidence suggesting numerous intact carcasses were brought to the site where they were processed. Despite evidence pointing towards large numbers of complete carcasses there were a low frequency of axial elements represented (Schmitt and Lupo 2005). Schmitt and Lupo (2005) suggest that although large numbers of leporids were transported to the cave where the heads, shoulders, and long-bones were processed, the axial skeleton was prepared for transport to another location. This corresponds with Dansie (1991) based on ethnographies of the Washoe where leporid axial skeletons would be dried and curated for lean or “bad” times. Based on numerous ethnographic accounts (Dansie 1991; Fowler 1993; Stewart 1938) Great Basin peoples often curated food items during times of plenty “good times” as a safeguard against harsh winters, droughts, and famine “bad times”. “Good times” and “bad times “are viewed in this thesis on a local level (seasonally driven safe guards), and not on a broad scale for the Middle Holocene as a whole as proposed by Schmitt et al. (2002).

Table 4.16. *Lepu*s and *Sylvilagus* Cut and Uncut Mandibles from Stratum V.

	Mandibles	
Genus	**Cut**	**Un-cut**
Lepus	27	216
Sylvilagus	2	89

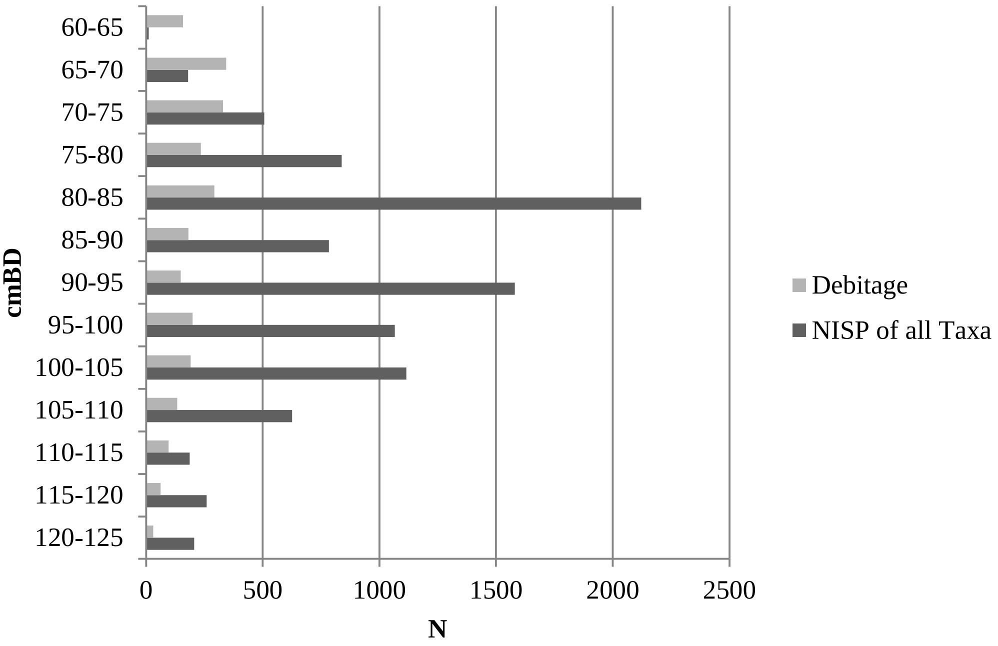
χ^2=5.56, *df*=1, *p*=0.0184

Table 4.17. Lepus and Sylvilagus Axial Skeleton Portions Recovered from Stratum V (Skull Portions from Table 4.2. are Combined Here).

	Taxa	
Element	***Lepus***	***Sylvilagus***
Axis	1 (.04%)	-
Cervical Vertebrae	2 (.07%)	-
Lumbar Vertebrae	2 (.07%)	-
Rib	47 (8%)	2 (.2%)
Skull Fragments	683 (25%)	118 (12%)
Thoracic Vertebrae	7 (.3%)	2 (.2%)
Vertebrae	3 (.1%)	-

Chipped stone artifacts and tools in relation to bone accumulation within LSP-1 is further evidence that this faunal sample is the result of human deposition (Figure

4.14). A Pearson's correlation test shows that there is a moderate positive correlation (*r* = +.311) between debitage and bone frequencies by 5-cm arbitrary excavation level, suggesting that foragers manufactured/maintained stone tools at the site during different periods, they also processed, consumed, and/or discarded subsistence residues.



Pearson's *r*= +0.311.

Figure 4.14. Counts of elements and flakes by 5-cm excavation levels in Stratum V.

Summary

In this chapter, I argued that fauna in LSP-1 – in particular, leporids – were primarily deposited by humans. Overwhelmingly high frequencies of adult leporids indicate capture and deposition by humans as opposed to non-human agents that tend to contribute all life stages in an assemblage. Evidence of burning, polishing, cutmarks, and diaphysis cylinders further point toward humans as the primary agent of deposition within LSP-1. I then reconstructed human use of those taxa, beginning with how they were likely collected, processed, cooked, consumed, and perhaps transported away from the site. In sum, humans harvested leporids, primarily *Lepus*, and deposited them within LSP-1. Elements are highly processed (e.g., all major long-bones [both high and low-utility] were fashioned into diaphysis cylinders), many of them exhibiting microscopic cutmarks and striae associated with disarticulation, skinning, and boiling in cooking vessels with no evidence for bead manufacturing. In Chapter 5, I place the LSP-1 faunal assemblage and what it tells us about human behavior in northern Warner Valley into the broader context of northern Great Basin prehistory with an emphasis on human subsistence strategies.

Chapter 5: Discussion

Archaeofauna recovered at LSP-1 are well preserved and abundant. The assemblage is dominated by leporids with *Lepus* representing the bulk of the sample, followed by *Sylvilagus*. The presence of xeric adapted species such as *Lepus* and *Dipodomys* indicates that desertification of the region around LSP-1 had occurred when they started to accumulate in the rockshelter.

My thesis research was aimed at addressing several questions. First, which taxa are represented at LSP-1? Second, are they products of human or non-human agents? Third, which types of human behavior occurred at LSP-1? And fourth, does the LSP-1 assemblage reflect “good” or “bad” times? Results indicate that leporids are represented in high numbers, reflecting hunting techniques similar to those observed during the ethnographic period in the Great Basin. Specifically, they appear to indicate that communal rabbit drives likely occurred in the autumn or early winter near LSP-1. The presence of highly processed elements may indicate that the inhabitants of LSP-1 processed leporid carcasses for curation for when times got hard, as observed ethnographically (Dansie 1991), or that the axial portions of the carcasses were transported to another site.

Evidence for Human and Non-Human Deposition of Fauna at LSP-1

Abundant cutmarks, polishing, burning, and diaphysis cylinders in the faunal sample from LSP-1 indicate that most fauna were deposited by humans (see Table 4.9).

Conversely, evidence that non-human agents played a major role in the accumulation of fauna is minimal (see Table 4.4). Of the only 10 specimens that exhibit non-human modification, four are weathered, four are rodent-gnawed, and three show evidence of gastric juice polishing produced from the casting process of raptors. One of the elements (a *Dipodomys* tibia) with signs of polishing also has shearing damage to its proximal end consistent with that produced by a feeding raptor (Figure 5.1) (Hockett 1993:207). *Dipodomys merriami* are xeric adapted scatter hoarders (hiding food in a wide range of sites) that are common prey for nocturnal raptors (Hall 1946; Vander Wall 1990). Weathering on elements from LSP-1 is likely the product of rodents depositing bones from outside the shelter into it. Additionally, two of the specimens exhibiting non-human modification are juveniles.

Figure 5.1. *Dipodomys merriami* tibia from Stratum V exhibiting gastric polishing and shearing (proximal end) from raptor feeding.

Human Behavior at LSP-1

Cutmark profiles from LSP-1 are consistent with what Lloveras et al. (2009) reported in their leporid skinning, disarticulation, and defleshing experiments. Each of these behaviors leaves different marks on bones and specific activities can be identified based on locations and frequencies of cutmarks. First, cutmarks should occur just above the metapodials, where cuts allow the skin to be easily peeled back using one's hands or a tool. Second, some cutmarks may be produced on the fore- and hindlimbs to accomplish hide removal more smoothly. Third, the hide should peel off easily until the head is reached, at which point cutmarks may be produced on various points of the cranium, around the snout (incisive), and below the dentition (Lloveras et al. 2009). *Lepus* mandibles recovered from LSP-1 commonly exhibit these very characteristic features (Figure 5.2). Damage to other elements during skinning is usually minimal and Lloveras et al. (2009) discovered that small game can often be skinned without any traces left on elements. In addition to leporid mandibles displaying cutmarks, one marmot mandible, three bushy-tailed woodrat mandibles (Figure 5.3), one bobcat distal mandible (also burned), and one kit fox mandible (Figure 5.4) possess cutmarks likely related to skinning. Ethnographically, bobcat hides retaining the fur were used for winter footwear (Fowler 1992:145, 147). Bobcats were also cooked and eaten when hunted for their pelts (Fowler 1992:79). The presence of woodrat and fox mandibles showings evidence of hide removal suggests that other animals may have been used in similar fashion.

Evidence for skinning damage is important since ethnographically, one of the most important items of Northern Paiute clothing were rabbitskin blankets (*Kammɨwiga*) or robes (Fowler 1992:141). These garments were worn during the winter and typically made out of 50-100 leporid (primarily *Lepus*) skins, depending upon the size desired (Fowler 1992:118): a child's blanket required only 40 leporid skins (Wheat 1967:77). Rabbitskin blankets were the main defense against the bitter cold winters for Great Basin people (Fowler 1992; Wheat 1967). People also used the blankets during the summer as nights can often be cold (Wheat 1967:74). *Lepus californicus* skins were also fashioned into aprons worn by women during the summer (Fowler 1992:140). Numic peoples in the Great Basin also made bedding out of leporid skins due to their warmth and the availability of this resource (Fowler 1992; Inter-Tribal Council of Nevada 1976). The ~10,600 cal B.P. Spirit Cave burial contained one adult-sized rabbitskin blanket fashioned out of *Lepus* hides, indicating that reliance on leporids for clothing was important throughout prehistory in the Great Basin (Tuohy and Dansie 1997). One *Bison* bone flake tool (Figure 5.5) was recovered from Stratum V. Bones with usable edges produced during processing can be modified prior to being used, whereas some bone tools exhibit modification from use during skinning or butchering with no initial preparation for such activities (Lyman 1984b:318). Bone tools were used in some cases to loosen hides on artiodactyls being blunter than chipped stone tools therefore not damaging hides (Frison et al. 1970:12). Bison femur fragments fashioned into tools with use-wear striae on the working surfaces have been found in the Great Plains, indicating that they came in contact with soft, resilient surfaces associated with skinning hides (Frison et al. 1970:27). It is possible that the LSP-1 bison femur flake tool was used in hide preparation for either artiodactyls or leporids.

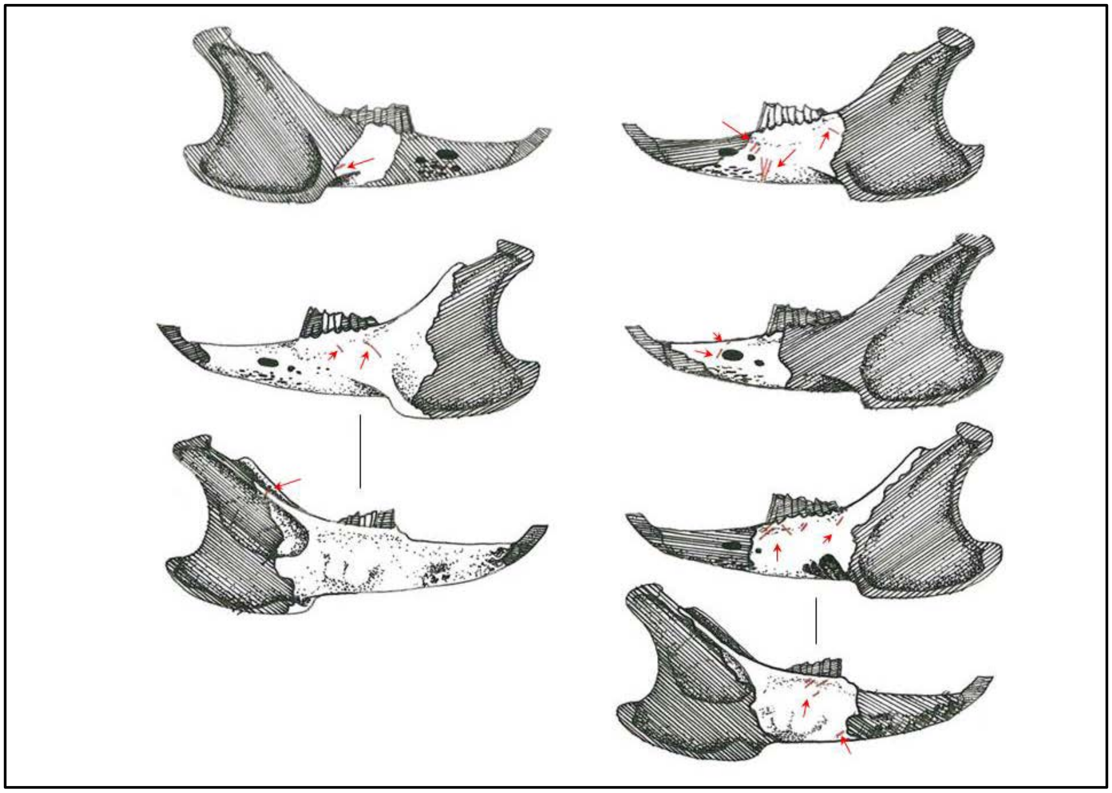


Figure 5.2. Selected *Lepus* mandibles exhibiting cutmarks associated with skinning behavior.

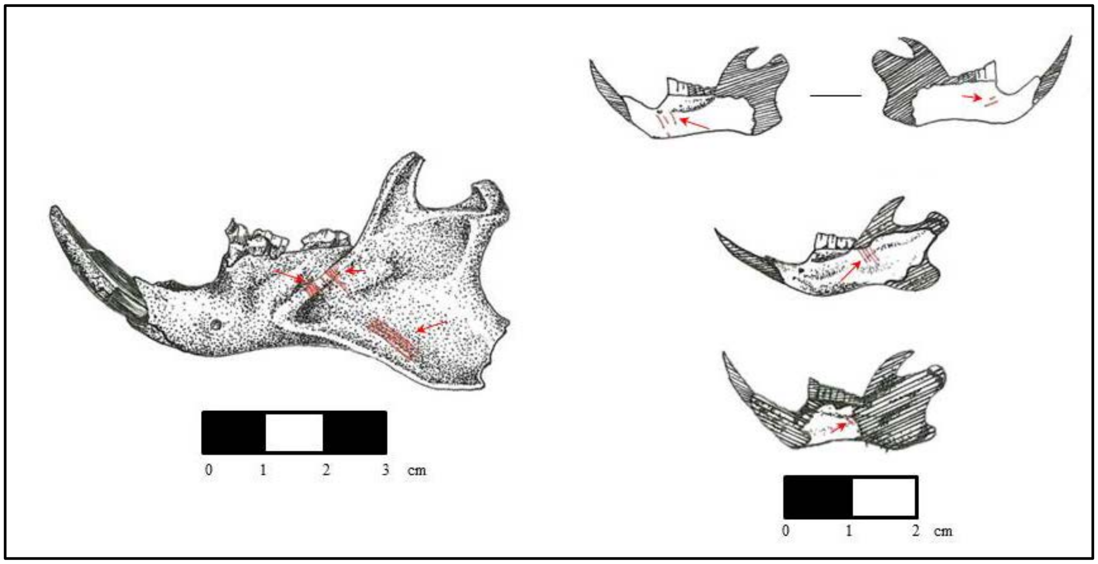


Figure 5.3. Rodent mandibles exhibiting cutmarks: left = *Marmota flaviventris*, right = *Neotoma cinerea*.

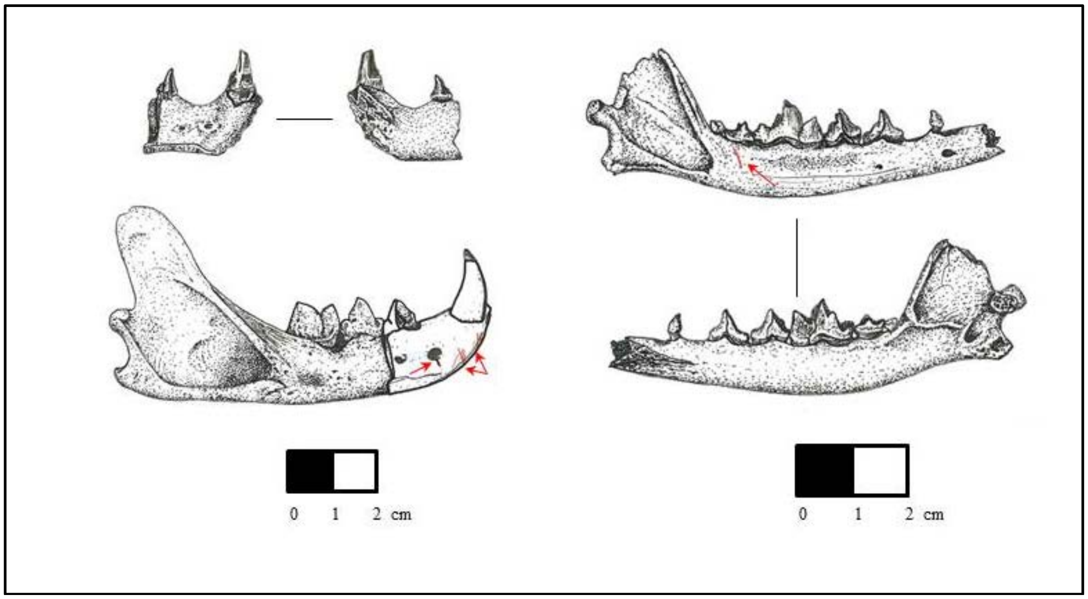


Figure 5.4. Carnivore mandibles from Stratum V exhibiting cutmarks consistent with skinning (left = *Lynx rufus*, right = *Vulpes macrotis*).

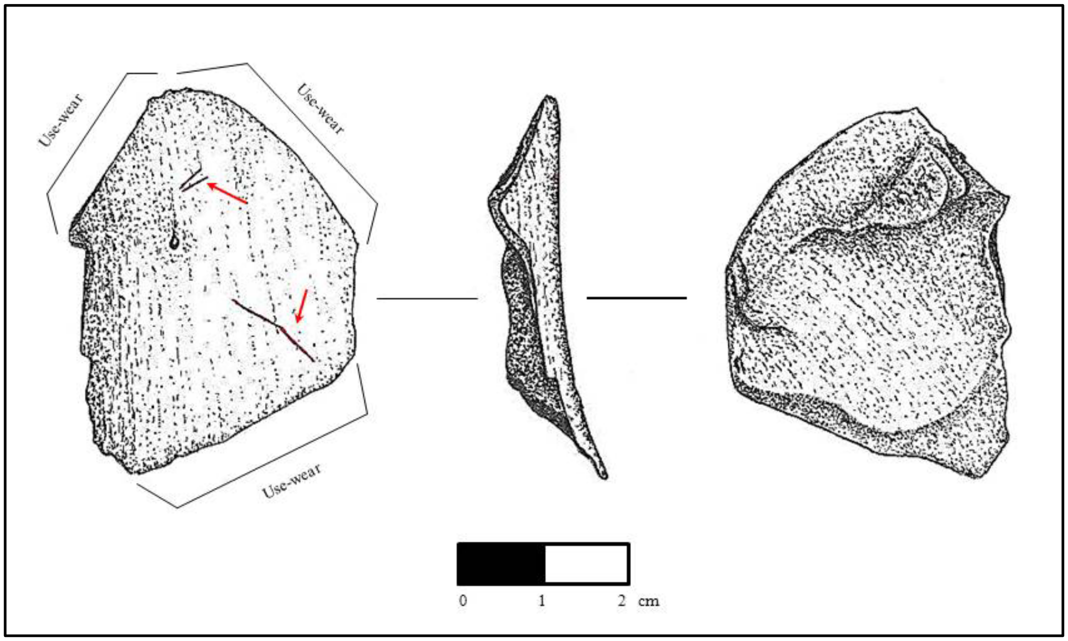


Figure 5.5. Bison green fracture femur flake tool with cutmarks (arrows) and use-wear recovered from Stratum V.

Unlike skinning, disarticulation leaves high frequencies of cutmarks on the proximal and distal ends of long bones, primarily femora and tibiae (Figure 5.6) (Lloveras et al. 2009). The highest frequency of cutmarks on *Lepus* long-bones from LSP-1 are tibiae (n=92) and femora (n=66) with other long-bone elements including metapodials, radii, humeri, and ulnae exhibiting lower frequencies (see Table 4.7). Cutmarks on *Sylvilagus* occur in similar frequencies: femora (n=46) and tibiae (n=41) are most commonly cut with other long-bones displaying cutmarks less often. Lower frequencies of cutmarks on *Lepus* and *Sylvilagus* radii, humeri, and ulnae are consistent with Lloveras et al's. (2009) experimental disarticulation results. The relatively high numbers of cutmarks on *Lepus* metapodials are likely due to removal of the feet. Burned metapodials (87 of 178 *Lepus* and 10 of 52 *Sylvilagus*) indicate that some of the feet were likely left attached to the carcasses during cooking – a common practice during the ethnographic period (Fowler 1992:78).

Finally, defleshing leporid carcasses produces high frequencies of cutmarks on the axial skeleton (Lloveras et al. 2009). Although axial elements are uncommon at LSP-1, some (most notably, pelvis elements) display cutmarks, which indicates that at least some of the leporids brought to LSP-1 were defleshed.

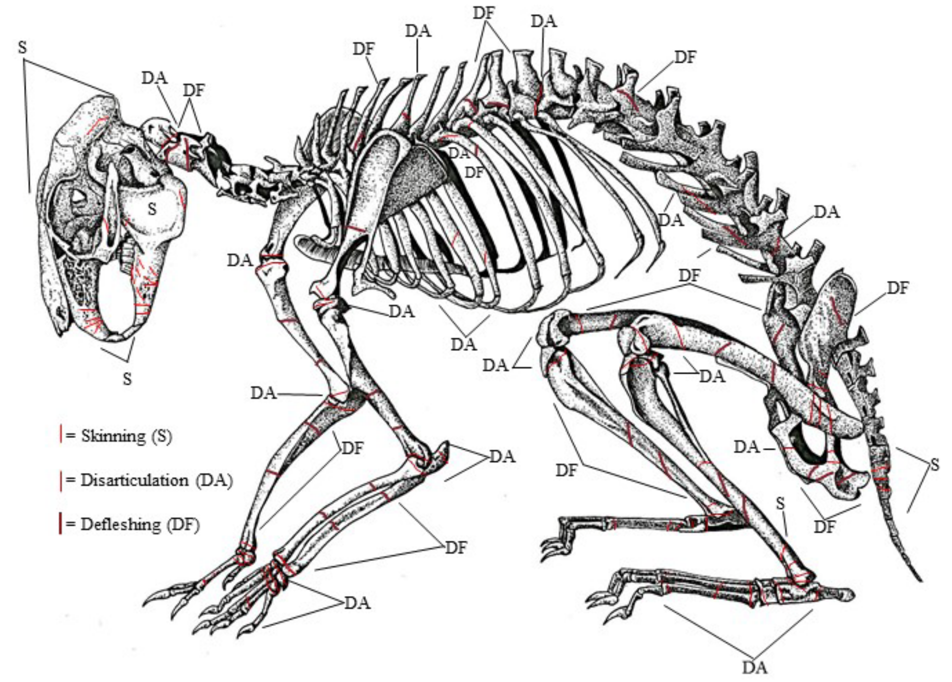


Figure 5.6. Location of skinning, disarticulation, and defleshing marks on leporid elements from LSP-1 (adapted from Lloveras et al. 2009).

Adult *Lepus* skeletal part abundances show that hindlimbs (MAU=189) are favored over forelimbs (MAU=90) (Figure 5.7). This is not surprising since hindlimbs are meaty and characterized as high utility portions, along with forelegs and shoulders (Schmitt et al. 2002). Similar trends in skeletal element representation have been noted by Schmitt et al. (2002) at Camels Back Cave; however, there are a couple of differences. First, at Camels Back Cave, hindlimbs did not outnumber forelimbs, as is the case at LSP-1 (Schmitt et al. 2002). Second, metapodials are far more common at LSP-1 than at Camels Back Cave. There is one trend that LSP-1 shares in common with Camels Back Cave: skull fragments are common, suggesting that whole carcasses were carried to the site for processing (Schmitt et al. 2002:93).

Figure 5.7 illustrates the dominance of appendicular elements and the scarcity of axial elements for leporids at LSP-1. As mentioned in Chapter 4, during the ethnographic period the axial skeleton was often dried and curated for later use as a safeguard when food became scarce (Dansie 1991). The Washoe of the western Great Basin dried the skeletons of leporids and saved them for “hard times” (e.g., harsh winters) (Dansie 1991:99). When needed, they were ground into bone meal (Dansie 1991; Downs 1966). The bone meal was then mixed with grease and leftover meat and/or pinenuts (Dansie 1991; Downs 1966). Such behavior could explain the fact that low numbers of those elements are present in LSP-1. As outlined in Chapter 4, however, bone survivorship is another potential explanation for the low frequencies of axial elements (Schmitt and Lupo 1995:500) at LSP-1. Because such elements are less dense than appendicular bones, they may simply have not preserved to the same extent. Finally, the underrepresentation of axial elements at LSP-1, Camels Back Cave, and other sites may indicate that people processed carcasses and transported away higher utility portions for consumption elsewhere, perhaps at residential sites (*sensu* Schmitt et al. 2002).

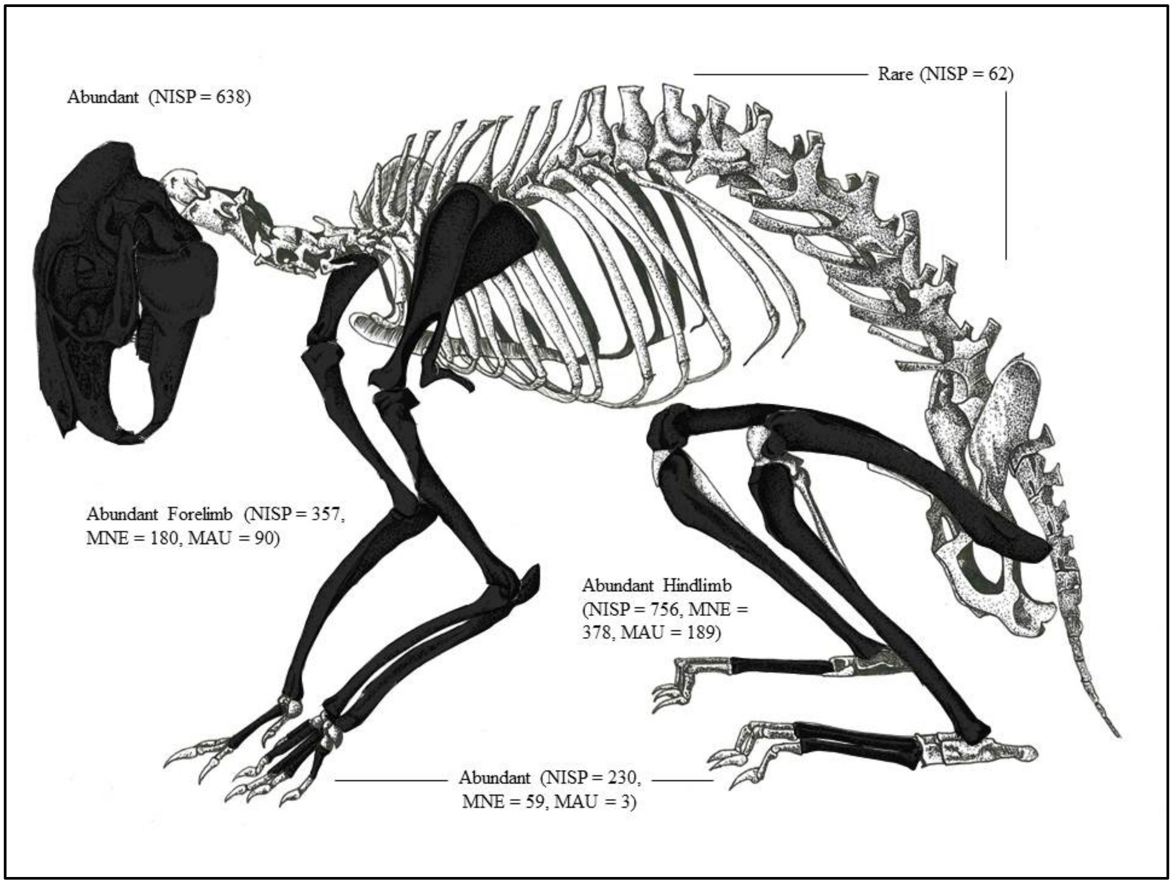


Figure 5.7. Adult *Lepus* skeletal element abundances recovered from Stratum V. MNE and MAU values were not calculated for the skull or axial skeleton due to problematic nature of siding these portions. NISP counts exclude some elements (i.e., teeth, phalanges) (adapted from Schmitt et al. 2002).

225 *Lepus* diaphysis cylinders/diaphysis cylinder fragments with cutmarks (see Table 4.7) and 108 *Sylvilagus* diaphysis cylinders/diaphysis cylinder fragments with cutmarks (see Table 4.8) were recorded in the LSP-1 sample (Figures 5.8 and 5.9). Diaphysis cylinders are generally regarded as the byproduct of marrow extraction (Hockett 1993), although some leporid diaphysis cylinders have also been interpreted as sucking tubes used by shamans to extract disease during curing ceremonies (Zeier and Elston 1986:290). Leporid diaphysis cylinders are found in sites across the Great Basin

(e.g., Camels Back Cave, Hogup Cave, Bonneville Estates Rockshelter) indicating that this was a common practice (Hockett 1991, 1993. 2007; Schmitt and Lupo 2005; Schmitt et al. 2002). One artiodactyl femur exhibiting a green break spiral fracture likely produced during marrow extraction and containing over 20 cutmarks is one of the few examples in the sample suggesting intensive processing of non-leporids (Figure 5.10).

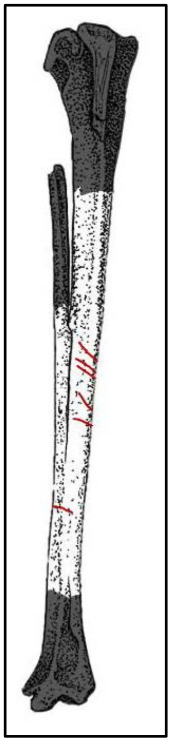


Figure 5.8. Lepus tibia showing where the proximal and distal ends (blacked out) are typically snapped off for marrow extraction. Lines on the diaphysis cylinder are where some cutmarks were observed in the sample from LSP-1.

Figure 5.9. Select *Lepus* femora diaphysis cylinders from Stratum V.

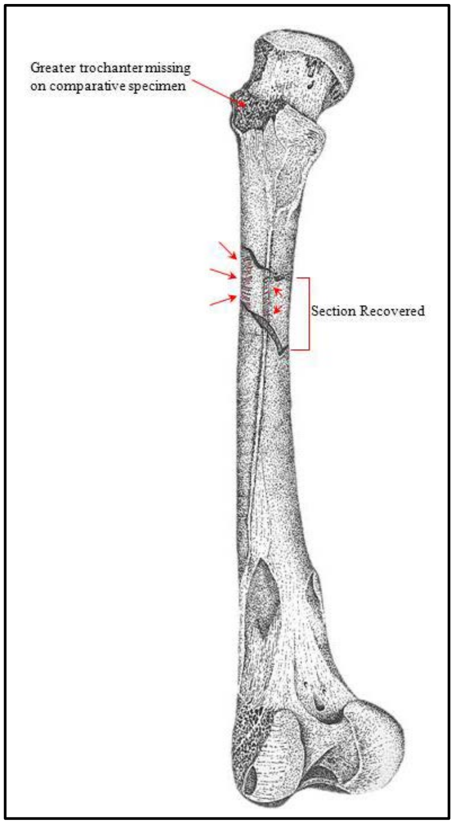


Figure 5.10. *Odocoileus hemionus* femur exhibiting cutmarks (arrows) and green break fracture.

LSP-1 within a Broader Context

During the Early Holocene, occupations were short at many sites (e.g., the Buffalo Flat sites) in the northern Great Basin (Pinson 2004:73), mirroring terminal Early Holocene behavior at LSP-1. Sites such as the Connley Caves reflect seasonal occupations based on the fauna represented in their assemblages. There, greater sage grouse dominate the small game assemblage from Early Holocene deposits along with some leporids, artiodactyls, and waterfowl (Grayson 1979). The grouse are important because there are very few juveniles represented, indicating that they were likely deposited by humans during the winter and/or early spring when the birds typically congregate in large numbers at lek sites (Grayson 1979:20). Like the Connley Caves, the LSP-1 faunal assemblage is primarily comprised of adult specimens, albeit of different taxa, indicating fall-early spring occupations at that site as well.

During the Early Holocene, groups exploited lacustrine resources as well as dry valley and upland resources (Pinson 2004:75). These sites are dominated by small game with large game rarely present in faunal assemblages dating to that period (Pinson 2007). The open-air Tucker Site, like LSP-1, is dominated by small game with few artiodactyls (Pinson 2004:73). The Small Game Index (SGI) values for northern Great Basin sites suggest that foragers relied heavily on small game with large game playing virtually no role at all in subsistence. The Fort Rock Cave faunal record is spotty but its Early Holocene assemblage produced a SGI value of 0.97 (Grayson 1979:431). The SGI value for Connley Cave 4 is 0.93 and 1.0 for Connley Cave 6 (Grayson 1979:438-439). I did not have access to the faunal list from the Buffalo Flat sites but it also shows that foragers accumulated an overwhelming number of small game (Oetting 1994). In comparison, the LSP-1 SGI value is 0.99, indicating that foragers primarily relied on small game.

The focus on leporids at Early Holocene cave and rock shelter sites is mirrored by subsistence data from open-air sites dating to the same period. At the Buffalo Flat sites, whose Early Holocene use dates from ~11,500 to 9,800 cal B.P., the presence of large roasting pits filled with burned leporid remains shows how they were an important source of both food and material to produce goods (e.g., clothing, bedding) (Oetting 1994). At the Tucker Site the SGI is 1.0 (Pinson 2004:72).

Middle Holocene radiocarbon dates are uncommon in the northern Great Basin (Louderback et al. 2010:370), leading to speculation that the region was less populated than earlier or later times. Those populations that remained appear to have employed one of two foraging strategies: (1) foragers occupied more sedentary lowland sites clustered around available water sources; and (2) foragers were more mobile in the uplands (Moessner 2004; Wingard 2001). The Bergen Site is an example of a sedentary site. It is located on the shores of Lake Beasley where foragers relied on wetland and lake resources for food and non-food items (Helzer 2004). Another such site is the Bowling Dune site, which was utilized as a short-term seasonal site during the Middle Holocene located away from water where foragers predominantly harvested a wide range of small game with large game playing virtually no role in subsistence, mirroring the record at LSP-1 (Jenkins 2004:152). These lowland sites are associated with large storage or cache pits at various sites (e.g., the Bowling Dune, the DJ Ranch site, and the Locality III sites) suggesting that groups relied on cached resources in times of need (Jenkins 2004; Moessner 2004; Prouty 2004). The Bowling Dune site’s storage pits contained a wide range of foodstuffs that were cached as people made seasonal rounds in diverse environments (Jenkins 2004:152). Caching pits at this site along with the DJ Ranch and Locality III sites indicate that early Middle Holocene foragers were highly mobile as opposed to later Middle Holocene foragers who became more sedentary just prior to the onset of the Late Holocene (Jenkins 2004:154). Foragers utilized a wide range of different environments including wetlands (which provided eggs, waterfowl, fish, and amphibians), sagebrush grasslands (which provided artiodactyls, cottontails, jackrabbits, and grouse), and forests (which provided artiodactyls and grouse) (O'Grady 2004). Upland sites also contain storage features and excavations of the Newberry Crater House suggests that early Middle Holocene foragers utilized plant resources not found in lowland sites and cached them in pits at upland sites (Wingard 2001:19).

Grayson (1993) notes that many caves and rockshelters in the northern Great Basin were abandoned during the Middle Holocene as aridity intensified. Because most of those sites are located near shallow water, this suggests that people sought other locations that retained more reliable sources of water (Grayson 1993:248). After ~8,800 cal B.P. human occupation of the Connley Caves drastically decreased and they were not again used with any intensity until the late Middle Holocene (~6,200 cal B.P.) when conditions became more mesic (Jenkins et al. 2000:34). A similar trend is reflected at LSP-1 with a terminal Early Holocene occupation of the shelter followed by a Middle Holocene hiatus before visits resumed ~4,500 cal B.P.

Around 6,200 cal B.P. the Middle Holocene warm dry period ended, resulting in increased human populations within the northern Great Basin (Jenkins et al. 2000:27; Louderback et al. 2010). During that period, artiodactyl hunting increased in some places but subsistence strategies remained variable (Pinson 2007:203). The onset of the Late Holocene ~5,200 cal B.P. is characterized by greater reliance on artiodactyls and plant resources with decreased reliance on leporids in the northern Great Basin (Pinson 2007:203), although the data from LSP-1 do not support this interpretation at least for northern Warner Valley.

The SGI values for northern Great Basin sites during the Late Holocene shows that foragers relied more on large game with small game still playing an important role in subsistence. At Carlon Village the SGI value for House 1 is 0.70, 0.42 for House 2, 0.70 for House 3, and 0.50 for House 5 (Greenspan and Ricks 2001:544). Structure 3 at the Big M Site the SGI value is 0.96 (Dean 1994:518-519) suggesting that at some sites in the northern Great Basin small game was the primary focus, as was the case at LSP-1.

Upland resources (e.g., *Lomatium*, ponderosa pine, mountain mahogany) were heavily exploited, as seen at sites such as Carlon Village in the Fort Rock Basin (Wingard 2001). Many sites such as the Connley Caves and, apparently, LSP-1 were reoccupied following a Middle Holocene hiatus (Grayson 2011:314). Sites such as the Carlon Village suggest that lowland sites within the northern Great Basin were more sedentary based on the presence of substantial pithouses along lakebeds and marsh environments (Wingard 2001:108).

Summary

Human behavior at LSP-1 is reflected by its faunal assemblage. The site's SGI is 0.99, indicating that large game played a very minor role in subsistence. There appears to have been a hiatus at LSP-1 during most of the Middle Holocene with people returning to the site after the onset of the Late Holocene. Like Camels Back Cave (Schmitt and Madsen 2005), LSP-1 likely served as a short-term site where foragers gathered to pursue and process leporids. Mandibular cutmarks indicate that some taxa, primarily *Lepus*, were skinned possibly for robe or blanket manufacture. Long-bone diaphysis cylinders in the faunal sample are consistent with marrow extraction. High frequencies of cranial fragments and mandibles suggest that whole carcasses were transported to LSP-1 for processing. High abundances of hind- and forelimbs deposited within the shelter suggest that meat and marrow from those elements were consumed onsite while axial portions were either: (1) discarded outside of the shelter; (2) ground into bone meal and eaten; or (3) transported to another location and consumed or cached. Based on ethnographic accounts, missing axial elements may indicate “bad” times, or rather preparation for anticipated “bad” times, in the form of curating the carcasses of leporids for later use when food was scarce and stores became depleted (Dansie 1991).

Chapter 6: Conclusions

This thesis had four main goals: (1) Determine which taxa are represented at LSP-1 and in what abundances they occur; (2) Determine which agents were responsible for deposition at LSP-1 (i.e., human or non-human); (3) Discern what types of human behavior occurred at LSP-1; (4) Consider if the LSP-1 faunal assemblage reflects "good" or "bad" times. The faunal sample presented in Chapters 4 and discussed in 5 were analyzed, described, and interpreted with these questions in mind.

Prehistorically, leporids provided a source of food and material culture (e.g., bone promontory pegs, beads, and robes) since at least the Early Holocene (Fowler 1992; Grayson 2011; Hittman 1984; Hockett 1991, 1994, 1995b; Oetting 1994; Tuohy and Dansie 1997). More recently, black-tailed jackrabbits (*Kammu* in Northern Paiute) and cottontails (*Taboo'o* in Northern Paiute) have played a prominent role in traditional stories (Fowler 1992; Pope 1981; Ruby Kennison-Fox, personal communication, 2012). It is believed that *Kammu* were intelligent and could understand native languages; therefore, rabbit bosses or drive leaders were careful to keep the location of the coming drives secret until just before they occurred for fear that the rabbits would hear and spoil the hunt (Inter-Tribal Council of Nevada 1976:14). Communal hunting events were taken very seriously as they usually coincided with family gatherings that resulted in marriages, storytelling, and the passing of cultural knowledge (Hittman 1984). Ethnographic stories about the relationships between people and the game they pursued reflect the respect given to animals, which ensured their continued availability to people for food and clothing (Figure 6.1). Such behavior likely extends deep into Great Basin prehistory (Fowler 1992:180).

LSP-1 has yielded a robust faunal assemblage that is well-preserved and dominated by leporids. The sample from Stratum V consists of ~9,500 specimens representing at least 23 different taxa. Age profiles of leporids suggest that humans were responsible for their accumulation and reflect seasonal (primarily fall/winter) harvesting. In terms of reconstructing human diet at LSP-1, leporid elements are highly processed with both high and low-utility long-bone diaphysis cylinders represented in high frequencies suggesting that marrow was extracted. Many diaphysis cylinders exhibit burning, polishing, and cutmarks associated with butchering, cooking, and boiling. Mandibular cutmarks suggest skinning behavior, distal and proximal locations of cutmarks on long-bones suggest disarticulation, and cutmarks on the axial skeleton and medial surfaces of elements (e.g., longbones) suggest defleshing (*sensu* Lloveras et al. 2009). These data, along with skeletal element abundances, suggest that at least some whole carcasses were transported to LSP-1 and both processed and consumed at the site. Low frequencies of axial skeletal elements suggest that leporids bodies were either ground up into bone meal (*sensu* Dansie 1991) or transported elsewhere (*sensu* Schmitt and Madsen 2005). Like Camels Back Cave in western Utah (Schmitt and Madsen 2005), LSP-1 likely served as a short-term location where foragers briefly gathered to pursue and process jackrabbits and cottontails during the fall/winter. The SGI value for LSP-1 (0.99) indicates that artiodactyls played an extremely limited role in subsistence during such visits.

LSP-1 in a Broader Context

Terminal Pleistocene and Early Holocene foragers focused on diverse small game including insects, with large game seemingly playing a lesser role in human subsistence (Hockett 2007; Janetski et al. 2012; Jones and Beck 2012; Pinson 2004). Humans first used LSP-1 at the end of the Early Holocene (~9,600 cal B.P.). Around the same time, foragers harvested leporids *en masse*, potentially via communal drives, at sites in Buffalo Flat (Oetting 1994). During the Middle Holocene as conditions deteriorated, groups seem to have increasingly occupied lowland sites associated with dependable water sources (Grayson 1993; Helzer 2004; Moessner 2004; Wingard 2001). Many caves and rockshelters were abandoned at that time (Grayson 1993), and this appears to have been the case at LSP-1, where diagnostic projectile point frequencies and radiocarbon dates suggest that after ~9,300 cal B.P. a substantial hiatus occurred. Survey data from the valley below LSP-1, which also reflect a paucity of Middle Holocene occupations (Pattee 2014), support this interpretation. At the onset of the Late Holocene, the number of archaeological sites in the northern Great Basin increased dramatically and suggests that as climatic conditions improved, people reoccupied many parts of the region (Grayson 2011; Louderback et al. 2010). People reoccupied LSP-1 ~4,500 cal B.P. and appear to have resumed leporids hunting in much the same way that earlier visitors did.

Problems with the LSP-1 Dataset

As outlined throughout my thesis, LSP-1 likely contains two temporally discrete occupations rather than an uninterrupted record of human use beginning in the terminal Early Holocene and extending into the Late Holocene, as was originally thought (Smith et al. 2012a). Unfortunately, several out-of-sequence radiocarbon dates and a lack of a clear bimodal distribution in artifact density (see Figure 4.15) suggest that some vertical mixing of material has occurred. Further radiocarbon dating and obsidian hydration analysis are planned and will hopefully help to separate the Early and Late Holocene occupations of the site. Until that work is completed, however, it will be difficult to confidently assign the faunal sample discussed here to finer time periods.

Future Research Using LSP-1 Fauna

Future research on the archaeofauna of LSP-1 would greatly benefit from additional analyses. Zooarchaeological as well as taphonomic analysis of the entire assemblage will provide additional patterns of processing behavior (e.g., skinning, disarticulation, defleshing) and may indicate differential use of the space within the shelter. Although based upon observations made during fieldwork it appears that fauna throughout the site are consistent, additional studies of materials from elsewhere in the shelter will help confirm my interpretations made using a small sample. For example, age profile data will help determine if fall/winter occupations of the site persisted in different time periods as noted in my sample. Additional analyses of skeletal element abundances will also determine if people continued to transport axial portions of the carcasses away from the site, as is suggested by my sample. Further analysis will provide more data for small mammal use (i.e., woodrat hide procurement) and may indicate that as Warner Valley recovered from Middle Holocene aridity, waterfowl returned to the area.

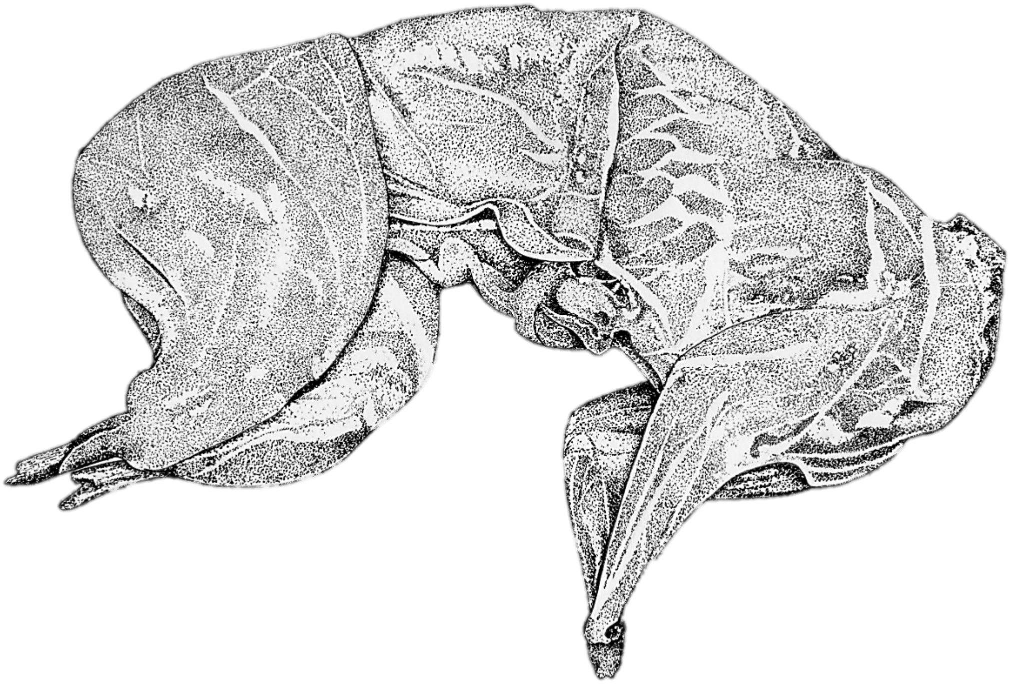


Figure 6.1. Skinned and gutted *Sylvilagus* carcass.

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