

Supplement 3: Faunal Remains

Supplemental Table 2. Specimen identification for Swan Point CZ4b.

		NISP	MNE	MNI
Mammalia				
Artiodactyla				
Bovidae				
<i>Bison</i> sp.	Bison	1	1	1
Cervidae				
<i>Alces alces</i>	Moose	1	1	1
<i>Rangifer tarandus</i>	Caribou	3	2	2
Unidentified Cervid (Antler)		1	-	-
Perissodactyla				
Equidae				
<i>Equus lambei</i>	Yukon Horse	10	4	1
Proboscidea				
Elephantidae				
<i>Mammuthus primigenius</i>	Woolly Mammoth			
Skull		1	1	
Cheek teeth		127	2	4
Incisors		718	3	
Ribs		12	8	
Lagomorpha				
Leporidae				
<i>Lepus (Lepus)</i> sp.	Unidentified Arctic Hare	2	2	1
<i>Lepus (Poecilolagus) americanus</i>	Snowshoe Hare	2	2	1
Rodentia				
Cricetidae				
<i>Myodes rutilus</i>	Northern Red-Backed Vole	3	3	1
<i>Microtus oeconomus</i>	Tundra Vole	3	3	2
<i>Microtus xanthognathus</i>	Taiga Vole	3	3	1
<i>Microtus/Myodes</i>	Unidentified Vole	2	2	-
Dipodidae				
<i>Zapus hudsonius</i>	Jumping Mouse	215	210	10
Sciuridae				
<i>Urocitellus parryi</i>	Arctic Ground Squirrel	79	69	4
Undetermined Order				
Mammal Size 2		1	1	-
Mammal Size 5		7	5	-
Aves				
Anseriformes				
Anatidae				
<i>Anas</i> sp.	Teal	2	2	1
<i>Anas</i> sp.	Pintail, Mallard or Wigeon	1	1	1
Anatinae	Unidentified Large Duck	1	1	-
<i>Anser fabalis / Branta canadensis</i>	Unidentified Large Goose	1	1	-
Anserini	Unidentified Goose	33	31	4

Anatidae	Unidentified Goose or Duck	8	8	-
<i>Cygnus columbianus</i>	Tundra Swan	3	3	-
<i>Cygnus</i> sp.	Unidentified Swan	5	5	2

Galliformes

Phasianidae				
<i>Lagopus lagopus</i>	Willow Ptarmigan	5	5	1
<i>Lagopus leucurus/mutus</i>	Rock or White-tailed Ptarmigan	1	1	1
<i>Lagopus</i> sp.	Ptarmigan	2	2	-

Undetermined Order

Bird Size 2		2	2	-
Bird Size 4		1	1	-
Bird Size 5		1	1	-

Total **1,257 383 38**

Quantification units follow the definitions in Lyman (2008). Mammal and bird size classes are defined in Supplemental Table 3.

Supplemental Table 3. Size classes used for this study.

Size Class	Possible Genera (Non-Exhaustive)
Mammal 1	<i>Microtus, Myodes, Zapus</i>
Mammal 2	<i>Uroditellus, Marmota, Tamiasciurus</i>
Mammal 3	<i>Lepus, Vulpes, Castor</i>
Mammal 4	<i>Canis, Ovis, Saiga</i>
Mammal 5	<i>Cervus, Bison, Alces, Equus</i>
Mammal 6	<i>Mammuthus</i>
Bird 1	(not assigned)
Bird 2	<i>Lagopus, Tympanuchus, Dendragapus, Bonasa, Anas, Aythya, Bucephala</i>
Bird 3	<i>Anas, Aythya, Bucephala, Clangula, Histrionicus, Melanitta, Mergus</i>
Bird 4	<i>Branta, Anser, Chen, Pandion, Buteo, Bubo</i>
Bird 5	<i>Cygnus, Aquila, Haliaeetus, Grus, Pandion</i>

Supplemental Table 4 (attached as .xlsx file). Raw faunal data for CZ4b (does not include most mammoth ivory). Codes included as Supplement 4.

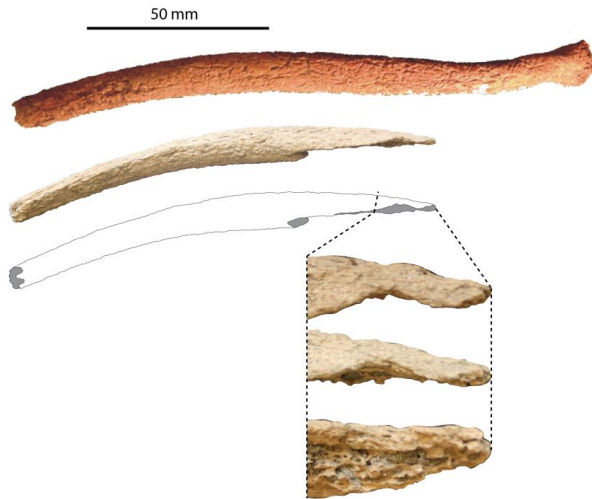
Mammoth

Three types of mammoth remains were identified, including incisors (i.e. ivory, or tusk), cheek teeth, and bones. Cheek teeth fragments account for a MNE of 2; two well-preserved fragments yielded widths of 51.30 and 51.66 mm, falling in the size range of the fourth deciduous premolar (dp4/M3) and the first molar (m1/M4) (Maschenko 2002; Metcalfe et al. 2010; Roth and Shoshani 1988). No occlusal wear was present; based on eruption and wear stages, the individual represented must have been around two (if a dp4) or five (m1) years old (Haynes 1991; Maschenko 2002). One mandible fragment can be assigned to a three to five year-old calf based on the estimated length of the mandible (30 to 40 cm, to compare with specimens in Maschenko [2002]).

A large left tusk (Lanoë and Holmes 2016: Figure 4) was previously attributed to a 15-year-old female based on growth rings (Holmes et al. 2012), and another fragment of similar diameter could be from the same individual. A small broken tusk missing the pulp cavity (Lanoë and Holmes 2016: Figure 3), with a chord length of 256 mm and a maximal diameter estimated to 26-30 mm can be assigned to an individual between six and eight years old (Maschenko et al. 2006). Other tusk fragments consist in numerous, small and non-descript splinters.

Eight ribs were recorded, of which at least four were attributed to a very young calf, one or a few months old (Holmes et al. 2012). Green breaks were recorded on two ribs, and one of them displays a notch characteristic of dynamic loading impact (Supplemental Figure 4); it is likely that part of the ribcage was butchered by humans and consumed.

Overall at least four individuals are represented: a young prime adult of about 15 years old, a calf about five years old, a calf older than six years old, and a neonate. Evidence of human procurement for consumption, whether hunting or scavenging, is only present for the neonate.



Supplemental Figure 4. Mammoth infant rib fragment, medial view (specimen #15941). Side is undetermined; the proximal side (towards the rib-head) is to the right. For comparison, a left rib (position 10 to 13, not to scale) is displayed on top. A notch characteristic of dynamic loading impact (Capaldo and Blumenschine 1994) is present on the mesio-proximal portion of the blade.

Other Ungulates

Bison (either *Bison priscus*, *B. antiquus*, or *B. occidentalis*, see Shapiro et al. 2004; Wilson et al. 2008) is represented by a single cranial fragment. Caribou is represented by a juvenile metatarsal and a male adult shed antler (Lanoë and Holmes 2016: Figure 2). Yukon horse (*Equus lambei*) was identified from cheek tooth measurements (Burke and Cinq-Mars 1996) and is represented by at least two opposite M3 of similar dimensions and wear, which can be assigned to an individual 3-5 years old (following Guadelli 1998:93), and a stylohyoid. Moose (*Alces alces*) is represented by a distal phalanx. Unidentified ungulates are represented by rib and tooth fragments.

Apart from the ribs, the elements recorded have limited to no nutritional value (Outram and Rowley-Conwy 1998). Bison and horse brains and tongues, as well as cervid feet, may have been used primarily for other purposes than food, such as hide tanning or sinew extraction. In contrast to other Beringian sites (Potter 2005), there is no evidence at CZ4b of primary butchery and

large-scale consumption of ungulates; nutritious body parts may have been transported away for consumption and/or processed at another location or in a non-excavated area of the site.

Moose and bison are only represented by one specimen each. Because both species are present in CZ3 (, and in the absence of direct radiocarbon dating, it cannot be excluded that their presence in CZ4b is due to contamination from the components above. However this issue has no bearing on the arguments presented throughout this article.

The mammoth and horse remains from CZ4b are among the most recent occurrences of their genus in eastern Beringia, while the moose, if *in situ*, is among the earliest (Guthrie 2006).

Lagomorphs and Rodents

Hares are represented by four elements. Two subgenera were likely to be present in eastern Beringia at the Pleistocene-Holocene transition: the arctic hare s.l., *Lepus* (*Lepus*), for which possible species include *Lepus othus* and *Lepus timidus* (Waltari and Cook 2005), and the snowshoe hare, *Lepus* (*Poecilolagus*) *americanus*. Based on measurements both are present in CZ4b.

Rodents are represented by the Cricetid, Sciurid, and Dipodid families (Supplemental Table 2). Cricetid species identification followed Semken and Wallace (2002). Human predation is at best limited to the arctic ground squirrel (Supplement 2). Skeletal part distribution shows a relatively even representation of body parts with high-density elements suggesting intact bodies were brought to the site.

Birds

At least six species of birds were identified in the assemblage including tundra swan, a large goose, a large duck, a teal, the willow ptarmigan and a smaller ptarmigan (Supplemental Table 2). Anatidae elements are notoriously difficult to identify to species, and this is particularly true for eastern Beringia. While the American central and Pacific migratory flyways might have been in place by the late Pleistocene (Yesner 1996), Palearctic species may also have held breeding grounds in eastern Beringia at a time when the Bering Strait was not a major biogeographic barrier (Buehler et al. 2006; Salomonsen 1972), and when Nearctic species could have established preferential breeding grounds south of the Laurentide icesheet (Moss and Erlandson 2013). To the potential 27 species of terrestrial Anatidae that occur today in Alaska can be added six strictly Palearctic species; as a result, identification of Beringian Anatid is difficult, particularly in the absence of dated well-preserved assemblages (see Fitzgerald 1991; and Harington and Cinq-Mars 2008 for non-dated assemblages). A detailed rationale for CZ4b specimen identification is presented in the next section.

Goose is the most common kind of bird with at least four individuals (Supplemental Table 2). Skeletal part distribution is relatively even for high-density elements (Supplemental Table 4) suggesting geese were brought to the site as complete carcasses. On the other hand, swan is only represented by forelimb elements, including humeri, radii, and ulnae (Supplemental Table 4), accounting for at least one adult and one juvenile. The swan skeletal part pattern suggests that wings, or possibly legless bodies, were transported to the site after field processing.

Considerations of weight may have been more important for the comparatively heavy swan (up to 9.6-12.7 kg, Brazil 2009:48) than for geese (up to 3.0-5.1 kg, Brazil 2009:42-6). Alternatively, the difference in skeletal pattern may be related to organic technology (see below).

Other waterfowl specimens include large duck, teal, and unidentified Anatid (Supplemental Table 2). The dissolution of extremities hinders recognition of juvenile individuals; nevertheless, five, comparatively small, geese elements, and eight elements that could not be identified to tribe level probably belong to juvenile geese.

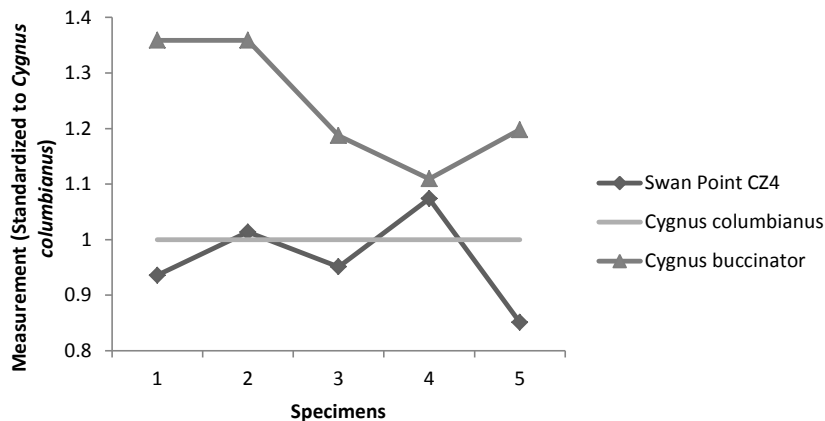
In addition to waterfowl, specimens of at least two individuals of two different ptarmigan species were recovered, and two bird specimens could not be identified to family (Supplemental Table 2). A total of 489 small rounded pebbles, arguably gastroliths (Hoskin et al. 1970), were recorded; but no eggshell.

Ninety percent of the articular ends of birds long bones were absent, leaving only diaphyses and hindering identification to species level. This preservation pattern is most likely due to the bones light build (Serjeantson 2009) making them vulnerable to dissolution, rather than human modification (only 17 percent show green breakage).

Identification of Birds

Anatidae: Once identified to the Anatidae family, specimens were assigned to classes, including swan, large duck (*Anas acuta*, *Anas americana*, *Anas clypeata*, *Anas penelope*, *Anas platyrhynchos*, *Aythya americana*, *Aythya fuligula*, *Aythya marila*, *Aythya vasilineria*, *Bucephala clangula*, *Bucephala islandica*, *Clangula hyemalis*, *Histrionicus histrionicus*, *Melanitta spp.*, *Mergus spp.*), and small duck (*Aythya affinis*, *Aythya collaris*, *Anas americana*, *Anas carolinensis*, *Anas clypeata*, *Anas discors*, *Anas formosa*, *Bucephala hyemalis*, *Mergellus albellus*). Small or young geese can be differentiated from large ducks on most long bones specimens based on the ratio length/width of the bone, higher in geese.

Specimens identified to swan were measured when possible (non-standard measurements) and compared with comparative specimens of *Cygnus columbianus* and *C. buccinator*. The three possible species of swan range in size from *C. columbianus* (length 120-150 cm, wingspan 167-225 cm) to *C. cygnus* (140-165, 205-243) and *C. buccinator* (150-180, 230-260) (Brazil 2009). Supplemental Figure suggests at least two individuals are represented here. Three specimens (1, 2, 3) fall close to the measurements for *C. columbianus*. The fourth measurement cannot be attributed to either species. The fifth is particularly small, and probably represents a juvenile. Overall, attribution to *C. columbianus* is likely for at least three specimens.



Supplemental Figure 5. Comparison of measurements of swan elements from Swan Point CZ4b with references for *Cygnus columbianus* and *C. buccinator*.

Specimens identified to goose were compared to comparative specimens from *Anser albifrons*, *Chen caerulescens*, and *Branta canadensis* (no comparative specimen was available for *Anser fabalis*, *A. erythropus*, and *Chen rossii*). Geese bones are notoriously difficult to identify to species and even genus (Bacher 1967), even more so when fragmented. Only one ulna was large enough (element length estimated to 165 mm) that it could be attributed to a large goose, either *Branta canadensis* or *Anser fabalis* (Gilbert et al. 1981).

Eight specimens could be identified to the Anatidae but it was not possible to differentiate between a small (or juvenile) goose and a large (adult) duck.

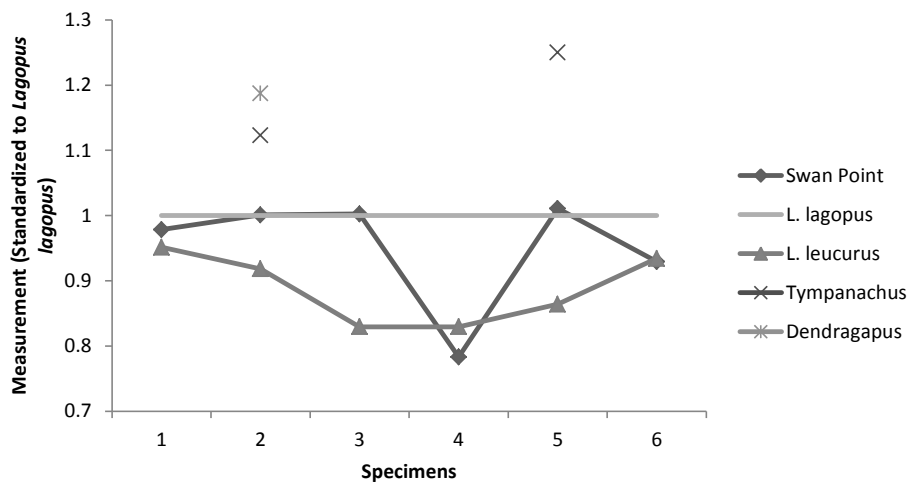
Three adult duck specimens were identified to the genus *Anas* following Woelfle (1967). One was in the size range of the larger *Anas* ducks (*Anas (Dafila) acuta*, *A. (Mareca) americana/penelope*, *A. (Anas) platyrhynchos*), and two were in the size range of the teals (*Anas (Tettion) crecca*, *A. (Spatula) discors*, *A. (Sibirionetta) formosa*).

Another specimen could be identified as a large duck but not at the genus level.

Phasianidae: Once identified to the Phasianidae family, specimens were compared to comparative specimens of *Lagopus leucurus* (also used as a substitute for the similar-sized *Lagopus mutus*), *Lagopus lagopus*, *Tympanuchus phasianellus*, and *Dendragapus obscurus* (used as a substitute for the similar-sized *Dendragapus canadensis*). I did not have access to specimens of *Bonasa umellus* which is similar in size to *Tympanuchus phasianellus* (Alderfer 2005).

There is a size graduation between the six species of Phasianidae likely to occur in central Alaska, in particular ptarmigans are significantly smaller than grouses. For all specimens

recorded a measurement was taken and compared to comparative specimens. Four measurements (numbers 1, 2, 3 and 5) were in the size range closest to *Lagopus lagopus*, and 1 (number 4) was closest to *Lagopus leucurus* (Supplemental Supplemental Figure 6). Number 6 is closest to *Lagopus leucurus* but is from an immature element. In addition, two adult tarsometatarsals provided standardized measurements: 39.64 mm (number 3 on Supplemental Figure 6) and 30.96 mm (number 4). Those fall neatly in the published range for *Lagopus lagopus* and *Lagopus leucurus/mutus*, respectively (Kraft 1972, Bochenski 1985), for an element in which size is characteristic to species (Bochenski 1985).



Supplemental Figure 6. Phasianidae specimens measurements from Swan Point CZ4b with references for *Lagopus lagopus*, *Lagopus leucurus*, *Tympanachus phasianellus* and *Dendragapus obscurus*.

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