REPORT

The Sheep Mountain Animal Net Revisited

Linea Sundstrom and Danny N. Walker

A juniper fiber net discovered in a cave near Cody, Wyoming, had been radiocarbon dated at 8860 BP (6910 ± 170 BC; RL-396) in 1986. Reanalysis and four additional AMS radiocarbon dates indicate an age younger than 1300 cal BP. Net metrics are consistent with archaeological and ethnographic examples identified as rabbit nets.

Keywords: hunting net, Great Basin, Great Plains, radiocarbon dating

Una red de fibra de enebro, descubierta en una cueva cerca de Cody, Wyoming, había sido datada por radiocarbono en 8860 aP (6910 ± 170 aC; RL-396) en 1986. Un reanálisis y cuatro fechas radiométricas adicionales del espécimen indican una edad que es menor de 1300 cal aP. Las medidas de la red son consistentes con los ejemplos arqueológicos y etnográficos que han sido identificados como redes para conejos.

Palabras clave: red de caza, Gran Cuerca de América del Norte, Grandes Planicies de América del Norte, datación por radiocarbono

A juniper bark fiber net discovered in a cave on Sheep Mountain in the Absaroka Mountains of Wyoming was reported in 1986 (Figure 1; Frison et al. 1986). The original report noted "discovery of the net was accidental, and the circumstances of preservation were unique. Packrat (*Neotoma cinerea*) midden covered and protected the object, and there was no associated evidence of human occupation of the cave" (Frison et al. 1986:352). The report supplied no additional details as to the discovery, removal, and subsequent curation of the net. The net is currently curated at the University of Wyoming Archaeological Repository in Laramie, on behalf of Old Trail Town Museum, Cody, Wyoming. The artifact and its presumed site of recovery were assigned site number 48PA1022 in 1988.

The Sheep Mountain Net

The Sheep Mountain find consists of cordage loosely woven into a net with three small stakes, which had been folded into a compact rectangular bundle. The 1986 article states that the net had been folded in on itself on each long side and then folded accordion-style with the stakes still attached. The deteriorated condition of the net precluded unfolding it (Frison et al. 1986:352). The original report estimated the height at 1.5–2.0 m and the length at 50–65 m (Frison et al. 1986:354).

Lengths of the three stakes are not reported in the original report. We measured one stake (Stake 1) at 31.5 cm long and a second (Stake 2) at 45.2 cm (Figure 2). Stake 1 is broken and the proximal end is missing. The third stake is

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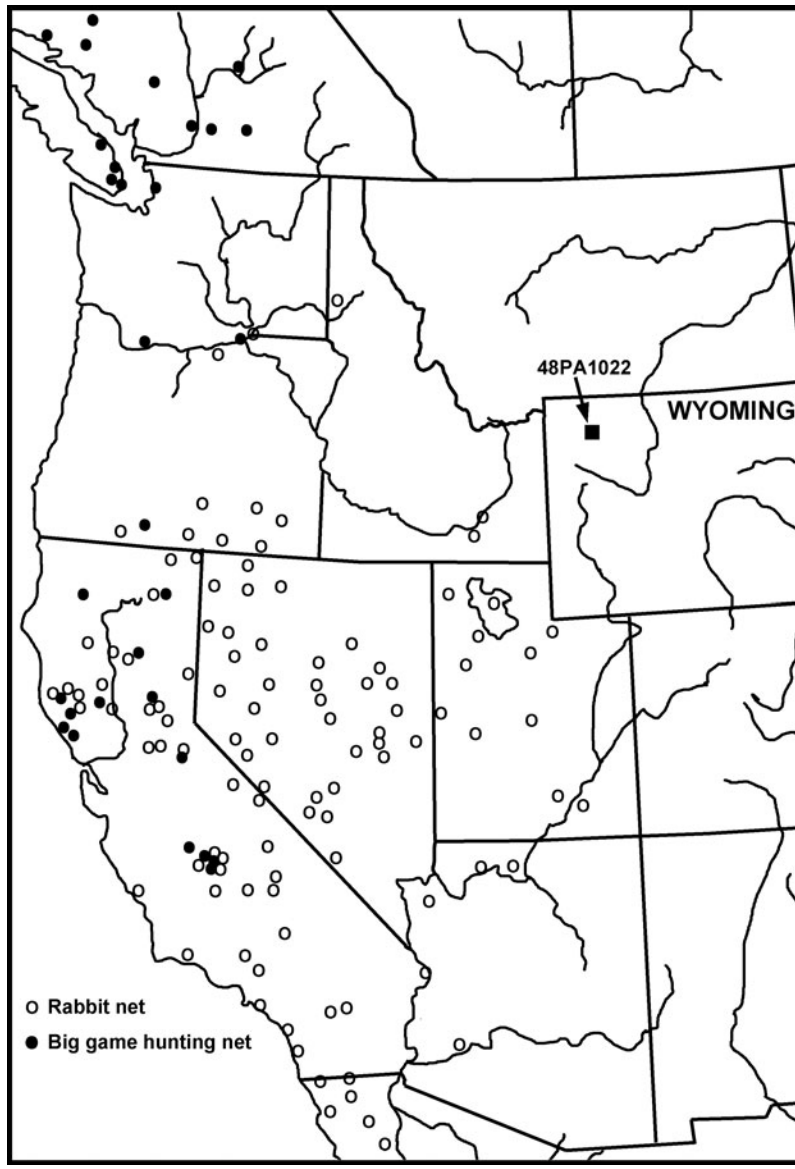

Figure 1. Generalized map of western North America, showing location of 48PA1022 and distribution of large game and rabbit hunting by use of nets from ethnographic reports (adapted from Anell 1969).

not visible in published photographs and cannot be accessed for measurement (Frison et al. 1986:355; Kornfeld et al. 2010:313). Using photographs of the net, we have measured the mesh size (center of knot to center of next knot) at 5.5–7.0 cm (Figure 3).

The net was further described in 1984 by Andrews and collaborators, quoted here by permission of Dr. James Adovasio:

The net specimen from Sheep Mountain, Wyoming, was produced via the free end process and is a looped rather than a linked fabric. Following the format of Andrews and Adovasio (1980:31), the specimen is allocated to the "knotted loop" category, which is also called "knotted netting." It is ascribed to a single numbered structural type within the "knotted loop" category

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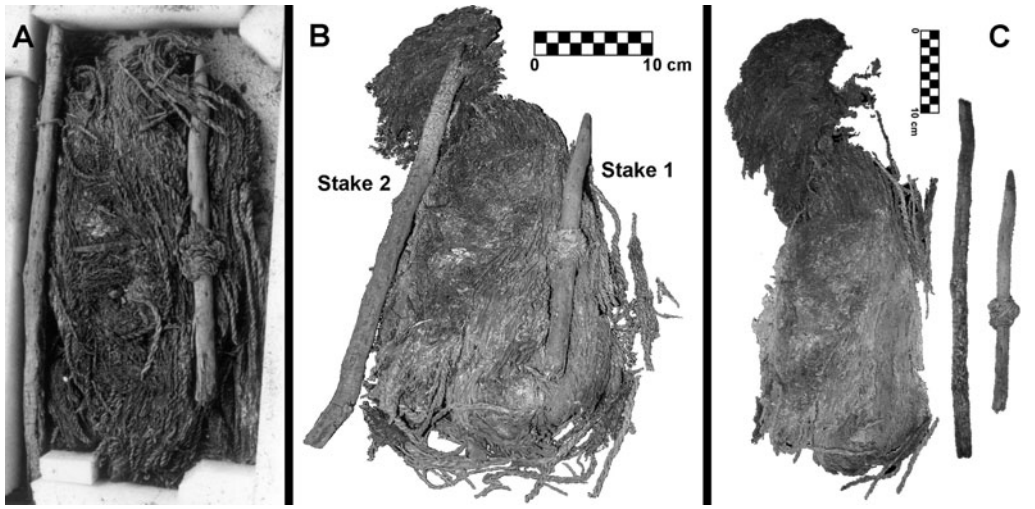

Figure 2. Photographs of net taken in (left) 1986, (center) 2010, and (right) 2016, showing deterioration of netted material. (Left photo by George Frison; center and right photos by Danny N. Walker.)

based on the type of knot used in the mesh.

. . . This net specimen consists of a quadrilateral mesh constructed of a series of sequential, regularly spaced and fixed fishnet knots (Emery 1966:38–39). The knots are asymmetrical, and the knot faces are dissimilar. On each net surface, knots in consecutive rows exhibit alternate faces.

The specimen is made with two ply, Z spun, S twist (S ZZ) cordage of variable diameter. Cordage splices are made by securing the new raw material beneath the exhausted cordage ply. No body splices are evident in the exposed portion of the net.

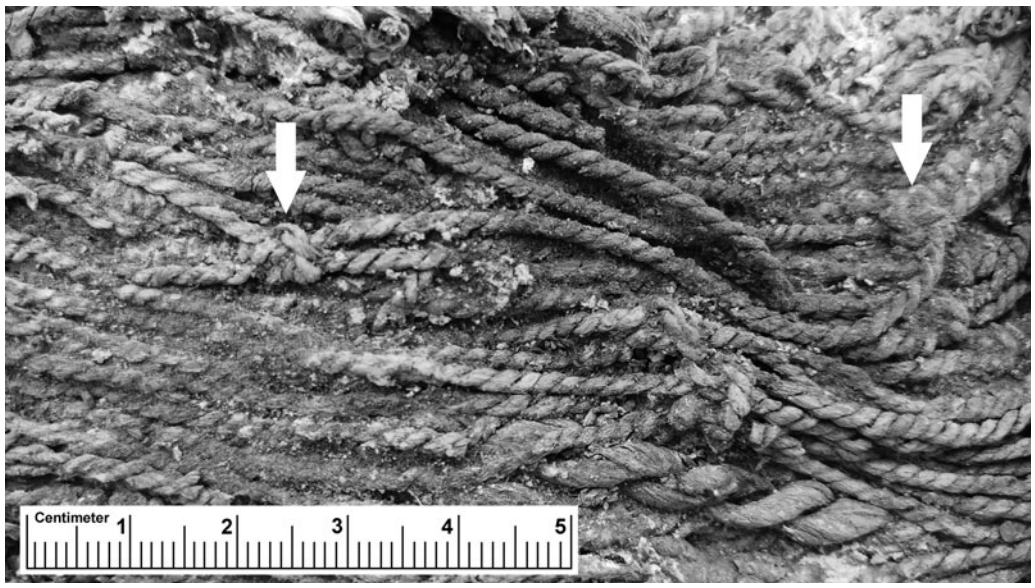

Figure 3. Detail photograph of net showing cordage with knots used to estimate mesh size. (Photo by Rick Weathermon.)

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Cordage of various diameters is used throughout the net, and in fact, it appears to grade continuously from relatively thick cordage to that which is relatively thin. To facilitate discussion of this cordage, the diameters are grouped into four analytical categories labeled simply "large" (4.10 mm to 5.20 mm), "medium/large" (2.65 mm to 3.00 mm), "medium/small" (1.10 mm to 1.65 mm) and "small" (0.70 mm to 1.00 mm). In the portions of this folded net that are visible, "large," "medium/large," and "medium/small" to "small" cords constitute, respectively, 5%, 15%, and 80% of the exposed surface area. As found, the net was folded into a rough rectangular configuration measuring 21 cm × 38. The "large" diameter cordage predominates along both margins of the long axis of the rectangle, while the "medium/large" cordage is found near one of the shorter edges. This grades into smaller and smaller diameter cordage toward the center and "bottom" of the specimen. Mesh gauge varies from ca. 0.71 cm to 3.01 cm and is a function of cordage diameter.

The Sheep Mountain net includes three nearly straight sticks positioned along the long axis of the folded net. In a three-dimensional perspective, the sticks actually form a triad. . . . All three sticks are decorticated and detwigged. Each of the paired sticks has been sharpened to a single point, but the points are oriented in opposite directions. One of these pointed sticks was initially intact. A length from the end opposite the point was [removed by making a cut] perpendicular to the stick's long axis and was used for radiometric dating. The butt end of the other one of the paired sticks is fragmented. Details on the modification or working of the third twig are precluded by the friability of the net; however, the stick appears to be cut at a ca. 35° angle on one end. Some 15 cm and 35 cm (5.9 in and 13.8 in) from the sharpened ends of the fragmented and whole stick, respectively, the net has been wrapped two or more times about the sticks. The wrapped net portion consists predominantly of large cords, but the presence of some small cords suggests that manufacture of the net preceded its attachment.

> . . . The net shows no visible signs of mending, but it is charred at one end. Cords in the "large" diameter category seem to be stained red or reddish-brown; this may represent either intentional staining or unintentional, post-depositional staining (Andrews et al. 1984:3–8) [James Adovasio, personal communication 2020].

The stakes were identified only as "hardwood" in the original report but are identified here as greasewood (*Sarcobatus vermiculatus*), based on macroscopic examination. The visible, exterior portion of the net was later examined under magnification. No blood, tissue, or hairs were observed on it. No attempt has been made to extract animal DNA from the fibers because the net's postexcavation environment was not conducive to DNA preservation.

Age of the Net

The original article reported a radiocarbon date of 8860 BP (originally reported as 6910 ± 170 BC; RL-396) for the net, placing it in the Late Paleoindian period. Calibration using OxCal gives a range of 8350–7583 cal BC for the date, within 95% probability. The dated sample came from a small piece of wood detached from the charred end of Stake 2 (Frison 1991:258; Frison et al. 1986:354). The sample was taken parallel to Stake 2's long axis and did not shorten the stake. No attempt was made until recently to verify the Late Paleoindian date, although—as the original study noted—"the probability that such an extremely perishable item of such great age would be preserved at all is extremely low" (Frison et al. 1986:352).

A recent radiocarbon sample on the juniper fiber netting itself called into question the Paleoindian age for this net. The sample was a cordage fragment that had fallen away from the net. This yielded a date of 1320 ± 30 BP (Beta-443460; juniper fiber), with two possible calibrated date ranges: AD 655–720 and AD 740–765, both within the 95% probability level. Because of the large discrepancy between this and the date reported in 1986, a third sample was submitted for dating. This sample consisted of a small piece of cordage removed from well inside the bundled

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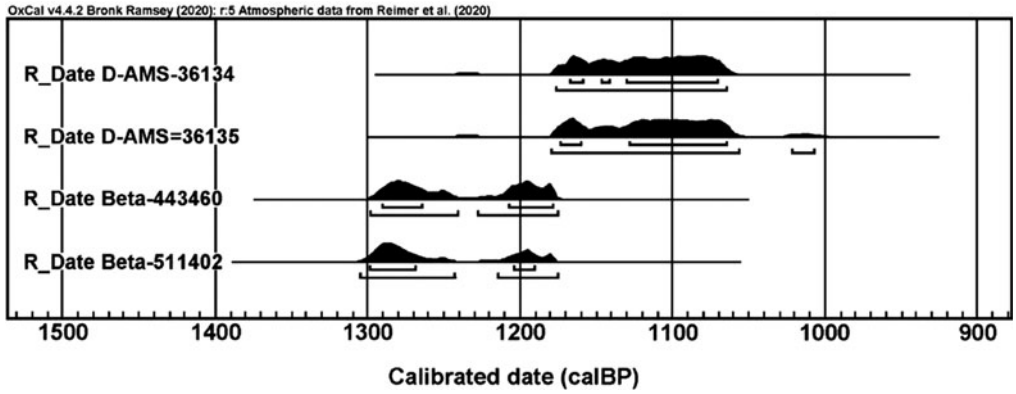

Figure 4. Calibrated dates of the Absaroka Mountain net from 2017 to 2018. (Calibration provided by Madeline Mackie of the University of Wyoming.)

net, and it yielded a date of 1340 ± 30 BP (Beta-511402; juniper fiber), with the same two calibrated ranges as the previous date.

When compared with the original 1986 date, these two Late Prehistoric dates suggested the possibility of old wood having been used for the stakes, resulting in the discrepancy. Wood samples removed from both accessible stakes again yielded Late Prehistoric dates, although slightly younger than the two dates from net fiber: 1201 ± 21 BP (D-AMS 036134; wood) and 1191 ± 25 BP (D-AMS 036135; wood; Figure 4). All four dates were obtained using accelerator mass spectrometry (AMS; Table 1). The slightly younger dates of the two stakes are likely the product of breakage and replacement. Whereas the net would have been mended before reuse, any broken or split stakes would simply have been replaced, resulting in a slight age discrepancy between netting and stakes. The dates for the stakes and the net converge at 1220 cal BP but cover a range of up to 240 years. Whatever the explanation for the variation in the four dates, the artifact is clearly of Late Prehistoric age. The reason for the older date returned in 1986 remains unknown.

Net Function

The original study proposed that the net had been designed for taking large animals, such as deer or mountain sheep (Frison et al. 1986:354–355, 359). Although the net's function cannot be conclusively demonstrated, current data do not support its hypothesized use for deer or mountain sheep. Because no animal hair, tissue, or blood adheres to the accessible portion of the Sheep Mountain net, its form is the only clue to its use. There are no documented examples or descriptions of nets used for mountain sheep. A

Table 1. Radiocarbon Dates on Net from 48PA1022.

Sample ID	Material	Analysis	Age	Error	Calibrated Range (cal AD 68%)	Calibrated Range (cal AD 95%)
D-AMS-36134	Greasewood stake #1	AMS	1201	21	783–791 (7.7%) 803–809 (4.8%) 820–879 (55.8%)	773–885 (95.4%)
D-AMS-36135	Greasewood stake #2	AMS	1191	25	777–790 (10.9%) 821–885 (57.3%)	771–893 (93.2%) 929–943 (2.2%)
Beta-443460	Juniper bark cordage (exterior)	AMS	1320	30	660–685 (33.4%) 743–771 (34.9%)	652–709 (51.9%) 722–774 (43.6%)
Beta-511402	Juniper bark cordage (interior)	AMS	1340	30	652–681 (52.2%) 746–759 (16.1%)	644–714 (84.1%) 744–765 (11.3%)

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few rock art panels from the Great Basin show long nets in conjunction with mountain sheep; however, these cannot be relied on for specific net metrics, and the presence of pictures of other animals on the same panels muddies the connection between the nets and mountain sheep. Archaic rock art in the Black Hills shows detailed scenes of deer hunting using stand nets, providing reliable, but much earlier, evidence for this hunting method in the region (Sundstrom 2004:53–62).

Net Metrics

The exact height of the net cannot be determined. As noted, the length of the longer stake is 45.2 cm. A witness to a Great Basin rabbit drive noted that the supporting stakes were "a few inches" longer than the height of the extended net (Egan 1917:236). This suggests a net height of between 50 and 60 cm. The original article presents contradictory data about the net height. The net is described as forming a bundle about 21 × 31 cm and having been folded in thirds lengthwise before being accordion-folded and bundled. The outside edges must have been bound with a supporting string that had been strung through the outermost meshes; however, no such support cord is visible on the specimen or in photos of it. If the net had instead been folded with the two outside edges meeting in the middle, these outside edges and support strings would not be visible, but the net would have been in half—not in thirds. Assuming it had been folded in thirds, the unextended height would be 114 cm (38 × 3). If it had been folded in half, the unextended height would be 76 cm (38 × 2). Use height—with the net extended so that the meshes were roughly square—would be less: 80.6 cm if folded in thirds, and 54 cm if folded in half (unextended height × 0.707). The net could be made lower if extended farther or allowed to droop between the supports. In any case, the original estimate of "1.5 m to 2 m high" is not congruent with the available metrics for either netting or stakes.

James Teit described deer-hunting nets from two Columbia Plateau tribes, both made of *Apocynum* fiber: the first as about 2 m high and from 14 m to 180 m long with "large" meshes; the second as 2 m to 3 m high and from 15 m to 60 m long, mesh size not specified (Teit 1900:245–258, 1930:246). Museum specimens identified as rabbit nets vary from 0.45 m to 1.8 m high and from 6 m to 120 m long with a 5–7.6 cm mesh size, "approximately the size of a rabbit's head" (Table 2; Connelly et al. 2017:148). Wildlife biologists recommend 2.4 m high fencing to inhibit mountain sheep movement and note that these animals can "readily hop over" a 1 m high fence (Clevenger and Huijser 2011:178; Paige 2015:16). Deer require a 2.1–2.4 m high fence (Clevenger and Huijser 2011:178; Paige 2015:47). The Sheep Mountain net lies within the metrics for known rabbit nets, but it is less than half as tall as known deer nets or modern fences for mountain sheep.

The stakes included with the Sheep Mountain net also suggest use for small animals. The stakes are between 1 cm and 1.8 cm in maximum diameter, which is comparable to known supports for rabbit nets. The longer of the two accessible stakes is notched at the butt end, as would be expected for a rabbit or sage grouse net. Ethnographic accounts state that for rabbit drives, these long nets were strung along notched sticks such that the net would collapse when the drove of rabbits ran into it, entangling the animals (Anell 1969:45; Riddell 1960:38; Steward 1938:38; Wheat 1967:41).

Faunal Assemblages

Faunal assemblages from the area indicate consumption of both small and large animals. A study of faunal assemblages from 58 archaeological sites in the Green River Basin of western Wyoming listed bison, rabbits, rodents, and pronghorn in order of frequency, with cottontails often outnumbering jackrabbits (Lubinski 2000; McKibbin 2000:158). Studies in the Wind River Basin of central Wyoming gave similar results, with faunal material dominated by rabbits—both cottontail and jackrabbit—but again with cottontails dominant (Eakin et al. 1977; Rood 2018; Rood et al. 2012; Walker 1997). Although bone carried in by carnivores may skew leporid counts (Hockett 1994), the use of rabbit flesh for food, skins for woven robes, and bone for beads is well established archaeologically and ethnographically (Hockett 1991:668–669; Wheeler 1997:18–34). Faunal material from at least two sites in the Big Horn Basin also

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Table 2. Game Nets from Archaeological and Ethnographic Collections with a Known or Proposed Function.

Site	Collection Type	Length (m)	Height-Width (m)	Size of Mesh (cm per side)	Cordage Diam. (mm)	Material	Stakes	Proposed Function
1	Arch.	50–65	<0.806[a]	5.5–7.0[b]	0.70–4.10	Juniper	31.5 (broken), 45.2 (complete), sharpened and notched	
2	Arch.	NR	NR	NR	1.82	NR	None	Small animals
3	Arch.	NR	NR	5.5–6.4	1.3–2.1	NR	None	Long net fragment; rabbit or waterfowl
3	Arch.	18	1.1	4.5–6.0	1.32–1.80	NR	None	Long net; rabbit or waterfowl
4	Arch.	42.7	1.2	4.0–5.0	NR	Sagebrush	Two 46 cm sticks	Small game
5	Arch.	NR	NR	3.2–6.4	NR	NR	None	Small game
6	Arch.	73.2	1.1	6.35	2.38	*Apocynum*, human hair	None	Rabbits
7	Arch.	73	1.1	6.3	NR	*Apocynum*	None	Rabbits
8	Arch.	50.4	1.1	6.5	2–3 mm	Human hair, yucca	27 notched and sharpened sticks	Rabbits?
9	Arch.	NA	Unknown	6.35	NR	*Apocynum*, human hair	None	Rabbits?
10	Arch.	NA	Unknown	6.35	NR	Yucca, human hair	None	Rabbits
11	Arch.	5.49	Unknown	5.08			5 sharpened and notched sticks	Rabbits
12	Ethno.	137–183	0.76	5.1	NR	NR	None	Rabbits
13	Ethno.	NR	NR	7.6	NR	NR	None	Rabbits
14	Ethno.	40–60	0.6	"size of rabbit's head"	NR	*Apocynum*?	None	Rabbits
15	Ethno.	NR	1.2	NR	NR	NR	None	Rabbits
16	Ethno.	3.1–182.9	NR	NR	NR	NR	None	Rabbits
17	Ethno.	13.7–182.9	2.1	"large"	NR	*Apocynum*	None	Deer
18	Ethno.	15–60	2–3	NR	NR	*Apocynum*	None	Deer
19	Ethno.	37.8	1.2	6.35	NR	*Apocynum*	Notched stakes	Rabbits
20	Ethno.	91.44	0.825	4.7–5.1	1.0–1.2	NR	None	Long net fragment; rabbits

Table 2. Continued.

Site	Collection Type	Length (m)	Height-Width (m)	Size of Mesh (cm per side)	Cordage Diam. (mm)	Material	Stakes	Proposed Function
21	Ethno.	18.3	9.1–1.2	NR	NR	*Asclepias*	None	Rabbits
22	Ethno.	91.4	0.46–0.61	7.62	NR		None	Rabbits

[a]Calculated from folded net dimensions as reported in Frison and colleagues (1986).
[b]Measurement based on photos, not as reported in Frison and colleagues (1986).
1. Sheep Mountain, Park County, WY (Frison et al. 1986)
2. Hinds Cave, Val Verde County, TX (Andrews and Adovasio 1980)
3. Chewaucan Cave, OR (Connolly et al. 2017)
4. Hogup Cave, UT (Adovasio et al. 2009; Aikens 1970)
5. Etna Cave, NV (Adovasio et al. 2009; Wheeler 1973:22)
6. White Dog Cave, AZ (Adovasio et al. 2009; Guernsey and Kidder 1921:77)
7. Kayenta Cave, AZ (Anell 1969:47)
8. Cave Creek, AZ (Kaemlein 1971:39–42)
9. Cave 10, AZ (Guernsey and Kidder 1921:106)
10. High Cave, AZ (Guernsey 1931:79)
11. Brooks Cave, TX (Jackson 1937:88)
12. Deep Creek Gosiute (Adovasio et al. 2009; Egan 1917:235–237)
13. Washo (Adovasio et al. 2009; Kroeber 1925:572)
14. Surprise Valley Paiute (Adovasio et al. 2009; Kelly 1932:88) and Little Lake and Koso Mountain Shoshone (Adovasio et al. 2009; Steward 1938:82)
15. Washo (Adovasio et al. 2009; Lowie 1939:327); Lemhi Shoshone, Fort Hall Shoshone, and Bannock Northern Paiute (Adovasio et al. 2009; Steward 1943:267)
16. Small Creek Shoshone, Battle Mountain Shoshone, and Mill City Northern Paiute (Adovasio et al. 2009; Steward 1941:329)
17. Thompson River Indians (Teit 1900:245–248)
18. Salishan Indians (Teit 1930:246)
19. Paiute net at Peabody Museum (Guernsey and Kidder 1921:78)
20. Wasson net (Connolly et al. 2017)
21. Walapai (Kniffen et al. 1935:63)
22. Washo (Kroeber 1925:572)

suggests a stronger dependence on small mammal exploitation than on large game, at least seasonally (Stuckenrath and Mielke 1972; Walker 1988, 2007).

Mummy Cave, in the Absaroka Mountains, had rabbit remains in all levels (Harris 2002; Hughes 2003; Husted and Edgar 2002). Three excavated sites in the Green River and Big Horn Basins had bone counts suggesting communal rabbit hunting: the Dick Myal housepit site, 48FR6256, with a minimum of 26 jackrabbits (Rood 2018); the Raptor site, with a minimum of 60–69 cottontails (Lubinski 2003); and Rabbit Bone Cave, with 44 cottontails and four jackrabbits (Stuckenrath and Mielke 1972; Walker 1988). A fourth probable communal rabbit hunting site contained 51 jackrabbit tibiae (Frison 1991:264; Kornfeld et al. 2010:335–336).

Except for Mummy Cave, these studies refer to lower-elevation sites and consequently cannot be directly applied to the higher-elevation Sheep Mountain area; however, they show that rabbits made up a significant proportion of animals hunted throughout the precontact history of the region (Frison 1991:263–265; Kornfeld et al. 2010:335–337; Lubinski 2003). Deer and mountain sheep are relatively rare in these basin sites, with deer occurring about twice as frequently as mountain sheep. Several Late Prehistoric sites at higher elevations in the Absaroka Mountains indicate greater dependence on mountain sheep, including 48PA853 and 48PA919 (Eakin 1989; Eakin and Eckerle 2012). Mummy Cave contained high proportions of mountain sheep in levels 30 and 36, the latter corresponding in age to the Sheep Mountain net (Harris 2002:166; Husted and Edgar 2002:168–170). Remains recovered from these and other sites suggest that mountain sheep were relatively abundant at the time the Sheep Mountain net was in use. Although the Sheep Mountain net was found outside of jackrabbit habitat, it could either have been used at a lower elevation, or it could have been used for cottontails—which are common in faunal assemblages from the area—or both. Nets can be, and were, used in basins and higher elevations for rabbits, regardless of species.

None of these observations would preclude the use of the Sheep Mountain net for other small animals, such as sage grouse (*Centrocercus urophasianus*), which also occurs in archaeological assemblages from the area (Fenner 2007; Husted and Edgar 2002:167–170; Kornfeld et al. 2010:338–340; Lubinsky 2000:182–183; McKibbin 2000:159–160). Shoshone groups in Nevada employed a rabbit net to take sage grouse (Steward 1941:222).

Discussion and Conclusions

Overall, reanalysis of the net's age is a cautionary tale about relying on a single, anomalous radiocarbon date. Because of the proposed Paleoindian age and the uniqueness of an animal trapping net from that time, the occurrence has been referenced many times (for example, Connolly et al. 2017:143; Driskell and Walker 2007:230; Fiedel 2007:30; Frison 1988:88, 1992:35; Frison et al. 1990:208; Hughes 2003:73–74; Kauffman et al. 2018:37; Kornfeld 2007:53; Kornfeld and Larson 2008:25; Kornfeld et al. 2010:312–313, 349; Lupo and Schmitt 2002:160–161; Sundstrom 2004:51; Walker 1988:6.08.3; Whitley 2000). The four additional AMS radiocarbon dates yielded an age between 1300 and 1200 years for the netting and around 1150 cal BP for the stakes, placing the Sheep Mountain net in the Late Prehistoric period.

Based primarily on the thickness of some of the cordage, Frison and colleagues (1986) proposed that the Sheep Mountain net had been used on animals up to the size of mountain sheep or deer rather than rabbits or other small game. Although its cordage is thick in comparison with known rabbit nets from other locations, the latter are made of materials other than juniper fiber. Juniper may require (or result in) a thicker cordage. This possibility has not been explored, but it provides a reasonable alternative explanation for the thick cordage. Overall, the size, height, and form of the net argue for use for small game—probably rabbits or sage grouse.

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unpublished manuscript in the Old Trail Town files. We also appreciate Dr. James Adovasio for taking the time to discuss the history and details of the original research on the net. Dr. Jody Clauter, collections manager of the University of Wyoming Archaeological Repository, provided access to the net in 2018 to collect the first of the radiometric samples, and later, Collections Manager Dr. Marieka Arksey assisted in accessing the other three samples. Senior Academic Professional Research Scientist Dr. Rick Weathermon, Department of Anthropology, University of Wyoming, assisted in collecting the second fiber sample from the net and provided Figure 4. Michael T. Bies assisted with various aspects of the project. He and Dan Bach assisted with identification of the wood. Dr. Caroline Solazzo of the Smithsonian Institution advised on the item's potential to contain usable animal proteins and DNA. Last, but not least, we would like to acknowledge the late Dr. George Frison and his longtime commitment to understanding the prehistory of Wyoming.

Data Availability Statement. All original data used in this study are presented in the text.

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