PREHISTORIC FISHING IN WYOMING

By Amy Phillips

University of Wyoming Honors Thesis

Abstract. Recorded history of human habitation in Wyoming dates back about 13,000 years. Wyoming prehistory is characterized by changes in subsistence practices as marked by changes in material culture, such as projectile points. Such changes in material culture reflect temporally corresponding changes in subsistence practices and create a chronology for Wyoming's inhabitants prior to the arrival of European peoples. Despite the notable emphasis commonly placed on subsistence in archeological thought thereabout, little research on prehistoric fishing within the archaeological record in Wyoming has been conducted. A search of the University of Wyoming Archaeological Repository database yielded 340 fish bones and 83 net weights from excavated sites throughout the state. These come from a total of 10 sites. While other sites with fish bones are documented in the state, these could not be confirmed on a bone-by-bone basis as fish and were not included. Most fish bones date to the Late Prehistoric era. The influences of fish bone preservation, climate change, and caloric return rates were used to interpret this bias. Different fish bones preserve better in either acidic or alkaline soils. Comparative preservation rates of head and vertebral bone fragments versus rib bones from sites throughout Wyoming suggest that the bones were being consumed. The Medieval Warming Period during the Late Prehistoric likely caused a migration of people and animal to higher altitudes. The decrease in large, grazing animals during this time rendered fish, difficult to obtain, but imbued with high caloric return rates, an advantageous form of subsistence as per the diet breadth model (DBM).

Background

Archaeological research into prehistoric subsistence practices in Wyoming focuses on large game and plants. Though fish bones have been found at sites within the state, inquiry into the role of fish in subsistence practices is notably missing (Lubinski 1996, 2000) despite a high potential caloric return rate (Lindstrom 1996). In a collection-based survey, fish bones from sites throughout Wyoming were compiled into a database. The majority of bones, 89.4%, were dated to the Late Prehistoric. This trend could be the result of the Medieval Warming Period which caused a population decrease of large, grazing herds, forcing prehistoric peoples to exploit other avenues of subsistence.

Humans have inhabited Wyoming for roughly 13,000 years. Until the arrival of Europeans, all those who lived in Wyoming lived by hunting and gathering. This is not to say that nothing ever changed. In fact, archaeologists divide Wyoming's prehistory into time periods based primarily on changes in subsistence and material culture (Table 1). The first inhabitants, known as Paleoindians, hunted megafauna such as the mammoth. With the extinction of megafauna, subsistence practices changed. During the Early Archaic, hunters shifted from megafauna to smaller—but still large—game such as bison, deer, antelope, and elk. Some plant foods were also incorporated into the diet, with gathered foods becoming more common in the Middle and Late Archaic periods. Pithouse villages became prevalent in southwest Wyoming during the former. These villages suggest a decline in nomadism, but the subsistence data still point to a hunting and gathering diet, with plant foods becoming more important. The Late Archaic saw a return to a more nomadic lifeway which continued during the Late Prehistoric, when the bow and arrow emerged as a new technology. The Protohistoric era was a transition period between the Late Prehistoric and Historic eras during which Native Americans had access to European trade goods, but the Europeans themselves were still east of the Mississippi River. During the Historic era, European emigrants restricted Native American movement to reservations and discouraged the continued practice of their traditions, including a nomadic hunting and gathering lifeway.

Archaeologists in Wyoming have focused on game and plant foods, as evidenced by the discussion of Wyoming's chronology based on those foods, but there is a third category: fish. This paper seeks to determine when fishing was practiced within the state of Wyoming prehistorically and relate the results to fish habitat, climate change, and nutritional values.

Landscape of Wyoming

Fish require water. Although one of the scarcest resources in the state (Metcalf 1987), water throughout Wyoming provided homes for fish and a potential source of food for prehistoric hunter-gatherers. Wyoming can be divided into six river basins: the Snake, Wind/Bighorn, Green, Bear, North Platte, and Northeast River basins (Wyoming State Geologic Survey 2018). Today, "Fishing success is generally high and Wyoming has been called a fisherman's paradise" (Wyoming Information 2018). However, archaeological reports rarely mention fishing. Modern fishing success could be misleading given that both brown and rainbow trout, some of the most widespread fish in Wyoming, are invasive species. Despite the technological investment needed to harvest fish, which can be quite high, fish yield a high caloric return (Lindstrom 1996). If the rivers were healthy in prehistoric times, one would expect to see some evidence of prehistoric fishing.

Archaeological Evidence for Fishing

Archaeological remains collected from public land must be sent to a repository within the state in which they were collected for storage (University of Wyoming Archaeological

Repository 2013). The University of Wyoming Archaeological Repository (UWAR) is the only current federal repository within the state; it holds more than 3 million artifacts. Western Wyoming Community College also maintains their own storage facility for projects conducted by their faculty and students. A search of the UWAR database for entries related to fishing used the following terms: fish bones, net weights, nets, and hooks. There were no fishing nets and all fish hooks in the database were historic, putting them outside of the scope of research. Only fish bones and net weights were prehistoric.

In the UWAR database there were only 340 fish bones documented in the state of Wyoming. To put that in context, there were 87,856 catalogue numbers coded as bone in the UWAR database. Individual catalogue numbers could have multiple bones listed under them. So, while there were 9,761 catalogue numbers coded as bison bones, that figure represented more than 9,761 individuals.

The 340 fish bones came from nine sites. According to site reports and publications (Lubinski 2000), there are nine sites with fish bones in the Green River Basin alone. Two of those sites have been confirmed and were in the UWAR database while the remaining seven sites said to contain fish bones were unconfirmed. Pescadero Site (48LN2068) was included in the site profile database because of the high number of fish bones reported there, though it was not confirmed bone-by-bone. The rest of the sites were not included in the bone database because they were not housed at the University of Wyoming Archaeological Repository and therefore could not be confirmed as fish bones.

Fishing is also indicated by particular pieces of technology. This could include fish hooks and nets, but those are rarely preserved. Instead, the primary evidence of fishing comes from notched stones interpreted as net weights (McKibbin 1995). Net weights are pebbles, usually fist-sized, with working along the edges; they are thought to have been used to weigh down nets. Eighteen sites were listed as having net weights (Lubinski 2000) but all were housed at Western Wyoming Community College and could not be checked. The analysis includes only sites that could be personally examined and confirmed.

Sites with Fish Bones

The average elevation of sites with fish bones was 1,744 meters (5,722 feet) and these sites were an average of 320 meters (1,049 feet) from water sources known to be present year-round. Soil deposition is dominantly alluvial, i.e., sediment deposited by water in some way. Sites were spread throughout the state of Wyoming (Figure 1). Due to the small sample size of only ten sites, running statistical tests was not feasible.

Wyoming's Game and Fish listed forty-nine species of fish native to the state (Wyoming Game and Fish 2018). Of the nine total sites used, only 48SW6454, Pescadero, and 48BH499 had fish identified by species. These included the Salmonidae, Cyprinidae, and Catostomidae families (McKibbin1995; Walker 2007). 48BH499, the Medicine Lodge Creek site, contained a large concentration of small fish bones in a level considered to be 8,500 years old (Walker 2007).

The majority of fish bones, 89.4% (143 of 160), came from sites, or levels in sites that date to the Late Prehistoric, 1800 to 300 years before present (BP). One bone came from the Late Archaic and the remaining sixteen were classified as Prehistoric Unknown. This could mean that fish were used more intensively in the Late Prehistoric period, or it could mean that earlier fish bones have not been recovered because they completely decomposed.

Fish Bone Preservation

The composition of the fish bones in the sample is as follows: 57.7% of fish bones were vertebral, 23.4% were unidentified elements, and 11.7% were rib bones (Figure 2). The distribution of fish bones seen in Figure 2 is not unexpected given that, along with cranial elements, vertebral bones are one of the densest bones in a fish and therefore most likely to survive (Sutton et al. 2010). The absence of cranial bones could be the result of human use. Lubinski's (1996) experiment with whitefish and soil conditions found burned and boiled fish heads tended to be destroyed faster than vertebrae in both acidic and alkaline soils. Preparation, cooking, and discard practices could further affect archaeological evidence. Bogstie (2013) suggests the preparation of fish and cultural discard methods could result in an absence of evidence of fishing. Some preparation methods leave few remains behind or increase the likelihood that the bones will decompose rapidly. These methods could have included removing fish heads before cooking, pulverizing fish bones for soups, and drying the fish (Bogstie 2013). In these cases, people would have consumed the bones and, having been digested, bones would have been even more prone to decomposition as well as deposition off-site, where archaeologists are not likely to find them (Jones 1986). Other cultural practices can remove fish bones from sites. The story "Why the Salmon Come to the Squamish Waters" details a ritual in which salmon bones are thrown back into the stream in order to ensure more fish to catch in the future (Native Online 2013). While this story details a cultural Native American practice from present-day Washington, similar practices may have occurred in Wyoming. If fish were used and their remains thrown into the river, there would be no fish bones left in the archaeological record.

Another variable affecting fish bone preservation is soil quality. In "Prehistoric Fishing at Shark Bay, Western Australia," Bowdler and McGann (1996) write, "Remains of different species of fish possess differing rates of resilience to erosion both before and after interment. The survival rate thus produces its own pattern which must be taken into account when considering prehistoric assemblages." In Wyoming, well-stratified sites are rare due to the state's arid environment. This means erosion may have a significant impact on fish bone preservation. However, sites with well-preserved sediments located near fishable waters may indicate erosion is not the only variable accounting for the lack of fish bones outside the Late Prehistoric period. One example is Alm Shelter (48BH3457), located on the west side of the Bighorn Mountains about 200 m from Paint Rock Creek, a stream recognized by anglers as an excellent fishing stream. This site had excellent preservation with faunal remains preserved in sediments up to 12,000 years old. A preliminary study of the site's faunal assemblage recovered over 10,000 bones from large mammals such as bison and deer, as well as birds and small mammals. Despite the preservation, however, the rock shelter had no fish bones (Rowe 2014). The fact that the small, delicate bones of other animals were found in the site indicated that the lack of fish bones was not a product of poor preservation; despite the nearby presence of the stream, people likely did not fish when they occupied the rockshelter.

Recovery Bias

The increased number of fish bones during the Late Prehistoric could also be the result of recovery bias. When archaeologists excavate a site, they routinely run all sediment through screens, but that was not always the case. Today, those screens are usually 1/8" mesh, but in the past ¼" mesh was used, and at times prior to the 1970s, the sediments were not screened at all. Bogstie (2012) suggests the use of screening and the size of the mesh are the most important variables in recovering fish bones, with screens of 1 mm being ideal (Bogstie 2012). None of the sites included in the sample used a ¼" mesh. At Pescadero, fish bones were retrieved while in-situ, through the screen, and hand-picked from sediment samples (this is known as "matrix-picking") (McKibbin 1996). No other sites mention picking site matrix. Recovery procedures could be a possible explanation for the bias in fish bones toward the Late Prehistoric: if more

Late Prehistoric sites were excavated with smaller mesh, then that excavation strategy would increase the chances of collecting fish bones from those sites. However, this seems unlikely. Although only anecdotal, we can point again to Alm Shelter, whose sediments were all screened through 1/8” mesh.

Since almost ninety percent of fish bones recovered date to the Late Prehistoric, it could be that preservation both before and after the Late Prehistoric decreases significantly or that people were not using fish as a resource. One thing to keep in mind is that, “A case of negative evidence does not necessarily mean that fish were underutilized” (Bogstie 2012). Bogstie studied the disparity between ethnographic and archaeological data for prehistoric fishing along the Snake River in Idaho. Fishing was a large part of subsistence among the Northern Shoshone and Bannock according to ethnographic accounts, but the lack of archaeological evidence, i.e., fish remains, could suggest prehistoric peoples living along the Snake River were not exploiting anadromous fish (Bogstie 2012). Preservation alone does not seem to account for the lack of fish remains because of sites like Alm Shelter, sites that are ideally positioned for fishing and have a long stratigraphic record with excellent preservation.

Nutritional Value of Exploiting Fish

Prehistoric fish procurement methods include fishing with nets, spears, and weirs. Fishing with spears was usually employed when fish were large and preferred shallow water (Jones et al. 2016). The three species of fish identified in Wyoming archaeological contexts do not spend significant amounts of time in shallow water except during the spawn. This limits the use of a spear to a very small window of time with low yield (i.e., one fish at a time) suggesting that it was unlikely the spear was used in Wyoming. In any case, spear fishing would be hard to demonstrate since the technology for it—a wooden spear—would not preserve except in extraordinary circumstances. Net fishing is an alternative, especially for smaller fish that are difficult to spear. Nets are even less likely than spears to preserve (Powell 1995), but net-fishing usually entailed the use of stone net weights that would, of course, preserve. The presence of net weights throughout Wyoming sites suggests that fishing with nets might have been the preferred technique.

Lindstrom (1996) modeled caloric return rates of fish native to the Truckee River Basin, of California and Nevada. While Lindstrom uses the caloric returns from Lahontan cutthroat trout, a subspecies of cutthroat was also found in Wyoming during the Late Prehistoric. As these belong to the same species, return rates should be comparable. She also reports caloric return rates from the mountain sucker, found in Wyoming at sites such as Pescadero. According to Lindstrom, a large Lahontan cutthroat trout fillet from net capture during spawn has a caloric return rate of 26,112-64,995 kcals/hr while fresh. A medium white fish during the same conditions has a return rate of 18,292- 23,134 kcals/hr fresh (Linstrom 1996). For comparison, a deer has a caloric return rate of 17,971- 31,450 cal/hr while an individual antelope has a caloric return rate of 15,725- 31,450 kcal/hr (Kelly 2013). Fish captured in bulk, such as when using a net, display a higher maximum caloric return rate than an individual deer or antelope. So why is there so little evidence for prehistoric fishing? One explanation comes from the diet-breadth model (DBM).

Kelly (2013) describes the DBM in some detail. Without going into mathematical detail, the DBM predicts whether a forager will harvest a resource after encountering it while out foraging. The DBM assumes that a forager will exploit the suite of resources that provide the best overall return rate. The overall return rate considers both the search and handling costs, that is, how long it takes to find a resource and, once found, to obtain it and convert it into edible food. Researchers have discovered that hunter-gatherers added food resources in terms of the resource's post-encounter return rates, a product of how much caloric energy a resource provides relative to the time it takes to harvest and process it. The return rates given above for cutthroat trout, for example, are post-encounter return rates. Hunter-gatherers always exploited the highest ranked resources (those with the highest post-encounter return rates), adding resources of lower post-encounter return rates as those high-ranked resources become rare (due, e.g., to depletion due to growth in the human population size, or climatically-induced changes in resource abundance). Note that if a high-ranked resource was *not* exploited, there could have been some other reason such as a culturally-imposed taboo (Kelly 2013), or some element of the resource that a culture considered distasteful. For example, the Apache avoided fish because of their scales (Lubinski 2000).

Technology factors in to the diet-breadth model as well. The more complex the technology, the greater the upfront manufacture cost and maintenance cost (Kelly 2013). The decision to use a more complex technology, such as nets or traps, depends on the resource being pursued. Resources that are difficult to exploit, that must be mass-harvested, or that are less temporally predictable require more complex technology in order to maximize return rates (Kelly 2013). If the technology needed to exploit a resource has a high cost associated with it, the resource must have a high return rate and be the only resource of its rank. Fish are both difficult to exploit and less temporally predictable than grazing, herd animals. For hunter-gatherers to have taken advantage of the potentially high caloric return rate fish offer, they must have invested in complex technology. This entails a trade-off: time spent in making complex tools is time not spent in the food quest. This trade-off could have been more beneficial at some times than at others. One possible variable that could help determine when the trade-off was beneficial is climate.

Climate Change During the Late Prehistoric

The Late Prehistoric period witnessed a climatic interval known as the Medieval Warming Period. This was a time of a more arid climate (warmer temperatures and decreased precipitation) from about AD 800-1350. This was similar to another warming period known as the Altithermal which occurred roughly 6,000 years earlier. Radiocarbon dates from the Altithermal indicate that human populations declined in places and relocated in response to changing conditions (Creasman 1987). Frison (2007:195) expands on this idea:

> "We believe there is sufficient evidence to indicate that, after Late Paleoindian times, at about 8,000 years ago, ecological conditions in the Big Horn Basin deteriorated so seriously that there was no longer enough food to support large bison herds. Human populations were forced into more 'Archaic' lifeways with a greater emphasis on the economic products, both floral and faunal, found in the foothills, the mountains, and along streams in the interior basin. These conditions apparently persisted until about 5,000 years ago."

Although much shorter than the Altithermal period, the Medieval Warming may have produced similar effects. These might have been more pronounced than during the Altithermal, when the human population size was still small and could be accommodated by movement into new territory. The human population reached a peak in Wyoming at about AD 1000 (Zahid et al. 2016), increasing competition for food resources. A climatic warming would have increased competitive pressure. The arid environment would have also decreased the size of grazing animal herds, causing a broadening of the diet, according to the DBM, that Creasman (1987) suggests manifests in increased reliance on plants. This broadening of the diet could also have resulted in the increased use of fish, with netting technology that was now worth the cost of manufacture and maintenance.

Another factor may have been at work as well. Zahid and colleagues (2016) suggest the human population in Colorado and Wyoming decreased from its peak during the Medieval Warming Period. This could be partially the result of a decrease in available food sources as both humans and other species moved to higher elevations.

Salmonids, such as cutthroat trout, respond to warmer temperatures with mass movement to locations where the environment is ideal, such as moving up in elevation to cooler temperatures during a warming trend (Al-Chokhancy et al. 2013). It is likely that as temperatures rose in the Medieval Warming Period, populations of both game and humans throughout Wyoming moved to higher altitudes. As large grazing herds became smaller, the groups, at peak numbers during the start of the Late Prehistoric, had to rely on other subsistence methods. Fishing offered a high caloric return rate despite the initial technological investment. If there was no large game to target, fishing would have been a logical alternative. Lubinski elaborates, “The increased use of fish suggested ethnographically is a potential response to restricted mobility as preferred resources become less available to people with a shrinking territory” (Lubinski 2000).

Results and Discussion

Fishing did occur in the state of Wyoming prehistorically. While many of the fish bones could not definitively be attributed to human use, the high percentage of vertebral fragments compared to rib and skull fragments was consistent with survival rates of both boiled and burnt bone. The majority of fish bones identified within the UWAR database date to the Late Prehistoric period. Due to a lack of evidence for fishing in any other time periods despite well-stratified sites such as Alm Shelter, it may be that fishing only occurred during the Late Prehistoric period in specific locations. The Medieval Warming Period offers a potential explanation for this. The Medieval Warming Period, like the earlier Altithermal, caused both humans and animals to move to higher altitudes. The decrease in large, grazing animals meant hunter-gatherers had to broaden their subsistence approach. Fish were also pushed to higher altitudes by the Medieval Warming Period and were a high return rate food if they were taken in mass numbers with nets, something that would require a costly initial investment in fishing technology. With smaller herds of grazing animals to exploit, hunter-gatherers of the Late Prehistoric would have had the time to make this investment. The presence of stones thought to be net weights throughout Wyoming suggests that nets were used to harvest fish. As the Medieval Warming Period ended, Wyoming's inhabitants returned to hunting the grazing animals as their populations grew, and the use of fish declined.

The actual extent of fishing within Wyoming remained unknown for a number of reasons. The first was due to coding within the UWAR database. 48BH499 was said to have the most fish bones in the entire state of Wyoming in 2007 when *Medicine Lodge Creek: Holocene Archaeology of the Eastern Big Horn Basin, Wyoming* was published by George C. Frison and Danny N. Walker, but only five bones from 48BH499 were coded as fish bones within the UWAR database. That was likely due to two causes: first, very few people can identify fish bones from the archaeological record, and second, there was no code for fish in the UWAR database until recently. Sites recorded in UWAR's database could have fish bones that went unnoticed or were listed under rodent bones. Additionally, some of the sites said to have fish bones were stored at Western Wyoming Community College. They were excluded from this project with the exception of Pescadero because they could not be confirmed as fish bones. Both

UWAR and Western Wyoming Community College only house bones that were recovered from the field. If a large screen mesh size was used, fish bones could have been under-recovered by earlier excavations.

Further research on fishing in Wyoming should incorporate both the UWAR and Western Wyoming Community College collections. It should also address why fishing may have been practiced for subsistence during the Late Prehistoric due to the Medieval Warming Period, but no similar trend exists for the Altithermal, which was a similar climatic change, and similarly resulted in the movement of people to higher elevations. While 89.4% of the bones were from the Late Prehistoric, the remaining bones were classified as Unknown Prehistoric. Radiocarbon dating is a possible avenue to determine from what period those remaining bones belong. Finally, soil acidity impacts the preservation of cooked and uncooked bones differently (Lubinski 1996). Measuring the soil acidity from each site in the future could help to determine if the fish bones have been cooked in order to rule out natural deposition.

References

Al-Chokhachy, Robert, Jay Alder, Steven Hostetler, Robert Gresswell, and Bradley Shepard

2013 Thermal Controls of Yellowstone Cutthroat Trout and Invasive Fishes Under Climate Change. *Global Change Biology* 19: 3069-3081. doi: 10.1111/gcb.12262

Baker, Todd J.

2013 Why the Salmon Came to Squamish. *Native Online*. Webpage, http://www.nativeonline.com/why_the_salmon_came_to_squamish_.htm, accessed October 3, 2018.

Bogstie, Jason P.

2012 A Question of Evidence: Assessing Absence of Evidence as Evidence of Absence within the Archaeological Record. Master's thesis, Department of Anthropology, University of Wyoming, Laramie. Proquest (ATT 1015028282).

Bowdler, Sandra, and Sally McGann

1996 Prehistoric Fishing at Shark Bay, Western Australia. In *Prehistoric Hunter-Gatherer Fishing Strategies*, edited by Mark G. Plew, pp. 84-113. Boise State University Press, Boise.

Creasman, Steven D.

1987 The Altithermal: Paleoenvironmental Reconstruction and Subsistence Change in Southwest Wyoming. In *Perspectives on Archaeological Resources Management in the Great Plains*, edited by Alan J. Osborn and Robert C. Hassler, pp. 283-297. I & O Publishing Company, Omaha.

Frison, George C.

2007 Introduction. In *Medicine Lodge Creek: Holocene Archaeology of the Eastern Big Horn Basin, Wyoming*, Vol. 1, edited by George C. Frison and Danny N. Walker, pp. 1-9. Clovis Press, Santa Fe.

Jones, Terry I., Kenneth W. Godalet, and Brian F. Codding

2016 The Archaeology of Fish and Fishing on the Central Coast of California: The Case for an Under-exploited Resource. *Journal of Anthropological Archaeology* 41:88-108.

Jones, A. K.

1986 Fish Bone Survival in the Digestive Systems of the Pig, Dog and Man: Some Experiments. In *Fish and Archaeology: Studies in Osteometry, Taphonomy, Seasonality and Fishing Methods*, Series No. 294, pp. 53–61. BAR International, Oxford.

Kelly, Robert L.

2013 *The Lifeways of Hunter-Gatherers: The Foraging Spectrum*. 2nd Ed. Cambridge University Press, New York.

Lubinski, Patrick M.

2000 Prehistoric Fishing in the Middle Rocky Mountains. *Plains Anthropologist* 45(172): 155-168.

Lubinski, Patrick M.

1996 Fish Heads, Fish Heads: An Experiment on Differential Bone Preservation in a Salmonid Fish. *Journal of Archaeological Science* 23:175-181.

Metcalf, Michael D.

1987 Contributions to the Prehistoric Chronology of the Wyoming Basin. In *Perspectives on Archaeological Resources Management*, edited by Alan J. Osborn and Robert C. Hassler, pp. 233-262. I & O Publishing Company, Omaha.

McKibbin, Anne

1995 The Pescadero Site (48LN2068) Final Report of Excavations, Lincoln County, Wyoming. Manuscript on file, Wyoming State Historic Preservation Office. Laramie, Wyoming.

Powell, Judith

1992 Fishing in the Prehistoric Aegean World. In *Ancient History Resources for Teachers*. https://search.proquest.com/docview/1293471521?pq-origsite=gscholar. Accessed October 10, 2018.

Rowe, Matthew James

2014 Late Paleoindian Rockshelter Use Through Changing Environmental Conditions in the Bighorn Basin, Wyoming: Integrated Perspectives From Zooarchaeology and Geoarchaeology. PhD Dissertation, Department of Anthropology, Indiana University, Bloomington. Proquest (ATT 1564775828).

State of Wyoming

2018 Wyoming Information. http://www.wyo.gov/about-wyoming/wyoming-information, accessed October 1, 2018.

Sutton, Mark Q., Kristin D. Sobolik, and Jill K. Gardner
2010 *Paleonutrition*. University of Arizona Press, Tuscon.

University of Wyoming Archaeological Repository

2013 The University of Wyoming Archaeological Repository Guidelines and Standards. Electronic document, http://wyoarchaeo.state.wy.us/pdf/repository_guidelines.pdf, accessed October 3, 2018.

Walker, Danny N.

2007 Vertebrate Fauna. In *Medicine Lodge Creek: Holocene Archaeology of the Eastern Big Horn Basin, Wyoming*, Vol. 1, edited by George C. Frison and Danny N. Walker, pp. 177-208. Clovis Press, Santa Fe.

Wyoming Game and Fish

2018 Native Fish Species Wyoming. https://wgfd.wyo.gov/Fishing-and-Boating/Fish-of-Wyoming/Native-Fish-Species-of-Wyoming, accessed October 1, 2018.

Wyoming State Geologic Survey

2018 Wyoming River Basin Plans. http://www.wsgs.wyo.gov/water/river-basin-plans, accessed November 23, 2018.

Wyoming State Parks

2016 Visitor Use Program Report. wyoparks.state.wy.us/index.php/learn/state-use-planning-documents, accessed October 1, 2018.

Zahid, H. Jabran, Erick Robinson, and Robert L. Kelly

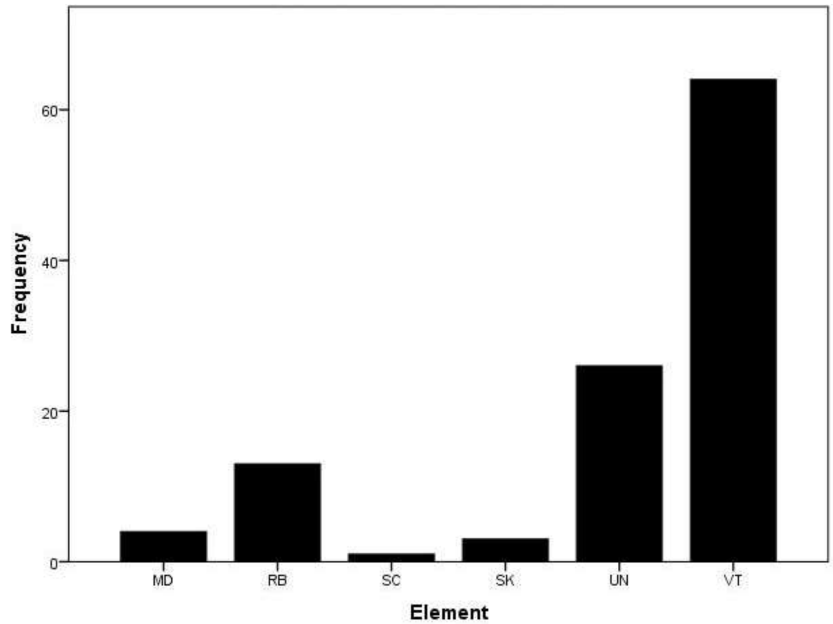
2016 Agriculture, Population Growth, and Statistical Analysis of the Radiocarbon Record. *Proceedings of the National Academy of Sciences of the United States of America* 113 (4): 931-935.

Figures

Figure 1.

Map of Wyoming displaying archaeological sites containing fish bones and net weights housed at the University of Wyoming Archaeological Repository.

Figure 2.



Count of fish bone by element including mandible (MD), ribs (RB), scale (SC), skull (SK), unknown (UN), and vertebrae (VT).

Tables

Table 1.

Wyoming Prehistory Chronology	
Time Period	**Years Before Present (BP)**
Paleoindian	13,000 – 9,000
Early Archaic	9,000 – 5,000
Middle Archaic	5,000 – 3,500
Late Archaic	3,500 – 1,800
Late Prehistoric	1,800 – 300

Appendix 1: Fishing in Wyoming by Fish Bone and Net Weights

Coding Guide

1. Site: Smithsonian Number
2. Catalogue Number (CAT #): Number assigned to the artifact by the University of Wyoming Archaeological Repository (UWAR)
3. Artifact Type (ART):
    - FS- Fish
    - NW- Net Weight
4. Number (#): Number of artifacts assigned to the catalogue number
5. Screen Size (SCREEN): Size of mesh artifact was found in if it was screened, in inches
    - 999 – Artifact was not screened
6. Time Period (TIME): The time period the artifact could be dated to based on site notes, radiocarbon dating, or diagnostic artifacts in the same sediment layer.
    - PL- Paleoindian
    - EA- Early Archaic
    - LA- Late Archaic
    - LP- Late Prehistoric
    - PH- Prehistoric Unknown
7. Element: Portion of artifact collected
    - CS- Chipped Stone
    - UN- Unknown
    - VT- Vertebrae
    - SK- Skull, portion unknown
    - MD- Mandible
    - RB- Rib
    - SC- Scale
8. Elevation (ELEV): Elevation the artifact comes from within the site based on site notes. Used to achieve an approximate date of the fish bone or net weight based on diagnostic artifacts in the same level.
9. Feature (FEAT): If the artifact was found within a feature, what number was the feature assigned? Used for determining an approximate date.
    - 999 – Artifact was not found within a feature
10. Burned (BURN): Was there any evidence of burning on the artifact?
    - A- Absent
    - P- Present

Appendix 2: Fishing in Wyoming by Fish Bone and Net Weights Database

Site	CAT #	#	ART	SCREEN	TIME	ELEMENT	ELEV	FEAT	BURN
48SW6454	1268	1	FS	999	LP	VT	99.50-99.40	999	A
48SW6454	1281	4	FS	999	LP	VT	99.50-99.42	999	A
48SW6454	1283	1	FS	999	LP	VT	99.50-99.42	999	A
48SW6454	1288	7	FS	999	LP	VT	99.90-99.80	999	A
48SW6454	1293	3	FS	999	LP	VT	99.90-99.80	999	A
48SW6454	1298	1	FS	999	LP	VT	99.90-99.80	999	A
48SW6454	1303	1	FS	999	LP	VT	99.90-99.80	999	A
48SW6454	1306	1	FS	999	LP	UN	99.90-99.80	999	A
48SW6454	1311	2	FS	999	LP	VT	99.90-99.80	999	A
48SW6454	1315	1	FS	999	LP	VT	99.90-99.80	999	A
48SW6454	1324	1	FS	999	LP	VT	99.70-99.60	999	A
48SW6454	1327	1	FS	999	LP	UN	99.70-99.60	999	A
48SW6454	1328	7	FS	999	LP	UN	99.70-99.60	999	A
48SW6454	1330	1	FS	999	LP	VT	99.80-99.70	999	A
48SW6454	1333	3	FS	999	LP	VT	99.80-99.70	999	A
48SW6454	1336	3	FS	999	LP	VT	99.80-99.70	999	A
48SW6454	1338	3	FS	999	LP	VT	99.60-99.50	999	A
48SW6454	1344	2	FS	999	LP	UN	99.80-99.60	999	A
48SW6454	1347	4	FS	999	LP	VT	99.80-99.60	999	A
48SW6454	1355	4	FS	999	LP	VT	99.70-99.60	999	A
48SW6454	1358	3	FS	999	LP	VT	99.60-99.50	999	A
48SW6454	1362	2	FS	999	LP	VT	99.50-99.40	999	A
48SW6454	1365	6	FS	999	LP	VT	99.80-99.70	999	A
48SW6454	1369	1	FS	999	LP	MD	99.80-99.70	999	A
48SW6454	1370	6	FS	999	LP	VT	99.80-99.70	999	A
48SW6454	1379	3	FS	999	LP	VT	99.80-99.70	999	A
48SW6454	1382	3	FS	999	LP	UN	99.80-99.70	999	A
48SW6454	1388	1	FS	999	LP	VT	99.70-99.60	999	A
48SW6454	1390	1	FS	999	LP	VT	99.70-99.60	999	A
48SW6454	1394	1	FS	999	LP	VT	99.59	999	A
48SW6454	1395	4	FS	999	LP	VT	99.59	999	A
48SW6454	1396	12	FS	999	LP	VT	99.60-99.41	999	A
48SW6454	1404	7	FS	999	LP	RB	99.60-99.41	999	A
48SW6454	1405	11	FS	999	LP	VT	99.60-99.41	999	A
48SW6454	1406	10	FS	999	LP	UN	99.60-99.41	999	A
48SW6454	1407	2	FS	999	LP	VT	99.60-99.41	999	P
48SW6454	1409	1	FS	999	LP	VT	99.65	999	A
48SW6454	1413	4	FS	999	LP	VT	99.70-99.50	999	A
48SW6454	1413	1	FS	999	LP	RB	99.70-99.50	999	A
48SW6454	1413	7	FS	999	LP	UN	99.70-99.50	999	A
48SW6454	1416	3	FS	999	LP	VT	99.70-99.60	999	A
48SW6454	1416	1	FS	999	LP	RB	99.70-99.60	999	A

48SW6454	1416	3	FS	999	LP	UN	99.70-99.60	999	A
48SW6454	1421	1	FS	999	LP	VT	99.70-99.50	999	A
48SW6454	1427	1	FS	999	LP	RB	99.70-99.60	999	A
48SW6454	1427	1	FS	999	LP	VT	99.70-99.60	999	A
48SW6454	1427	2	FS	999	LP	UN	99.70-99.60	999	A
48SW6454	1445	1	FS	999	LP	VT	99.70-99.60	999	A
48SW6454	1471	5	FS	999	LP	UN	100.04-99.90	999	A
48SW6454	1515	2	FS	999	LP	RB	99.70-99.60	999	A
48SW6454	1531	1	FS	999	LP	VT	99.80-99.70	999	A
48SW6454	1533	1	FS	999	LP	VT	99.80-99.70	999	A
48SW6454	1549	1	FS	999	LP	VT	99.50-99.40	999	A
48SW6454	1549	2	FS	999	LP	UN	99.50-99.40	999	A
48SW6454	1550	1	FS	1/16	LP	MD	99.50-99.40	999	A
48SW6454	1582	1	FS	999	LP	RB	99.80-99.70	999	A
48SW6454	1585	2	FS	999	LP	VT	99.80-99.70	999	A
48SW6454	1591	1	FS	1/16	LP	RB	99.80-99.70	999	A
48SW6454	1596	2	FS	1/16	LP	RB	99.70-99.56	999	A
48SW6454	1598	2	FS	1/16	LP	VT	99.70-99.56	999	A
48SW6454	1622	1	FS	999	LP	VT	99.70-99.60	999	A
48SW6454	1643	2	FS	999	LP	VT	99.80-99.70	999	A
48SW6454	1645	1	FS	999	LP	RB	99.80-99.70	999	A
48SW6454	1648	6	FS	999	LP	VT	99.70-99.60	999	A
48SW6454	1649	1	FS	999	LP	SK	99.70-99.60	999	A
48SW6454	1655	9	FS	999	LP	VT	999	6	A
48SW6454	1655	4	FS	999	LP	RB	999	6	A
48SW6454	1661	1	FS	999	LP	VT	999	999	A
48SW6454	1661	1	FS	999	LP	MD	999	999	A
48SW6454	1663	6	FS	999	LP	VT	999	999	P
48SW6454	1663	1	FS	999	LP	RB	999	999	A
48SW6454	1670	1	FS	999	LP	VT	999	999	A
48SU1042	277	2	FS	999	PH	UN	999	999	A
48SU1042	296	4	FS	999	PH	UN	999	999	A
48SU1042	297	7	FS	999	PH	UN	999	999	A
48CR122	2K384	1	FS	999	PH	VT	999	999	A
48TE1573	30832	1	FS	1/8	PH	VT	96.15-96.1m	999	A
48TE1573	31756	1	FS	1/8	PH	MD	96.15-96.1m	999	A
48TE1573	32163	1	FS	1/8	LA	VT	96.4-96.35m	999	A
48PL1444	33	1	FS	1/8	PH	VT	70-780cmbd	999	A
48BH499	33768	3	FS	999	PH	VT	12'2.5"bd	999	A
48BH499	33769	2	FS	999	PH	VT	11'7"bd	999	A
48PL1444	43	1	FS	1/8	PH	UN	100-110cmbd	999	A
48TE1573	5360	1	FS	1/16	PH	VT	96.3-96.25m	999	A
48CR122	62.4	1	FS	999	PH	UN	surface	999	A

48CR122	66.3	1	FS	999	PH	UN	surface	999	A
48FR2230	80	1	FS	999	PH	UN	999	Pithouse 1	A
48JO312	A540	1	FS	999	LP	UN	999	999	A
48JO312	A734	1	FS	999	LP	SK	999	999	A
48JO312	1072	11	FS	999	LP	UN	999	999	A
48SW6454	1170	1	FS	999	LP	UN	99.70-99.60	999	A
48SW6454	1178	1	FS	999	LP	SK	99.70-99.60	999	A
48SW6454	1178	39	FS	999	LP	UN	99.70-99.60	999	A
48SW6454	1178	1	FS	999	LP	RB	99.70-99.60	999	A
48SW6454	1180	1	FS	999	LP	RB	99.70-99.60	999	A
48SW6454	1180	22	FS	999	LP	UN	99.70-99.60	999	A
48SW6454	1181	4	FS	999	LP	VT	99.70-99.60	999	A
48SW6454	1181	7	FS	999	LP	UN	99.70-99.60	999	A
48SW6454	1207	3	FS	999	LP	VT	99.60-99.50	999	A
48SW6454	1210	3	FS	999	LP	VT	99.60-99.50	999	A
48SW6454	1215	3	FS	999	LP	VT	99.90-99.80	999	A
48SW6454	1226	1	FS	999	LP	UN	99.70-99.56	999	A
48SW6454	1228	3	FS	999	LP	VT	99.80-99.70	999	A
48SW6454	1231	1	FS	999	LP	VT	99.80-99.70	999	A
48SW6454	1234	2	FS	999	LP	VT	99.80-99.70	999	A
48SW6454	1242	1	FS	999	LP	VT	99.60-99.50	999	A
48SW6454	1242	3	FS	999	LP	UN	99.60-99.50	999	A
48SW6454	1259	1	FS	999	LP	VT	100.00-99.90	999	A
48SW6454	1264	2	FS	999	LP	VT	100.00-99.90	999	A
48SW6454	1266	1	FS	999	LP	VT	99.50-99.40	999	A
48CK1126	187	1	FS	999	LP	SC	97.40	999	A
48SW6454	824	1	NW	999	LP	CS	99.65	999	A
48SW6454	826	1	NW	999	LP	CS	999	999	A
48SW6454	828	1	NW	999	LP	CS	99.78	999	A
48SW6454	829	1	NW	999	LP	CS	99.62	999	A
48SW6454	830	1	NW	999	LP	CS	surface	999	A
48SW6454	831	1	NW	999	LP	CS	999	999	A
48SW6454	832	1	NW	999	LP	CS	999	999	A
48SW6454	833	1	NW	999	LP	CS	surface	999	A
48SW6454	834	1	NW	999	LP	CS	surface	999	A
48SW6454	7	1	NW	999	LP	CS	surface	999	A
48SW6454	8	1	NW	999	LP	CS	surface	999	A
48SW6454	50	1	NW	1/8	LP	CS	56	999	A
48SW6454	51	1	NW	1/8	LP	CS	surface	999	A
48SW6454	52	1	NW	1/8	LP	CS	999	999	A
48SW6454	57	1	NW	1/8	LP	CS	30-40	999	A
48SW6454	63	1	NW	1/8	LP	CS	99.60	999	A

48SW6454	64	1	NW	1/8	LP	CS	surface	999	A
48SW6454	65	1	NW	1/8	LP	CS	surface	999	A
48SW6454	704	1	NW	999	LP	CS	999	999	A
48SW6454	708	1	NW	999	LP	CS	99.62	999	A
48SW6454	797	1	NW	999	LP	CS	999	999	A
48SW6454	798	1	NW	999	LP	CS	999	999	A
48SW6454	800	1	NW	999	LP	CS	999	999	A
48SW6454	801	1	NW	999	LP	CS	99.68	999	A
48SW6454	802	1	NW	999	LP	CS	999	999	A
48SW6454	803	1	NW	999	LP	CS	999	999	A
48SW6454	804	1	NW	999	LP	CS	99.60	999	A
48SW6454	805	1	NW	999	LP	CS	99.60	999	A
48SW6454	806	1	NW	999	LP	CS	999	999	A
48SW6454	807	1	NW	999	LP	CS	999	999	A
48SW6454	808	1	NW	999	LP	CS	999	999	A
48SW6454	809	1	NW	999	LP	CS	99.82	999	A
48SW6454	810	1	NW	999	LP	CS	999	999	A
48SW6454	811	1	NW	999	LP	CS	999	999	A
48SW6454	812	1	NW	999	LP	CS	99.51	999	A
48SW6454	813	1	NW	999	LP	CS	99.69	999	A
48SW6454	817	1	NW	999	LP	CS	999	999	A
48SW6454	818	1	NW	999	LP	CS	99.78	999	A
48SW6454	820	1	NW	999	LP	CS	surface	999	A
48SW6454	821	1	NW	999	LP	CS	surface	999	A
48SW6454	822	1	NW	999	LP	CS	surface	999	A
48SW6454	823	1	NW	999	LP	CS	99.65	999	A
48SW6454	835	1	NW	999	LP	CS	surface	999	A
48SW6454	836	1	NW	999	LP	CS	surface	999	A
48SW6454	837	1	NW	999	LP	CS	surface	999	A
48SW6454	838	1	NW	999	LP	CS	surface	999	A
48SW6454	839	1	NW	999	LP	CS	surface	999	A
48SW6454	840	1	NW	999	LP	CS	surface	999	A
48SU1042	122	1	NW	999	PH	CS	99.80	999	A

Appendix 3: Site Summary
Coding Guide

1. Site: Smithsonian Number
2. Elevation: The elevation of the site, measured in meters and rounded to the nearest full number.
3. Fish Bones Number (FS#): Number of fish bones recorded at the site recorded numerically.
4. Net Weights Number (NW#): Number of net weights recorded at the site recorded numerically.
5. Site Type (TYPE):
    - CP- Camp
    - HP- Housepit
    - KL- Kill Site
    - RK- Rockshelter
6. Distance to Water (DW): Distance to water source present year-round, recorded in meters.
7. Depositional Environment (ENV): The sediment deposition of the site.
    - UN- Unknown
    - AE-Aeolian
    - AL-Alluvial
    - CL- Colluvial
    - AC- Alluvial and Colluvial
    - CR- Colluvial and Regolith
8. Time Period: Time periods the site spans based on artifacts and radiocarbon dates.
    - PL- Paleoindian
    - EA- Early Archaic
    - LA- Late Archaic
    - LP- Late Prehistoric
    - EP- Early Archaic through Late Prehistoric
    - PP- Paleoindian through Late Prehistoric
    - PE- Paleoindian through Early Archaic
    - PA- Paleoindian through Late Archaic
    - LL- Late Archaic to Late Prehistoric
    - PH- Prehistoric Unknown
9. Square Area (AREA): Square area of the site recorded in square meters.

Appendix 4: Site Summary Database

Site	Elevation	FS #	NW #	TYPE	DW	ENV	TIME	AREA
48SW6454	6205	297	47	CP	300	AE	LL	52500
48TE1573	6000	4	0	CP	20	AL	LA	34725
48CR122	6370	3	0	CP	240	AC	EP	999
48SU1042	7420	13	1	CP	150	AC	LL	8600
48BH499	4800	5	0	RK	300	AL	PP	328886
48PL1444	4760	2	0	CP	0	CR	LP	20000
48FR2230	6200	1	0	HP	2200	AE	EP	120000
48CK1126	4200	0	1	RK	100	CL	LA	60000
48JO312	4650	13	0	KL	0	UN	PH	999
48LN2068	6620	171	34	CP	200	AE	LP	3200