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CONTENTS

ARTICLES

- Reassessing the Use of Kelly's Mobility Index in Examining Late Archaic Assemblage Variability in Southern Idaho** 1
Shawn E. Roberts

- When Does Screen Efficiency Stop Being Efficient? 1/4-Inch vs. 1/8-Inch Mesh Size Experiment at 10-EL-215** 26
Jeremy W. Johnson

REPORTS

- Repatriation: Progressive Negotiation and Partnership** 35
Vicki Hall Stark
- Grizzly Bear-Related Artifacts from Caribou County, Idaho** 47
Cohen E. Croney

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ARTICLE

Reassessing the Use of Kelly's Mobility Index in Examining Late Archaic Assemblage Variability in Southern Idaho

SHAWN E. ROBERTS

Abstract

During the past two decades North American archaeologists have attempted to document levels of prehistoric aboriginal mobility. Robert Kelly has developed a fourteen-variable index for assessing mobility based upon the technological organization of chipped stone assemblages. Each variable has a binary outcome of high or low residential mobility reflecting Lewis Binford's expedient versus curated technologies. Kelly's index has been used to individually evaluate levels mobility of a number of Late Holocene age sites in southwestern Idaho. This research reanalyzes seven previously assessed sites as well as sixteen additional Late Holocene/Archaic open site assemblages along the Snake River in southern Idaho using Kelly's index of residential mobility.

A primary objective of this research is to re-evaluate the use of Kelly's index with respect to whether the inclusion of non-chipped stone materials would significantly alter the usefulness of the index. Additional variables evaluated in this research included pottery, groundstone, the presence of fire hearths, and storage features, all of which have been suggested as indicators of mobility. Following the assessment using Kelly's Mobility Index, 22 of 23 assemblages reflect high levels of residential mobility. Kendall's Tau correlations for the new variables showed that pottery and storage were significantly correlated with pottery, groundstone, the presence of fire hearths, and evidence of storage. A set of linear regression analyses assessing the relationship between assemblage size and diversity resulted in a low slope, which suggests a generalized toolkit for the sampled sites. The analysis suggests Kelly's index alone is not the most efficient means to assess mobility at the level of an individual site. Rather, the index and additional variables should be used as guidelines to assess mobility on a regional scale.

KEYWORDS: mobility, archaeology, Great Basin, Late Archaic, Kelly's Mobility Index

Introduction

Understanding the way in which prehistoric peoples moved across the Snake River Plain has been the focus of studies for over 20 years. Gould and Plew (1996, p. 78) conducted a quantitative analysis of seven Late Archaic assemblages along the Snake River in southern Idaho showing a relationship between prey species and tool types. Their analysis found that tool production was highly generalized and often consisted of expediently manufactured tools. In addition, faunal studies implied direct feeding, a strategy most often utilized by foraging groups (Gould and Plew 1996). Subsequent analyses of Late Archaic archaeological assemblages along the Snake River (Plew, Plager, Jacobs, and Willson 2006; Plew and Willson 2007, 2010, 2012; Willson and Plew 2007) have used Kelly's Mobility Index (Table 1) to assess assemblage variability and infer short-term occupational site use (Kelly 2001).

The Late Archaic is distinctive in the Great Basin for a number of reasons. Archaeologically, the Late Archaic in southwestern Idaho has been characterized by the introduction of ceramics and the bow and arrow (Plew 2008, p. 95). The common occurrence of ceramics in the region occurred approximately 1000 years ago whereas fire clay technologies have been dated to 6000 years ago. Ceramics from this period are undecorated, utilitarian vessels. The shift from atlatl to bow and arrow is generally associated with a shift toward hunting smaller prey species (Plew 2008, p. 95). This analysis would expect to see a more common occurrence of fired clay or ceramics in Late Archaic sites along the Snake River.

Faunal remains from Late Archaic sites suggest a diverse diet breadth, including "deer, antelope, mountain sheep, and numerous smaller mammals" (Plew 2008, p. 97). Many resources in the region appear to have been utilized when available and on a seasonal basis. These types of resources included salmon, bison, and camas. While these items were not necessarily primary resources, they do appear throughout the record and were likely utilized when the cost of acquiring and processing outweighed other available resources. Knowing there was a shift in prey species, instances of pottery, and technological preferences speak to a possible shift in how people moved around the landscape. Previous Snake River Plain mobility analyses have used the forager-collector continuum as a way to characterize assemblages and associate them with differing levels of mobility (Binford, 1980; Kelly, 1988, 1992).

In an effort to increase the ways in which archaeological data can be used to infer mobility, Robert Kelly's Mobility Index (2001) has been utilized in a number of southern Idaho mobility studies (Gould and Plew 1996; Plew et al. 2006; Plew and Willson 2010, 2012; Willson and Plew 2007). Kelly's Mobility Index (KMI) is a set of variables assessing the lithic component of the archaeological assemblages to infer levels of mobility; it is derived from Binford's (1980) forager-collector continuum. Variables in Kelly's (2001) index (Table 2) include items relating to flake types, bipolar knapping, prevalent raw material types, assemblage size,



Figure 1. Overview map of Idaho with study area highlighted, detail in Figure 2.

and diversity. Using experimental and ethnographic data, Kelly suggests differences in the archaeological assemblage that correspond with variance in high and low residential mobility.

Kelly's Mobility Index on the Snake River Plain has been utilized with seven Late Archaic sites to assess mobility for individual sites (Figure 2). These sites fall within an approximately 100 mile stretch of the river between Melba and King Hill, Idaho (Figure 1). The present analyses follow Kelly in examining chipped stone variables. Although useful, other artifact types have been shown to be likely indicators of mobility. These include pottery (Bright and Ugan 1999; Dean 2005; Eerkens 2003; Garvin 2011; Simms, Bright, and Ugan 1997), groundstone (Buonasera 2012; Dubreuil and Savage 2013; Hayden 1987; Wilke and Quintero 1996), presence of fire hearths (Kelly 2001; Panja 2003), and evidence of storage (Binford 1979, 1980, 1990; Panja 2003; Plew 2003).

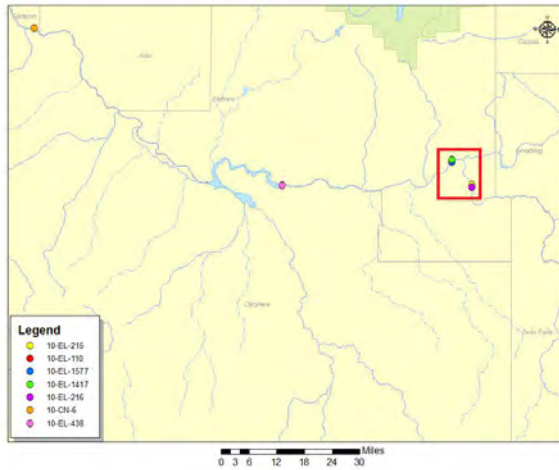


Figure 2. Locations of sites (n=7) that have previously been analyzed using Kelly's Mobility Index, detail Figure 3.

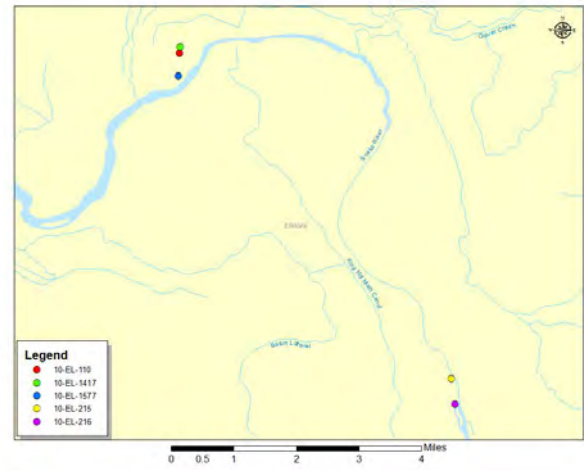


Figure 3. Detail from Figure 2. Five sites previously assessed using Kelly's Mobility Index.

Of the previously analyzed sites, 6 of 7 have been designated as having a majority of indices that suggest high residential mobility (Table 1). These sites support hypotheses by Gould and Plew (1996) that Late Holocene/Archaic faunal and artifact assemblages on the Snake River suggest a highly mobile prehistoric lifestyle. This research will increase the sample of sites assessed with Kelly's index in order to evaluate the effectiveness of KMI as a method to assess mobility. The expansion of the sample includes 23 Late Archaic open-site assemblages in the vicinity of the Snake River. The study is restricted temporally to the Late Archaic to limit the variance due to temporal differences in assemblages.

In addition, other indicators of mobility (i.e. pottery, groundstone, fire hearths, and storage features) will be examined in conjunction with KMI to assess whether the current usage of KMI is sufficient for analysis with Late Archaic site excavation archival data.

TABLE 1. Overview of KMI Correlation of Criteria According to Previous Site Reports

Sites	Informal Name	Previous KMI Correlation of Criteria	High/Low Mobility
10-EL-215	2012	10/4	High
10-EL-110	King Hill	12/2	High
10-EL-1577	Knox	2/12	Low
10-EL-1417	Swenson	10/4	High
10-EL-216		13/1	High
10-CN-6		12/2	High
10-EL-438		13/1	High

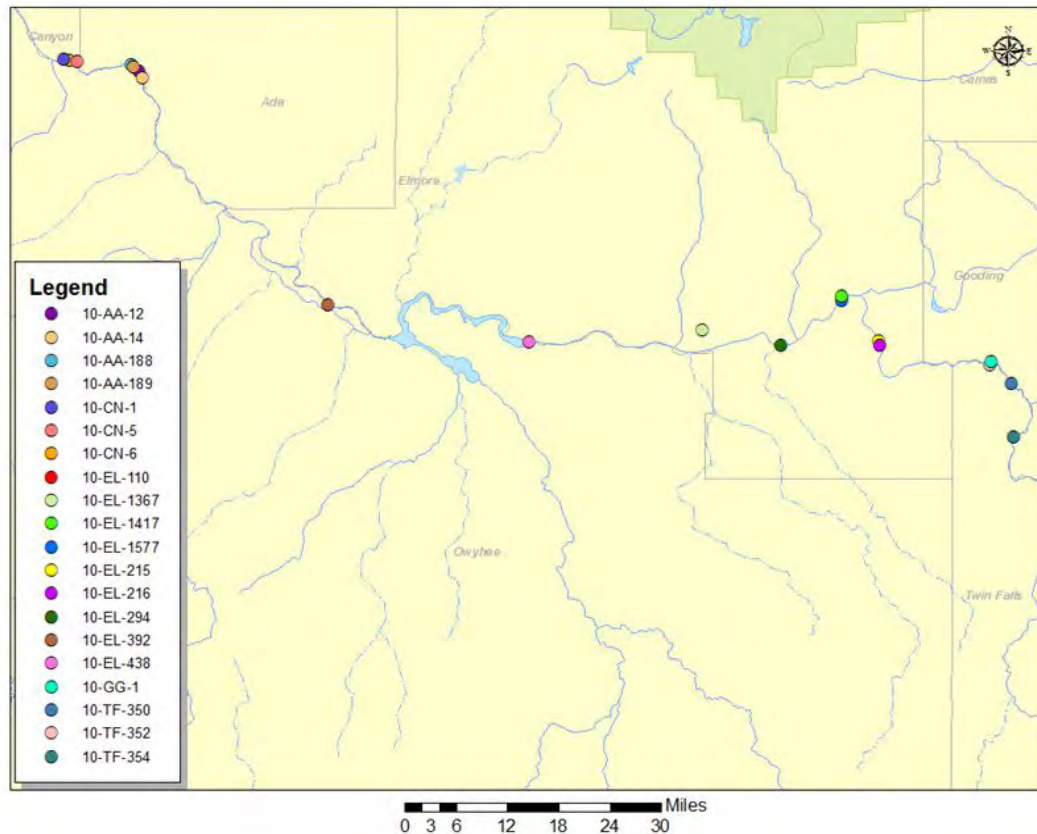


Figure 4. Location of sites used in this analysis.

With the expansion of variables and sample size, this research addresses the following research questions:

- 1) *What can frequencies of functional tool/debris types tell us about levels of mobility in Late Archaic sites on the Snake River Plain?*
- 2) *Does the addition of non-lithic variables to existing mobility indices alter designations of high or low residential mobility for sites along the Snake River, and if so, how and why?*
- 3) *What limiting factors are currently embedded in the use of chipped stone variables in mobility analyses?*
- 4) *Is the use of Kelly's Mobility Index an appropriate method for assessing the level of mobility from a single site?*

Background

The forager-collector continuum, the foundation for recent archaeological mobility studies, is a mechanism to compare material culture and the relationship to varying subsistence strategies (Andrefsky 1991; Bamforth 1991; Bettinger 1987; Binford 1980; Kelly 1983). Binford (1980) uses ethnographic information and activity area archaeology to outline what is expected in the archaeological record for foragers and collectors. A distinct foraging trait is the daily collection of food (Binford 1980, p. 5). Binford describes foragers as often using a central residential camp to return to nightly after foraging throughout the day. The archaeological remains of foragers generally fall into two categories: the *residential base* and

locations (Binford 1980, p. 5). Residential bases are generally the conglomerate of many activity areas and are often tethered to resources such as water. Locations include a wide range of short-term activities, generally the procurement, processing, or consumption of an acquired resource. Collectors are characterized by the storage of food and the organization of logistical parties for resource procurement (Binford 1980, p. 6).

Binford (1980) and Kelly (1992) discuss the formerly limiting mobile and sedentary categorizations of settlement patterns as an organic scale which groups move across based upon environmental constraints, resource abundance, and seasonal variance. The artifacts produced in both foraging and collecting strategies range from curated to expedient (Binford 1979). Curated items are those produced for a specific purpose in anticipation of a future need. They are maintained, transported, and recycled until they no longer fulfill a need (Bamforth 1986, p. 2). Expedient tools are often created opportunistically and are not intended to fulfill more than an immediate need.

With the use of functional analyses, mobility studies have begun to explore specific aspects of the archaeological assemblage and how trends in function can reflect levels of mobility. Kelly's Mobility Index (KMI) uses fourteen variables related to the chipped-stone aspect of the archaeological assemblage to assess levels of prehistoric humans' residential mobility. Each variable has a dichotomous outcome of high or low mobility based upon experimental and case study data. Kelly establishes the theory behind the Index as a reflection of expected behaviors.

A short-term residential/logistical model would produce bifaces for long-term use prior to groups entering the Carson Desert. The amount of naturally occurring toolstone is extremely limited to outskirts of the region. The available stones in the region include cryptocrystalline stone and glassy volcanics. Kelly suggests the use of quality lithic materials would be limited and a higher degree of precision would be exerted to minimize waste. This would result in more complete flakes and less angular debris. Bifaces would likely serve dual purposes as tool and source material (Kelly 2001, p. 73-74).

TABLE 2. Kelly's Mobility Index (2001) is a Tool to Compare Components of the Archaeological Assemblage to Expectations of Varying Mobility Patterns

Kelly's Mobility Index (2001)		
	High Residential/ Logistical Mobility	Low Residential Mobility or Sedentism
Lithic Raw Material	Cryptocrystalline	Siltstone, Tuff, Rhyolite
Evidence of bifaces as Cores	Common	Rare
Evidence of bifaces as by products	Rare	Common
Bipolar knapping/scavenging	Rare	Common
Flake Tools	Rare to Medium	Common
Fire-cracked Rock	Rare	Common
Site size/density	Small/low	Large/high
Tool/debitage ratio	High	Low
Biface/ flake tool ratio	High	Low
Compete flakes	Rare	Common
Distal Flake Fragments	Common	Rare
Proximal Flake Fragment	Common	Rare
Angular debris	Rare	Common
Assemblage size/diversity	Low slope	High slope

For a long-term residential model, Kelly suggests that as material shortages occur more often in an environment without readily available toolstone, bipolar reduction of exhausted cores or fragments would increasingly occur. Bipolar manufacture would become more common with extension of occupation, especially when groups stay in an area longer than anticipated. However, bipolar flaking would be less prevalent in sites where the acquisition of toolstone coincides with other activities. Kelly assumes there should be sufficient evidence of bifacial tool manufacture in the study area since they were commonly used throughout the Great Basin and are known to be maintained in residential locations (Kelly 2001, p. 74).

Based upon these expectations, Kelly created an index modified from Raven and Elston (1988) for assessment of a single site's mobility. It includes thirteen variables related to the chipped stone component of an archaeological assemblage with a dichotomous outcome for high or low residential mobility.

Pottery has been discussed as an artifact which reflects a higher level of investment, often associated with collectors (Eerkens 2003; Eerkens, Neff, and Glascock 2002). Eerkens (2003) studied the presence and densities of pottery in lower-elevations of the southwestern Great Basin. His analyses suggested that the use of fired clay technologies was not necessarily limited by residential mobility. Although the presence of pottery was not limited to sites associated with lower levels of mobility, he did note the comparative investment, or quality of the pottery, was notably discernible in foraging versus collecting associated sites (Eerkens 2003).

Simms, Bright, and Ugan (1997) provided an analysis of variation in ceramics for the Great Basin. The stylistic characteristics, as a proxy for investment, were used to infer levels of residential mobility. Pottery in the Great Basin is generally utilitarian. There is little evidence of decoration aside from the occasional incised or painted sherd. Simm's (et al.) argument is an economic hypothesis connecting the level of investment with the return rate from pottery identified as stylistically distinct. They suggest that as the use-life and utility of a pot increases, the more apt it is connected to a strategy of lower residential mobility or sites with multiple occupations. In their study, each sherd was examined for temper particle size and sherd thickness. Temper particle size is relevant as the "finer temper increases resistance to crack initiation as a result of thermal and mechanical stress. It also permits the production of vessels with thinner walls, which not only reduces weight but also increases thermal conductivity and thermal shock resistance" (Simms et al. 1997, p. 783).

Theoretically, thinner walls increase the heating efficiency, lower the weight, and increase heat conductivity. As the thickness of the sherd decreases, the implied investment increases. Therefore, thinner walls would suggest lower levels of mobility. The case study involved the examination of 5,345 sherds from 40 archaeological sites throughout the Great Basin. After examining 120 samples for variation in temper and clay composition, their research supported their hypothesis that "greater investment in the quality of ceramic manufacture with increasing residential stability, occupational redundancy, implying caching of ceramics with long use-life and/or the presence of a logistic system moving high quality ceramics to short-term camps" (Simms et al. 1997, p. 789). Bright and Ugan (1999) found a similar conclusion in their assessment of Great Salt Lake pottery. Their research suggested that pottery that indicated the highest degrees of investment was found in areas with the lowest seasonal variability in resources. Areas with higher degrees of resource seasonality had less prevalent occurrence of pottery.

Ceramics in the region studied by Simms et al. (1997) are rarely decorated and often differ simply in vessel shape and thickness. Simms et al. (1997) discussed the usage of X-ray Fluorescence (XRF) analysis to identify pottery made in differing regions when stylistic characteristics are not viable. They examined an admittedly small sample of typologically distinct pieces—specifically Snake Valley Red-on-Buff, which is thought to be exotic to the

area—and found that samples from the area had markedly similar chemical composition to sherds common in the Great Salt Lake area. This suggests the Snake Valley Red-on-Buff variation is not necessarily exotic to the area but could represent local variation in technique rather than different culture groups.

Pottery recovered on the Snake River is most often undecorated greyware and other than in variation in thickness, form, and mineralogy, sherds are not usually distinctive stylistically. Dean (2005) addresses the use of pottery variation and residential mobility in a case study conducted in Idaho. The study focused on residential mobility determined from surface sites by first categorizing sites by environmental classes. The pottery was split into thick and thin categories and correlated with the environmental classes. Dean found no specific correlation between either thick or thin pottery with specific environmental conditions. Rather, the research concluded that lower degrees of residential mobility are identifiable by the presence or absence of both thick and thin pottery sherds (Dean 2005, p.27).

One important caveat relating to the use of pottery is extreme variation in sherd size. Often, pieces as small as one square centimeter are recovered during excavation and catalogued. This speaks to the problem of using pottery sherd counts as comparable data, one sherd could be half of a pot and recorded as a single artifact, or it could be a tiny fragment. This is a limitation to note but does not deter us from comparing the absence and presence of pottery in archaeological sites.

Groundstone is an artifact with potential as a mobility indicator. Much like pottery, it exhibits variation in its occurrence among archaeological sites. It occurs in sites that have been designated as both short- and long-term use sites. Groundstone modification is often associated with sedentism or tethered mobility due to its general lack of portability, but a growing body of literature demonstrates the potential for hunter-gatherers to modify and increase the utility of groundstone in limited amounts of time (Buonasera 2012; Dubreuil and Savage 2013; Hayden 1987; Wilke and Quintero 1996).

The Great Basin provides insight into the complexity of groundstone as an indicator of site investment. A discussion of this is seen in the analysis of site 10-EL-215 (Plew and Willson 2012). This site has been categorized as reflecting high residential mobility and producing considerable amounts of groundstone. This instance may point to the use of groundstone as site furniture—items left behind and revisited over extended time periods (Binford 1979). There is debate as to whether these artifacts were produced over a period of time with repeated visits, or if their production is less intensive than previously suggested (Buonasera 2012; Dubreuil and Savage 2013).

Fire hearths also have potential as indicators of residential mobility. Fire-cracked rock is uniquely identifiable as an indicator of human processing and occurring when cobbles are heated and rapidly cooled when submerged in water. This action cools the cobbles and heats the water, often resulting in macro- and micro- cracked rock. These fire-cracked rocks are used to identify fire hearths in archaeological settings. Kelly's Index includes a "fire-cracked rock" category, whereas in highly mobile settings it is deemed "rare" (2001, p.73). While not impossible for a highly mobile individual to produce a fire, the expectation is such activities would be conducted in the central residential location, not on logistical forays. This connects with another issue in identifying fire hearths that are less formally distinguishable. Often fires are created with little to no formal change in the physical landscape (i.e., they do not rock-line an area or dig out a pit). This leads to less formidable archaeological evidence, often only identifiable in the distinguishable color differences seen in the profile of an excavated unit wall.

Thoms (2008) outlines the relationship between fire-cracked rock and increased nutritional return rates for various roots. Several types of fire hearths and earth ovens exist, with the common trait of fire-heated rocks lining a pit where food is processed. Thoms (2008)

found that the remnants of these fire pits or ovens were often just fire-cracked, rock-lined pits. These pits were found at sites dated thousands of years old. Thoms (2007) also illustrated the stability of fire-cracked rock in the archaeological record as an indicator of site integrity.

The location of fire hearths or fire-cracked rock in relation to other site elements can also be used as an indicator of site function. Panja (2003) discussed the relationship between structures and fire hearths, hypothesizing scenarios which would imply varying degrees of mobility. For example, large fire-pits in silos could be indicative of nondomestic or community utilized fire pits. The absence of fire pits in structures could indicate the structures were not intended for permanent occupation but rather for logistical or short-term use (Panja 2003). Given the limited number of structures on the Snake River with little to no evidence of fire hearths in the structures themselves, Panja's (2003) hypotheses would be testable using the association of fire-cracked rock with structures having varying levels of mobility.

One of the key components of identifying archaeological evidence of a collecting strategy is the discovery of caches, field camps, and repeatedly visited locations (Binford 1980). While these locale types vary in their manifestation in the archaeological record, the most common component is the presence of storage or structures. Collectors differentiate themselves from foragers by choosing to invest in technologies and strategies which involve storage of goods and tools (Binford 1980). The variability of structures has been suggested to indicate different levels of mobility with an implied inverse relationship between mobility and investment in housing (Binford 1990). Binford uses ethnographic data to correlate structure shape, roofing materials, and portability with varying degrees of mobility (Binford 1990).

On the Snake River, storage has been viewed as primarily associated with winter months (Plew 2003, p. 271). Such storage has been defined as including "food caches, storage pits, or features containing food or traces of foodstuffs, lined/unlined pits, and stone/rock features lining excavated features or delimiting them" (Plew 2003, p.272). In this study, these parameters were used to differentiate storage features from report data. Plew (2003), however, sampled 77 sites on the Snake River and found that only nine sites had evidence of storage. The nine sites are limited temporally to the Middle and Late Archaic (see also Morgan 2012).

This same study (Plew 2003) suggests that the lack of evidence for storage may be related to the nature of resources being stored and the environment of the region. One of the few examples of seasonal storage is Baker Cave III located in eastern Idaho (Plew and Sundell 2000). The remains of seventeen bison were recovered, the majority of which were adult females associated with fetal remains. This suggests a winter butchering and seasonal storage and processing of bison (Plew and Sundell 2000, p. 128).

According to Binford's (1980) forager-collector continuum, storage is a primary indicator of a collecting strategy. Storage is readily identifiable and archaeologically discernible, thus being a clear variable for use in conjunction with Kelly's index of residential mobility. Especially considering the ethnographic account by Steward (1938) and Murphy and Murphy (1960) in the next section, the identification of storage would prove a reliable indicator of low residential mobility.

Research in western Idaho has shown a disconnect between Steward's (1938) description of a collector/village strategy and the archaeological record. In the attempt to understand the range of activities along the Snake River, sites being excavated have included everything from large, multi-component sites, such as Three Island Crossing (Eastman 2011; Gould and Plew 2001), to surface lithic scatters across the Birds of Prey National Conservation Area (Sayer, Plager, and Plew 1996). Twenty-three assemblages from twenty-one sites have been chosen for the comparative analysis of Kelly's Mobility Index and additional assessment of indicators

of mobility. The sites were chosen based upon their vicinity to the Snake River, categorization as open sites, and availability of written records. Prior to this analysis, seven assemblages have been examined using KMI (Figure 2). These sites were included in the analysis so they may be examined with the addition of pottery, groundstone, fire hearths, and storage as mobility indices. Each according to variable, how they are assessed, method of assessment, and theoretical relevance, is explained below.

Archaeological Site Overviews and Research Parameters

Previously, the use of Kelly's Mobility Index has been limited to Late Archaic open sites along the Snake River. Late Archaic sites are characterized as having material culture including the bow and arrow and ceramics. In this region, Late Archaic sites generally date within the last 2,000 years (Plew 2008, p. 79). To keep the sample homogenous and limit the number of factors which could contribute to the preservation or nature of sites being assessed, the following criteria were established for inclusion in the data set: in direct vicinity to the Snake River, designation as an open site, having components designated as Late Archaic, including an inventory of artifacts and ecofacts, as well as a detailed description allowing calculation of cubic meters excavated. These parameters stem from the original research done using Kelly's Mobility Index in southwestern Idaho (Plew et al. 2006; Plew and Willson 2007, 2010, 2011, 2012; Willson and Plew 2007).

One modification from the previous use of Kelly's Mobility Index is a wider range of assemblage sizes and extent of excavation conducted. Previously, KMI was used on sites with sizable assemblages, both artifact and non-artifactual. The sample for this study includes a wide range of assemblage sizes including non-artifactual assemblages ranging from 47 to over 100,000 items and artifact assemblages from 0 to 1,403. The intention of increasing the range of assemblage sizes is to assess whether or not KMI is suitable for analyzing sites with less robust assemblages or less excavation. This type of site is common in the region and is integral for understanding the range of activities occurring on the Snake River.

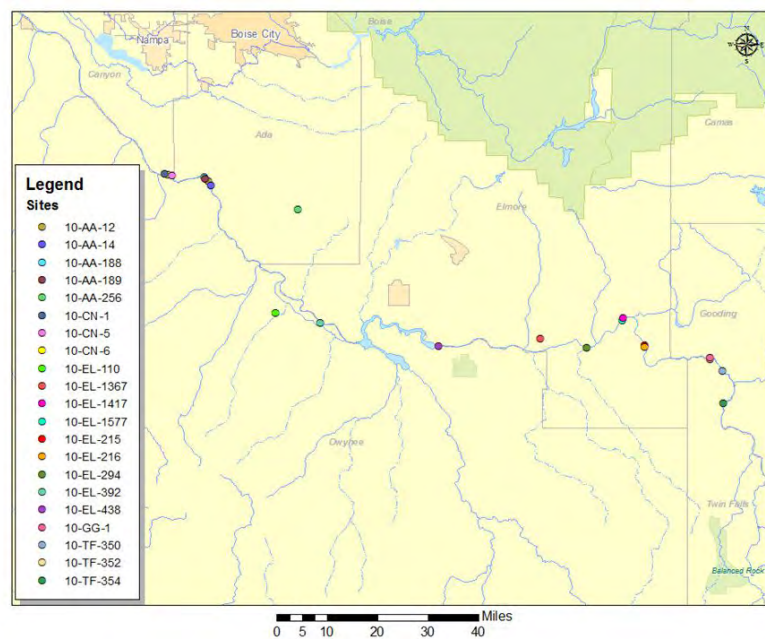


Figure 5. Sites analyzed using Kelly's Mobility Index along the Snake River.

Methods

Previously, the use of Kelly's Mobility Index has been limited to Late Archaic open sites along the Snake River. Late Archaic sites are characterized as having material culture including the bow and arrow and ceramics. In this region, Late Archaic sites generally date within the last 2,000 years (Plew 2008, p. 79). To keep the sample homogenous and limit the number of factors which could potentially contribute to the preservation or nature of sites being assessed, the following criteria were established for inclusion in the data set: in direct vicinity to the Snake River, designation as an open site, having components designated as Late Archaic, including an inventory of artifacts and ecofacts, as well as a detailed description allowing calculation of cubic meters. These parameters stem from the original research done using Kelly's Mobility Index in southwestern Idaho (Plew, Huter, and Benedict 2002; Plew et al. 2006; Plew and Willson 2007, 2010, 2011, 2012; Willson and Plew 2007).

The reports on the twenty-three assemblages meeting these requirements were acquired from the Center for Applied Archaeological Science repository. Seven of the sites sampled had already been assessed using KMI but were catalogued again in the same manner as new assemblages and reassessed using the standardized measurements outlined above. From each assemblage the following information was recorded:

- Lithic raw material(s)
- Breakdown of the inventory by artifact type
- Debitage, faunal, shell, botanical, and TAR counts
- Volume of excavation (meters cubed)
- Number of fire hearths
- Number of storage features

From this information each of Kelly's variables was calculated as follows.

Elements of Kelly's Mobility Index

Lithic Raw Material

Raw material is categorized as reflecting high or low residential mobility generally based upon the local availability of toolstone materials. In the Carson Desert valley located in Nevada and the focus of Kelly's case study, there was no naturally occurring knapping material. The closest materials were basalts, siltstones, silicified tuffs, and rhyolites at the southeastern edge of the desert (Kelly 2001, p. 73). Kelly outlines the expected use of CCS, or silicified rhyolites, in a short-term residential/logistical model as they were the most accessible material source on the southeastern edge of the desert.

Evidence of Bifaces as Core

Short-term use of sites would be identified by the presence and use of bifaces "as both tools and cores. Tool consumption and generation of lithic debris should be low at short duration sites . . . the extent tools are present assemblages should contain relatively large numbers of flake tools made on bifaces thinning flakes" (Raven and Elston 1988, p. 159).

Evidence of Bifaces as By-products

In opposition to the previous variable, “evidence of bifaces as by-products” would indicate that the location of the bifaces was used for the initial creation of the biface. More time and effort invested in creation of a long-term use tool suggests a less intense need for conserving toolstone. If a more sedentary location/strategy is being employed, we assume that toolstone is either being procured or stored for future use; therefore, the need to use existing bifaces as cores would be unnecessary. We would expect to find more exhausted cores and debitage flakes in a situation in which bifaces are by-products.

Bipolar Knapping/Scavenging

Bipolar knapping is “a technique of resting a core, or lithic implement, on anvil and striking the core with a precursor” (Crabtree p. 42, 1972). Kelly suggests that bipolar knapping would be common in situations of low residential mobility inasmuch as it is a conservation method used when raw materials are scarce. As far as scavenging, the archaeological testing of this concept is precarious, particularly when dealing with primarily archaeological reports.

Flake (Non-biface Reduction) Tools

Flake tools include scrapers and worked or modified flakes. These tools are often created for expedient use and are not intended to have a long-use life. They can be created quickly, be modified as functional need arises, and be used for lithic supply or as tools. A high flake-to-tool ratio was any site that exceeded 1:1 ratio.

Fire-cracked Rock

Fire-cracked rock (thermally altered rock or TAR) has been established as rare if it comprises less than 20% of a total non-artifactual assemblage (Plew and Willson 2012). Prior to Plew and Willson's (2012) quantitative definition of TAR, rarity analyses using KMI were limited to qualitative and relative measures. The significance of fire-cracked rock in determining mobility level speaks to both the site function and activity area use of a given locale. Rock assumes TAR attributes when heated in fires and dropped into water to bring a liquid to a boil. Notably, TAR varies greatly in sizes collected and is often only noted as being absent or present. When archaeological reports do report quantity, there is still little control over how large or how much fire-cracked rock was actually collected.

Site Size/Density

As designated in Plew and Willson (2012), artifact assemblages are small when the assemblage is less than 200 items, medium when ranging from 200 to 500, and large when the assemblage exceeds 500 items. Density is calculated by the total of the artifactual and non-artifactual materials divided by cubic meters. Non-artifactual assemblages are considered small if fewer than 5,000 items, medium from 5,000 to 20,000 and large when exceeding 20,000 items. These designations are important, especially in instances in which assemblages being compared vary greatly in size and the extent of excavation. Standardizing and calculating site size and density offer a measure by which small and large assemblages and sites can be compared.

Tool/Debitage Ratio

As defined in Plew and Willson (2012), the tool-to-debitage ratio is calculated with the following variables: number of tools, number of lithic flakes, and meters cubed excavated. The tools per cubic meter are divided by the debitage per meters cubed excavated. Based upon Kelly's scheme, one would expect a high tool-to-debitage ratio in instances of high residential or logistical mobility (Kelly 2001). Based upon open sites in the Great Basin, a high ratio was defined as any ratio exceeding .05. This measure can only be relevant if tool/debitage ratios for a known region have been calculated. Previously, the use of Kelly's index has been problematic since it has not been applied to a set content that can be compared to other regions.

Complete Flakes

Complete flakes are defined as those which have: a discernible single interior surface, a point of applied force, and intact margins (Sullivan and Rozen 1985; Kuijit et al. 1995). Complete flake fragments are considered indicative of more deliberate knapping and increased time investment (Kelly 2001, p.73).

Proximal Flake Fragments

Proximal flakes are defined as those which have a discernible single interior surface, a point of applied force, no sheared axis of flaking, and margins that are not intact (Kujit, Prentiss, and Pokotylo 1995). Proximal flake fragments are partial flake fragments indicative of less control during the knapping progress. Higher proportions of partial flakes suggest more expedient knapping methods (Kelly 2001, p. 73).

Distal Flake Fragments

Distal flake fragments are defined as flakes with discernible single interior surface without a point of applied force (Kujit et al. 1995). Distal flake fragments are partial flakes suggesting more expedient flaking and less control over the knapping process. (Kelly 2001, p. 74).

Angular Debris

Angular shatter is "multifaceted, angular toolstone fragments with no flake-like characteristics. Cortex is often present" (Raven and Elston 1988, p.186). When expedient knapping occurs, "less control [is] exerted in the knapping process, resulting in a high frequency of flake fragments to whole flakes, with perhaps high frequencies of angular debris" (Kelly 2001, p. 74).

Assemblage Size/Diversity

Assemblage size is generally correlated as increasing with extended periods of occupation. Conversely, it could also indicate repeated short-term occupational use and should be considered in the context of the entire index. To control for the range of excavation conducted at each site, the variables in KMI were analyzed per meters cubed.

Of the original thirteen variables in KMI, only seven are viable for use without the availability of physical collections. Excluded variables include bifaces as cores, bifaces as by-products, bipolar, knapped/scavenged, or complete flakes, proximal flake fragments, distal flake fragments, and angular debris.

Results

The assessment of KMI for 23 assemblages on the Snake River found that lithic raw material, flake tools, and biface/flake tool ratios were categorized as characteristic of high residential mobility for all 23 sites (Table 6). Fire-cracked rock had two assemblages with rates of low

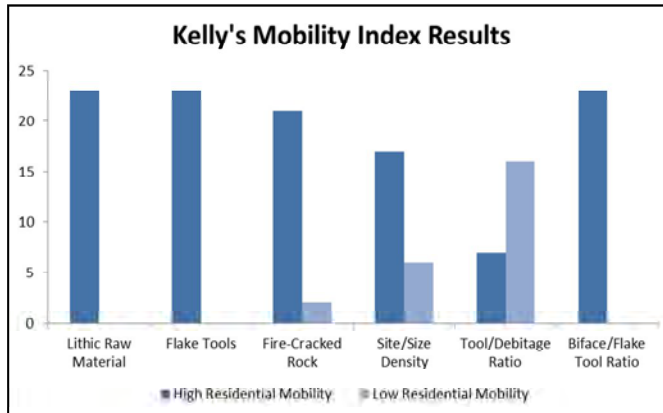


Figure 6. Designation for six variables from Kelly's Mobility Index for 23 sites along the Snake River.

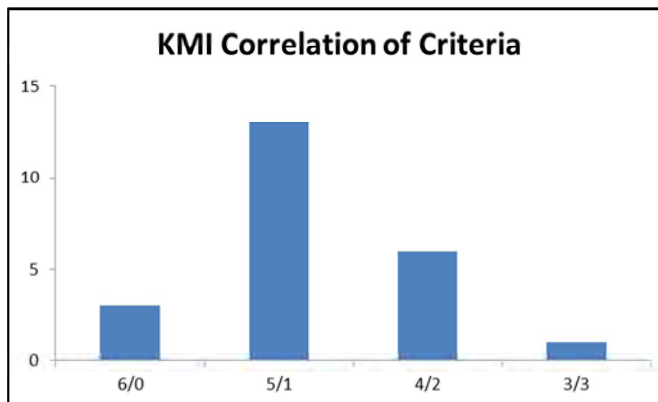


Figure 7. Correlation of criteria for KMI for 23 assemblages on the Snake River Plain.

residential mobility. The ratio of site size to density resulted in seventeen assemblages being categorized as high (Figure 6). Overall, three sites had exclusively high mobility traits, thirteen had five, six had four, and one had three (Figure 8). Site size and density resulted in inconclusive designations for four assemblages. The first assemblage originated from 10-GG-1, the Bliss site. Although characterized as having a large site size, it was designated low density due to the massive amount of excavation compared to the number of artifacts recovered. The three excavations at Three Island Crossing also experienced similar results—having extensive excavation and comparatively low artifact counts resulted in a large/low designation for all three assemblages from the site.

Since 22 of the 23 assemblages assessed were identified as having a majority of KMI variables reflecting high residential mobility, four additional indices of mobility were tested to see whether they correlated with one another. The assemblages were initially assessed for distribution

normality. For the 23 assemblages examined, a Shapiro-Wilk test was used to determine that artifact assemblages were non-normally distributed between small, medium, and large categories, $D(3)=.750$, $p<.001$, and non-normally distributed for non-artifactual assemblages $D(3)=.750$, $p<.001$. The sample of sites contained a disproportionate amount of small artifact assemblages—15 of 23—skewing the data and causing the abnormal distribution (Figure 8).

Inventory counts of pottery, fire hearths, groundstone, and storage were examined as indicators of mobility. The distribution of pottery $D(23)=.372$, fire hearths $D(23)=.430$, groundstone $D(23)=.288$, and storage $D(23)=.539$ were all significantly non-normal ($p<.001$).

The distribution of the presence of pottery $D(23)=.401$, fire hearths $D(23)=.422$, groundstone $D(23)=.464$, and storage $D(23)=.533$, were all significantly abnormal ($p<.001$) (Figure 9).

The non-normality of the outlined variables mandated the use of non-parametric statistical tests for all analyses. Due to the overwhelming occurrence of sites categorized as reflecting high levels of mobility, the analysis of the additional variables (pottery, fire hearths, groundstone, and storage) were analyzed internally for correlations using Kendall's Tau. Considering the amount of each variable inventoried, pottery and storage were significantly correlated with all other variables (Table 2).

When pottery, fire hearths, groundstone, and storage were converted into binary absence/presence variables, fire hearths were significantly correlated with storage and pottery (Table 3; Figure 9). Fifteen of the 23 sites reported pottery ranging from 1 to 947 sherds indicating that there is a wide range of variability in the presence of pottery in the data set. Notably, sites that did not report pottery all had artifact assemblages of 27 items or fewer. This, in conjunction with the fact that pottery was significantly correlated with fire hearths, groundstone, and storage, could suggest that sites with minimal use-life are not likely to have pottery in the assemblage. As noted earlier, evidence of storage has been rarely identified along the Snake River (Plew 2003). Of the 23 assemblages, only three (13%) were noted as having any evidence of storage. In contrast, 65% of assemblages included pottery,

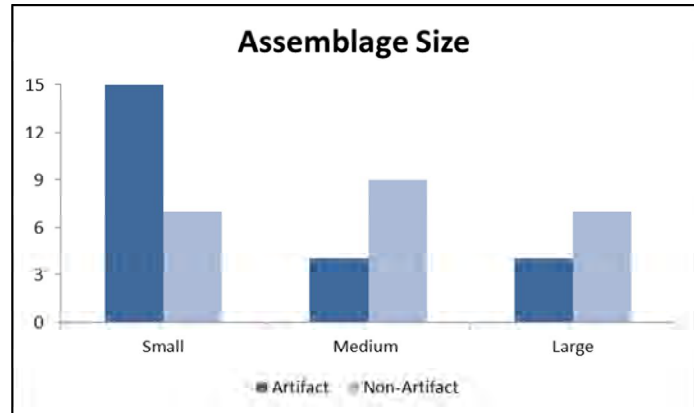


Figure 8. Variation in artifact and non-artifact assemblage size for 23 assemblages along the Snake River.

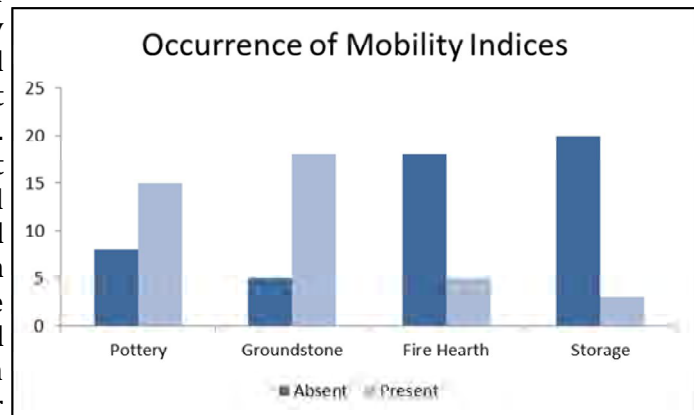


Figure 9. Absence or presence of pottery, fire hearths, groundstone, and storage for 23 assemblages along the Snake River.

TABLE 3. Kendall's Tau Correlations for Numerical Values of Pottery, Fire Hearths, Groundstone, and Storage Features for 23 Sites on the Snake River. Correlation is Significant at the .05 Level (Two-Tailed).

	Pottery	Fire Hearth	Groundstone	Storage
Pottery	1.00	.445*	.346*	.495**
Fire Hearth	.445*	1.00	.341	.568**
Groundstone	.346*	.341	1.00	.476**
Storage	.495**	.568**	.482**	1.00

TABLE 4. Kendall's Tau Correlations for Absence and Presence of Pottery, Fire Hearths, Groundstone, and Storage Features for 23 Sites on the Snake River. Correlation is Significant at the .05 Level (Two-Tailed).

	Pottery	Fire Hearth	Groundstone	Storage
Pottery	1.00	.483*	.279	.283
Fire Hearth	.483*	1.00	.120	.586*
Groundstone	.279	.120	1.00	.204
Storage	.225	.586*	.204	1.00

TABLE 5. Distribution of Artifacts by Functional Category for 23 Assemblages on the Snake River.

Sites	Weapons	Domestic	Fabricating	General Utility	Ornamen- tal
10-EL-215	5	2	5	10	1
10-EL-215	81	19.0	57	97	8
10-TF-352	18	20	7	44	3
10-TF-354	0	0	0	0	0
10-TF-350	0	2	0	0	0
10-GG-1	247	413	34	194	39
10-EL-110	87	110	34	13	31
10-EL-1577	224	108	132	125	17
10-EL-1367	30	35	12	17	1
10-AA-188	2	0	2	6	0
10-EL-1417	40	104	9	30	4
10-EL-294a	246	947	55	130	25
10-EL-294b	22	49	19	9	3
10-EL-294c	15	87	10	3	4
10-EL-216	9	0	5	8	0
10-CN-6	101	42	5	80	7
10-EL-392	15	17	6	11	0
10-AA-12	2	0	0	3	0
10-AA-14	5	0	0	0	0
10-AA-189	0	0	0	0	0
10-CN-1	63	17	21	28	12
10-CN-5	27	8	27	42	4
10-EL-438	23	48	9	13	3

78% included groundstone, and 21% included evidence of open fires or fire hearths (Figure 9).

Next, I analyzed the use of Winter's (1969) functional categories and their association with sites on the Snake River. The number of items in categories—weapons, $D(23)=.276$, domestic, $D(23)=.371$, fabricating $D(23)=.255$, general utility, $D(23)=.261$, and ornamental $D(23)=.306$, $p < .001$ —were all significantly atypical. A Spearman's rho correlation for the five functional types in Winter's (1969) categorization resulted in significant correlation for every possible combination (Table 5). This is indicative of highly generalized, non-specific assemblages. This is similar to the pattern Bicho, Haws, and Davis (2011) found in their analysis of Northwestern Coastal sites, where they posit a generalized toolkit being advantageous in mosaic environments. The desert environment of the Snake River has been

TABLE 6. Spearman's RHO Statistic for Winter's Technological Organization Categories. **.Correlation is Significant at the 0.01 Level (Two-Tailed).

	Weapons	Domestic	Fabricating	General Utility	Ornamental
Weapons	1.00	.838**	.868**	.914**	.920**
Domestic	.838**	1.00	.790**	.711**	.849**
Fabricating	.868**	.790**	1.00	.804**	.873**
General Utility	.914**	.711**	.804**	1.00	.820**
Ornamental	.920**	.849**	.873**	.820**	1.00

noted for patchiness in resources, an environment for which patch choice predicts foraging behavior (Elston and Zeanah 2002), and would explain the similar generalized assemblage results.

Finally, analyses of assemblage size and diversity calculated the slope of a linear regression comparing assemblage size and diversity. Kelly outlines this variable but never defines or describes how to calculate for an individual site. I was unable to find any other literature that outlines how to calculate the site size/density slope for an individual site. Bicho et al. (2011, p. 150-152) referred to Kelly's (2001) original text and used these variables to assess levels of mobility on the Northwest Coast. Their procedures were used for executing the linear regression needed to analyze a set of sites. When using this procedure to look at the entire sample of sites, the regression results in a low slope (as defined in Bicho et al. 2011) (Figure 10). This suggests a pattern of low diversity or non-specialized toolkit patterns. This non-specialized tool kit is reflected in both the slope of the linear regression and the correlation of functional categories (Table 7). This is similar to the pattern Bicho et al. (2011)

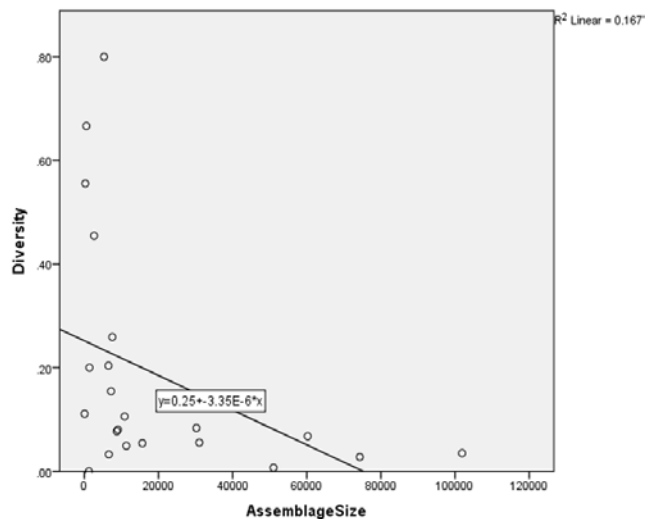


Figure 10. Linear regression model comparing diversity and assemblage size for 23 assemblages on the Snake River.

found in their analysis of Northwestern Coastal sites and suggests that a generalized toolkit is advantageous in similar mosaic environments.

Figure 10 highlights the large residuals in the original model and occurring within the spread of assemblage size over 100,000+ range. To test how these affected the outcome, I performed another linear regression after conducting a log transformation for the variable assemblage size. I found that this increased the R-square value slightly and increased the slope, but the overall interpretation of the analysis is the same (Figure 11).

Overall, the analysis using KMI showed that a majority of sites sampled on the Snake River reflect high levels of residential mobility. In addition, functional categories are all highly correlated with one another, suggesting sites are often comprised of highly generalized toolkits. Finally, the analysis of the diversity and assemblage size of the data set also supported a non-specialized toolkit.

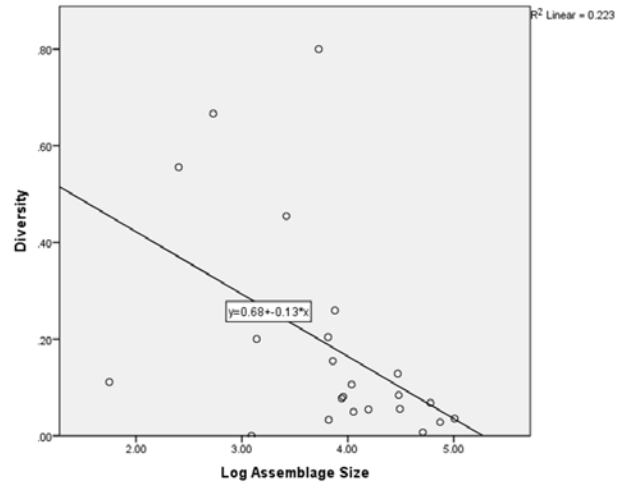


Figure 11. Linear regression model for diversity and log-transformed assemblage size for 23 assemblages on the Snake River.

TABLE 7. KMI Analysis for 23 Assemblages Along the Snake River.

Sites	Informal Name	High-Low	Lithic Raw Material	Flake Tools	Fire-Cracked Rock	Site Size/Density	Tool/Deb	Biface/Flake Tool Ratio
10-EL-215	1987	5-1	CCS/Bas/Obsidian	Rare	Rare	Small/High	Low	High
10-EL-215	2012	4-2	CCS/Bas/Obsidian	Rare	Rare	Large/High	Low	High
10-TF-352	Bliss	6-0	CCS/Bas/Obsidian	Rare	Rare	Small/Low	High	High
10-TF-354	Bliss	5-1	Obsidian	Rare	Rare	Small/Low	Low	High
10-TF-350	Bliss	6-0	CCS/Obsidian	Rare	Rare	Small/Low	High	High
10-GG-1	Bliss	5-1	CCS/Bas/Obsidian	Rare	Rare	Large/Low	High	High
10-EL-110	King Hill	4-2	CCS/ Bas/Obsidian	Rare	Rare	Large/High	Low	High
10-EL-1577	Knox	3-3	CCS/ Bas/Obsidian	Rare	Common	Large/High	Low	High
10-EL-1367	Medbury	5-1	CCS/ Bas/Obsidian	Rare	Rare	Small/Low	Low	High
10-AA-188		5-1	CCS/ Bas/Obsidian	Rare	Rare	Small/Low	Low	High
10-EL-1417	Swenson	4-2	CCS/ Bas/Obsidian	Rare	Rare	Large/High	Low	High
10-EL-294a	Three Island (2001)	4-2	CCS/ Bas/Obsidian	Rare	Common	Large/Low	High	High
10-EL-294b	Three Island (2010)	5-1	CCS/ Bas/Obsidian	Rare	Rare	Large/Low	High	High
10-EL-294c	Three Island (2013)	5-1	CCS/ Bas/Obsidian	Rare	Rare	Large/Low	High	High
10-EL-216		5-1	CCS/ Bas/Obsidian	Rare	Rare	Small/Low	Low	High
10-CN-6		5-1	CCS/ Bas/Obsidian	Rare	Rare	Small/Low	Low	High
10-EL-392		5-1	CCS/ Bas/Obsidian	Rare	Rare	Small/Low	Low	High
10-AA-12		5-1	CCS/ Bas/Obsidian	Rare	Rare	Small/Low	Low	High
10-AA-14		5-1	CCS/ Bas/Obsidian	Rare	Rare	Small/Low	Low	High
10-AA-189		5-1	CCS/ Bas/Obsidian	Rare	Rare	Small/Low	Low	High
10-CN-1		4-2	CCS/ Bas/Obsidian	Rare	Rare	Large/Low	Low	High
10-CN-5		4-2	CCS/Obsidian	Rare	Rare	Large/High	Low	High
10-EL-438		6-0	CCS/ Bas/Obsidian	Rare	Rare	Small/Low	High	High

Discussion and Conclusions

The analyses in this research reassessed the use of Kelly's chipped stone mobility index (2001) in conjunction with other variables discussed as indicators of mobility. This research examined mobility along the Snake River in a wider geographic range and set of variables than had been previously researched. The previous archaeological research suggested that Late Archaic sites along the river have been used in short-term, highly mobile contexts. This pattern contradicts the ethnographically-based assertions of Steward (1938) and Murphy and Murphy (1960; see also Gould and Plew 1996).

Seven sites were previously assessed using KMI but did not maintain standardized measurements for each variable resulting in sites with similar KMI correlation criteria being designated as different levels of residential mobility. Through the process of descriptive and analytic statistical work, this research has created a standardized set of parameters with which future sites may be added into the analysis.

The reassessment also sought to identify the archaeological characteristics of Binford's (1980) foragers versus collectors concept and to compare the expectations with ethnographic and archaeological evidence. The ethnographic accounts given by both Steward (1938) and Murphy and Murphy (1960) depict a lifeway similar to Binford's (1980) collector strategy. This includes discussion of villages, suggesting some sort of permanent or semi-permanent encampments, storage, and extended use of riverbanks for fish collection and processing. Archaeologically, research indicates that increased occupation results in larger sites, increased material densities, and stone acquisition, utilization, and processing activities that differ distinctly from those in a foraging strategy.

What Can the Frequencies of Functional Tool/Debris Types Tell Us About Levels of Mobility?

Using functional tool categories such as Winter's (1969) as a valid indicator of mobility does not seem to be a viable possibility. With the high significant correlations among all the categories of tools, the assemblages on the Snake River suggest that the toolkit was often wide in range even in the smaller assemblages. It appears that, if a site has any artifacts, more often than not there will be a wide range of items crossing functional barriers. Therefore, using functionality such as the instance of pottery or other specific tool types may not be the most accurate way in which mobility can be assessed.

The Knox site was originally characterized as having 12 of 14 KMI traits of a low mobility site and was ranked with the most indicators of low mobility, 3-3, in this analysis. The site has the largest debitage count of the data set at 80,948 lithic flakes and is one of two sites with common occurrences of thermally altered rock. Of the examined mobility indicators, the site has pottery, a fire hearth, and the highest groundstone count in the data set.

Reflecting sentiment from previous research (Gould and Plew 1996, 2001), there seems to be little archaeological significance to the ethnographically based assertions made by Steward (1938) and Murphy and Murphy (1960). While there are instances where sites could reflect a Binfordian collector strategy, the evidence from Three Island Crossing and the Knox site at this time suggest otherwise.

Does Adding Non-Lithic Variables to Existing Mobility Indices Alter the Accuracy or Reliability of the Previous Assessment?

Fifteen of the 23 sites reported pottery ranging from 1 to 947 sherds. Sites that did not report pottery all had artifact assemblages of 27 items or fewer. This could suggest that sites of extremely minimal use-life are not likely to have pottery in the assemblage.

Fire hearths were examined and inventoried regardless of the formality of the possible hearth, and reports featuring possible open fires or ash pits were considered in the fire hearth count. Sites including hearths ranged from one to six hearths per site and occurred in sites with non-artifactual assemblages ranging from 8,598 to 101,294 items and artifactual assemblages between 143 and 1,413 items. Fire hearths and storage, accepted indicators of lower or logistical mobility, were the only two variables that correlated significantly.

Groundstone included basin mortars, stone bowls, pestles, battered cobbles, and grinding slabs. Eighteen of twenty-four site assemblages included groundstone, and all the sites that lacked groundstone had fewer than ten artifacts. The sites did range in density, however, with non-artifactual assemblages ranging from 244 to 10,771. Similar to pottery, groundstone doesn't appear to be associated with extremely small assemblages or expedient sites.

Storage was the least recognizable of the examined variables, with only four sites mentioning possible storage facilities or caches: Three Island Crossing, Knox, and Bliss. These sites included all four variables, suggesting that storage may be one of the most telling variables when it comes to assessing mobility. Storage on the Snake River does not appear to be an integral part of the highly mobile, evolving environment of the plain (Plew, 2003).

What Limiting Factors are Currently Embedded in the Use of Chipped Stone Variables in Mobility Analyses?

As seen in the analysis above, not all the variables in KMI are practical with the use of records alone (distal flakes, proximal flakes, complete flakes, bifaces as cores, bifaces as by-products, and bifacial knapping/scavenging). Unless these criteria are specifically reported, which is extremely rare, they cannot be used without access to the physical collection. The archaeological identification of these variables is increasingly precarious, because none of the available literature has given a detailed or otherwise description of how investigators are able to archaeologically assess whether bifaces were used as cores or by-products. There may be a relationship between the amounts of debitage to bifaces in any given location that speaks to this problem, but to my knowledge this has not been identified or assessed.

The relationship regarding site size/diversity is also increasingly tenuous when being calculated per site. Again, I was unable to find any literature, including the original source materials, which outlines how to calculate the site size/density slope for an individual site. Procedures from Bicho et al. (2011, p. 150-152) were used for executing the linear regression needed to analyze the set of sites as a whole, but the assessment of individual sites was never addressed.

When this procedure is used to look at the entire sample of sites, the resulting low slope suggests a pattern of low diversity or non-specialized toolkit patterns. This is similar to the pattern Bicho et al. (2011) found in their analysis of Northwestern Coastal sites and suggests that a generalized toolkit is advantageous in similar mosaic environments.

The objective of this research has been to evaluate the application of Kelly's Mobility Index and other suggested indices of mobility on the Snake River. Until now, studies were limited to individual site reports and the synthesis of work in a limited geographic area over

the past decade (Plew, Huter, and Benedict 2002; Plew et al. 2006; Plew and Willson 2007, 2010, 2011, 2012; Willson and Plew 2007). The addition of assemblages analyzed with KMI appears to support Gould and Plew's (1996, 2001) suggested pattern of high mobility, short-term usage analyzed support the pattern on the Snake River.

The key to using Kelly's model, in a context without access to the physical collection, is to view it as a preliminary framework. Relying on a model to plainly inform on a concept as complicated as mobility is impractical. Rather, the model can be used in conjunction with adding non-chipped stone variables and a firm grasp on site function and regional patterns of site usage. The addition of those variables offers the opportunity to see that there is variability in common artifacts such as fired clay or pottery and their relationship to the duration of site use.

The use of functional categories is a common practice among archaeologists reporting site data. This study explored the premise that functional categories correlated with one another and could be used in contexts of mobility indices. While there is merit in merely identifying artifacts, this research demonstrated that the generality and wide range of artifacts at any given site makes the use of functional categories difficult to justify in the region, as such artifacts all generally appear at the same sites on the Snake River (Gould and Plew 1996, 2001). With 22 of 23 assemblages reflecting a majority of high mobility characteristics, this assessment supports previous assertions of high residential and short-term occupational use of sites along the Snake River (Gould and Plew 1996; 2001; Plew, Huter, and Benedict 2002; Plew et al. 2006; Plew and Willson 2007, 2010, 2011, 2012; Willson and Plew 2007).

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ARTICLE

When Does Screen Efficiency Stop Being Efficient? 1/4-Inch vs. 1/8-Inch Mesh Size Experiment at 10-EL-215

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Abstract

Since the late 1960s, archaeologists have questioned the validity of interpretations based on recovery rates of different sizes of screen mesh. Many archaeologists in the western United States have argued that one-quarter inch screens are adequate for the recovery of cultural materials; as such this size seems to have become the “industry standard” in these areas. However, do one-quarter inch mesh screens allow too much cultural material to pass through the screen thereby biasing archaeological interpretation of archaeological contexts? During the 2015 Boise State Archaeological Field School, an experiment was conducted at 10-EL-215 that tested recovery rate and time investment differences between one-quarter inch and one-eighth inch screen meshes. Analysis of the data shows that there exists a bias toward larger specimens for both lithic debitage and faunal remains.

KEYWORDS: Screen mesh size, zooarchaeology, Great Basin prehistory, lithic analysis , excavation methods

Introduction

For the nearly half a century, since David H. Thomas published his 1969 paper on sampling biases when using different sized meshes for dry screening, many archaeologists have debated whether screen mesh size matters for the recovery of archaeological material during excavation, and in turn archaeological interpretations. Thomas himself sets up the main issue involving dry screening techniques when he stated, “Ideally, one should always excavate with a maximum recovery screen, but the realities of archaeological fieldwork seem to preclude such exacting and time-consuming procedures (Thomas 1969).” Many studies have echoed this sentiment; see Casteel (1972, 1975), Brothwell and Jones (1978), Shaffer (1992), Gordon (1993), Shaffer & Sanchez (1994), James (1997), Nagaoka (2005), Ozbun (2011), and Lyman

(2012) for discussions.

Due to increasingly limited time and funding, archaeologists must balance the efficiency of screening with potential biases of interpretation by selecting one or two specific sized screens over other sizes (Ball & Bobrowsky 1987; Ross & Duffy 2000; Lyman 2012). On the one hand, fine-grained meshes allow for recovery of smaller flakes and faunal remains, which allows for a more complete and accurate archaeological analysis, but which has more constraints in processing time. On the other hand, coarse-grained meshes are quicker and allow for better sampling of the site since more units are able to be opened up and screened although at the cost of smaller cultural material potentially passing through the screen. The question for archaeologists then becomes whether the study should focus on a few, well-documented excavated units, or instead emphasize a better coverage of the site.

This paper addresses this question of sampling bias versus time constraints. An experiment was conducted during the 2015 excavation of site 10-AA-215 by the Boise State Archaeological Field School. This experiment collected data on the rates of recovery for faunal remains and cultural material using two different sizes of screen mesh—one-quarter inch and one-eighth inch. This study also collected data on the time requirements for processing matrix through both mesh sizes. Primarily this paper asks whether the loss of data through large-sized screens is truly detrimental to archaeological interpretation or if the amount of data recovered is still representative of a site as a whole, even when using a larger screen size. If there is no real difference in the representation of cultural material when using a larger-sized screen, then better coverage can be achieved by using a larger screen to process a larger volume of matrix. First, however, a brief discussion of how the recovery of cultural and faunal elements is important to archaeological interpretation for the context such elements provide.

Recovery Biases with Larger Sized Screen Meshes

Faunal remains play a major role in inferring archaeological context. Some aspects in which faunal remains recovered from archaeological sites are important for site context are uses in constructing paleoenvironments, interpretations of ecological patterns, and dietary reconstructions (see Brothwell & Jones 1978).

Many zooarchaeologists use rodent taxa to infer paleoenvironment and paleoecology. They do this because small mammals have small home ranges and are sensitive to changes within their environment whereas larger game have larger ranges and can typically move between ecotones (Shaffer & Sanchez 1994; Lyman 2012). Typically, small mammals stay within small, specialized, and relatively homogeneous environments; thus, any change in the distribution of plant patterns can have a major impact on the suitability of that environment for small mammals. If the change is severe enough, the animals will simply move away. In such a case, rodent remains, particularly teeth, are primary indicators of the type of environment in which the site was created, as well as changes that have occurred.

Several studies have shown differences in recovery rates of faunal material when using one-quarter inch mesh screens versus smaller sized meshes, like one-quarter inch mesh, which allows skeletal elements from smaller sized animals to pass through (Thomas 1969; Casteel 1972; Shaffer 1992; Gordon 1993; Shaffer & Sanchez 1994; James 1997; Nagaoka 2005). One-quarter inch meshes, therefore, tend to be biased towards larger specimens (Shaffer 1992) with the remains of smaller animals, such as fish, rodents, and even rabbits, being lost during the screen process. As much as 74-100% of animals having a live weight less than 700 grams—around the size of a skunk (Shaffer 1992)—are lost in large sized meshes (Thomas 1969). James (1997) estimated that 90% of fish remains might be lost during screening in a 1/4th inch mesh and that up to 71% of faunal remains from jackrabbit-sized

animals would pass through the mesh. Smaller faunal elements passing through the screen quickly become underrepresented within the assemblage (Gordon 1993; James 1997; Ross & Duffy 2000).

Shaffer (1992) extended this idea, and through experimentation created a model to predict the percentage of faunal lost with different meshes. From this study Shaffer (similar results in Gordon 1993; James 1997; Lyman 2012) showed that while using a 1/4th inch mesh any animal with a live weight ranging from 18-340 grams—deer mouse to mink—was almost never recovered. Animals with a live weight ranging from 340-3,100 grams (about the size of a jackrabbit) were unrepresented, and for only animals weighing above 4,500 grams, the size of a fox, was an accurate minimal number of individuals (MNI) achieved (Shaffer 1992).

Paleoenvironment and diet interpretations can suffer from this underrepresentation of smaller faunal remains by having a smaller MNI than should be present or by unrepresented resources being excluded from diet breadth models, like fish or lagomorphs. Indeed, some resource elements have been missed or overlooked due to the type of mesh utilized at a site. Thomas (1969) indicates that fish remains were never recovered at Hohokam sites in the Great Basin until the use of a 1/16th inch mesh screen. Richard Casteel (1972 & 1975) had similar results in the Pacific Northwest when the species of marine fish were only identifiable from remains recovered in 1/16th mesh but not in larger sized meshes when species' identifying skeletal elements fall through the screen's mesh. This means that prior to the use of 1/16th inch meshes, fish were never included within the diet breadth models for Hohokam or Pacific Northwest subsistence patterns.

Faunal and skeletal remains are not the only category of "small material" that has the potential for passing through larger mesh screens. Seeds recovered at archaeological sites can also play a major role in determining paleoenvironments and diet. These seeds tend to be smaller and like skeletal remains can pass through a large mesh screen. Aside from environmental and diet reconstructions, small cultural elements such as beads, pieces of red ochre, or charcoal can pass through large mesh screens; this could lead to cultural or behavioral interpretations that are inadequate or incomplete. None of the studies presented here mention seeds or small cultural elements besides lithic flakes (Ozbun 2011), but including these categories when discussing different mesh sizes for screens is plausible. Indeed, Ozbun (2011), through an experiment in which lithic flakes were passed through various-sized screens, showed lithic flakes up to two or three times the maximum dimension of the mesh size could pass through the diagonal of openings in the mesh. This means that when one-quarter inch mesh is used, flakes and artifacts between 1.2 and 1.9 centimeters wide have the potential to pass through the screen.

Time and Efficiency

Many of the studies mentioned above note another simple fact about dry screening: using a smaller sized mesh will increase the amount of time to process excavated matrix (Thomas 1969; Koloseike 1970; Ball and Bobrowsky 1987; Shaffer 1992; Ross & Duffy 2000; Lyman 2012), depending on the type of soils present at the site and the density of material collected and bagged while screening. Shaffer (1992) notes that while 1/16th inch mesh screen will increase the potential for recovering small animal remains, including fish and the various skeletal elements needed to identify species, this data comes at a 500% increase in the time it takes to screen the matrix that is excavated. Table 1 shows the increase in total hours for different sized meshes from a larger size to a smaller size in three different studies, including this one. In terms of total hours, when changing from a 1/4th inch mesh size to a smaller 1/8th inch mesh resulted in an average 398% increase in the time needed to process excavated

matrix, or nearly four times the number of hours needed to screen the excavated matrix at an archaeological site.

TABLE 1. Percent Increase in Total Hours to Process Matrix Going to a Smaller Mesh Size

1/2" Mesh à 1/4" Mesh	1/4" Mesh à 1/8" Mesh	1/8" Mesh à 1/16" Mesh	Source
767.1%	629.2%	674.5%	<i>Koloseike (1970)</i>
179.6%	186.7%	236.0%	<i>Ball & Bobrowsky (1987)</i>
Not Tested	164.4%	Not Tested	<i>This Study</i>

Methods

The experiment was conducted at site 10-EL-215, a large open terrace that rises steeply from the south side of the Snake River. During the 2015 Boise State Archaeological Field School, a total of eighteen one-meter by one-meter test units were excavated. The test units were excavated to depths ranging from 40 to 80 centimeters within a generally medium to fine-grained sand/silty soil that exhibited only a few clay particulates (Plew & Willson 2013). The soils were also dry for most of the experiment and did not require a lot of effort to screen. The experiment was conducted over the course of one week and involved all open test units during that week.

While excavating a test unit, the students filled two 13-quart buckets with matrix and then screened one bucket with a 1/4th inch mesh screen and the other on a 1/8th inch mesh screen. All cultural material from each screen was bagged and catalogued separately for analysis later. During the screening of each bucket, timing with a stopwatch collected data on the time required to screen and collect cultural material for each mesh size. To insure no bias of faster or slower individuals or continual use of the same screen, students were assigned to a screen as buckets were filled so that each participant screened nearly an equal number of buckets with each mesh size. During lab analysis each level's lithic flakes and faunal remains were counted and analyzed separately for the 1/4th inch mesh collection bags and the 1/8th inch mesh collection bags. The numbers were recorded within an archaeological catalogue for the site.

Results

Size Bias

Table 2 shows counts for different sizes of lithic material, percentages for each size category, percentage of total lithic material found with each screen size, and total faunal remains recovered with each mesh size. The total number of lithics recovered using the 1/4th inch mesh accounted for only 27.1% of the total recovered lithic material as compared to 72.9% with the 1/8th inch mesh. A similar rate of only 29.6% of the total faunal remains was recovered with the 1/4th mesh versus 70.4% with the 1/8th mesh. Only 7.1% of the 1 cm size category and 30.5% of material in the 2 cm category was recovered in the 1/4th inch mesh, 92.9% and 69.5% for the 1/8th inch mesh respectively, while the other size categories had

similar recovery rates between both mesh sizes. A size analysis was not conducted on faunal remains. These results indicate a bias toward larger sized lithic debitage, and toward faunal remains having smaller sized material falling through the mesh of a 1/4th inch mesh versus a 1/8th inch mesh.

TABLE 2. Quantities and Percentages of Lithic Material and Faunal Remains Recovered per Mesh Size

Mesh Size	Lithic Size Category	Quantity	Percent of Category Total	Percent of Total Lithics Recovered	Faunal Count (% of Total)
1/4 th inch	1 cm	30	7.1%	27.1%	16 (29.6%)
	2 cm	156	30.5%		
	3 cm	114	44.7%		
	5 cm	51	41.8%		
	> 5 cm	12	37.5%		
1/8 th inch	1 cm	390	92.9%	72.9%	38 (70.4%)
	2 cm	355	69.5%		
	3 cm	141	55.3%		
	5 cm	71	58.2%		
	> 5 cm	20	62.5%		

Time Requirements

Table 3 shows the time data collected during screenings on the two different sizes of screen mesh. Field students took an average of 56.68 seconds to screen the entire matrix and to collect the cultural material within a 13-quart bucket on a 1/4th inch mesh. In contrast, the process took 93.18 seconds (1 min 33 seconds) per bucket on a 1/8th inch mesh, an increase of 164.4% in the time to screen one bucket with the 1/8th inch mesh. The study site, 10-EL-215, excavated a total of 27.1 cubic meters, or 28,939.25 quarts, of matrix during the course of three field seasons (Plew & Willson 2013). Since all excavations prior to this experiment utilized a 1/8th mesh size for screening, this would equate to roughly 207,427.64 seconds, or 57 hours 37 minutes and 7.64 seconds. If this material had been screened using the 1/4th inch mesh extensively, the total time to screen the matrix would have been 126,175.13 seconds, or 35 hours 2 minutes and 55.13 seconds, a difference of 22.5 hours.

Discussion

Only 54 faunal remains were recovered from the levels screened during the experiment at 10-EL-215; none were identifiable skeletal elements. This small amount of faunal remains does not provide for an in-depth discussion relating to biases in faunal recovery. However, as previously mentioned above, most faunal remains will be unrepresented or completely lost for animals with live weights under 700 to 1,000 grams when one-quarter inch mesh is used (Thomas 1969; Casteel 1972; Shaffer 1992; Gordon 1993; Shaffer & Sanchez 1994; James 1997; Nagaoka 2005). Zooarchaeological analysis of the 8,168 faunal remains recovered from

TABLE 3. Screening Time for a 13-Quart Bucket on Different Sized Meshes

1/4th Inch Screening			1/8th Inch Screening		
Unit	Level	Total Screen Time (sec)	Unit	Level	Total Screen Time (sec)
1-2N, 12-13E	10-20 cm	36.06	1-2N, 12-13E	10-20 cm	57.81
1-2N, 12-13E	10-20 cm	26.64	1-2N, 12-13E	10-20 cm	41.44
1-2N, 12-13E	10-20 cm	19.41	1-2N, 12-13E	10-20 cm	30.67
6-7N, 15-16E	0-10 cm	75.94	5-6N, 15-16E	20-30 cm	161.12
6-7N, 15-16E	0-10 cm	162.05	5-6N, 15-16E	20-30 cm	229.76
6-7N, 15-16E	0-10 cm	67.56	6-7N, 15-16E	0-10 cm	96.31
6-7N, 15-16E	0-10 cm	57.61	6-7N, 15-16E	0-10 cm	143.51
6-7N, 15-16E	30-40 cm	81.28	6-7N, 15-16E	0-10 cm	106.64
8-9N, 12-13E	0-10 cm	60.45	6-7N, 15-16E	0-10 cm	110.34
8-9N, 12-13E	0-10 cm	34.00	8-9N, 12-13E	0-10 cm	64.85
9-10N, 16-17N	60-70 cm	69.54	9-10N, 16-17N	60-70 cm	127.89
9-10N, 16-17N	60-70 cm	45.94	9-10N, 16-17N	60-70 cm	81.04
10-11N, 19-20E	10-20 cm	31.61	10-11N, 19-20E	10-20 cm	52.16
10-11N, 19-20E	10-20 cm	49.72	10-11N, 19-20E	10-20 cm	50.98
10-11N, 19-20E	10-20 cm	52.23	10-11N, 19-20E	10-20 cm	65.77
10-11N, 19-20E	10-20 cm	60.45	10-11N, 19-20E	10-20 cm	70.59
Average time per bucket – 56.68 seconds			Average time per bucket – 93.18 seconds		

the previous two field seasons at 10-EL-215, 2011 and 2012, included 128 identifying elements from deer, antelope, marmot, porcupine, and beaver using a one-eighth inch mesh (Plew & Willson 2013). The last three animals weigh under 1,000 grams and would have a high potential for being underrepresented or even lost completely during screening if a one-quarter inch mesh had been used.

The loss of data from smaller specimens is not limited to faunal remains. Terry Ozbun (2011) provides the only known study that has looked at lithic debitage and screen mesh sizes recovery rates. In his study, Ozbun found that only 2%, n=6, of flakes created during flintknapping were recovered in a 1/4th inch mesh whereas 98%, n=310, of flakes were recovered in the 1/8th inch mesh. In this study, only 24.97%, n=186, of the total lithic debitage classified as late stage reduction (less than 2 cm) was recovered using the 1/4th inch mesh size versus 75.03%, n=745, recovered using the 1/8th inch mesh. The use of the 1/8th inch mesh, therefore, recovered over four times the amount of late stage reduction debitage. Like faunal remains, lithic debitage sizes can be utilized with analysis to describe site function, tool manufacturing, and cultural activity areas (Andrefsky 2011). Lithic size analysis of the lithic debitage recovered from the previous two field seasons indicates that retooling was a more common activity than tool production, with 87% of debitage being in the 2 cm size category or less and relatively little cortical material recovered—less than 1% (Plew & Willson 2013). Only 51% of the total debitage recovered with the 1/4th inch mesh was in the 2 cm size category or less with cortical material exhibited on 3.3% of the recovered material.

Conclusion

This study set out to address the question of time constraints versus sampling bias during excavation through the use of two different sizes of mesh screens, and whether this bias has an impact on archaeological inference. The experiment found that there was a substantial reduction in the time requirements for screening the matrix excavated at 10-EL-215 using a one-quarter inch mesh rather than a one-eighth inch mesh. Processing matrix took over 150% longer using the one-eighth inch mesh screen versus the one-quarter inch mesh screen. If the goal of the archaeological investigation was to provide as much site sampling, or coverage, as possible, then for every two units excavated and screened using a 1/8th inch screen, an extra such unit, or three units total, could be excavated and screened using a 1/4th inch screen. Granted this conclusion would depend on other factors as well, such as the number of people available for excavation and screening or the type of soil present at the site, but the implication is the same.

This study also found that 75% of smaller faunal and lithic material was lost through the larger mesh size. Unfortunately, very few faunal remains, none being identifiable, were recovered, making it difficult to discuss the potential bias in zooarchaeological analysis at 10-EL-215; however, with 75% of smaller remains passing through the screen there could be major issues for any type of analysis or research that involves the smaller sized specimens such as diet models or paleoenvironment. For example, approximately ten miles downriver from 10-EL-215 the Three Island Crossing site was excavated using a one-eighth inch mesh from which over 19,000 salmon individuals were recovered as well as several glass beads that were used for treading during the proto-historic period (Plew 2008). Had a one-quarter screen been exclusively utilized at Three Island Crossing, only 25% of the fish remains ($n \sim 4,750$ NISP) would have possibly been recovered. This is still a substantial amount but begs the question of how many identifiable elements would have been recorded, perhaps skewing the original analysis of the site, and it is possible that all the glass beads would have passed through the screen.

The same could also be true in lithic analyses: with smaller flakes passing through the screen, a different conclusion could be reached about site function or tool use. This is not the case for this study, however. Fundamentally, the data recovered during this study was still representative of previous findings at 10-EL-215. The size distribution of flakes recovered from the 1/4th inch screen was similar to that of the 1/8th inch screen. In both the one-quarter inch sample and the one-eighth inch sample, the pattern of lithic debitage was indicative of a retooling or secondary manufacture or a processing site as opposed to a primary tool manufacturing site or a residential base.

That being said, recovery rates that are biased toward larger specimens could still have implications for inferences about site function and diet breadth at other archaeological sites. Researchers need to consider the different rates of recovery when choosing a mesh size to utilize during excavation. One-quarter inch mesh will save time, which could lead to more test units being excavated and better site coverage but in the long run could produce biased data that leads to incomplete or inaccurate interpretations of archaeological sites. Archaeologists, therefore, need to consider the type of analysis to be conducted at the site to be excavated. Is the data recovered from the site going to be used for more in-depth, contextual analyses like environmental or diet reconstruction using a fine-grained mesh, or is better site coverage to generate more data and perhaps location of more features/elements preferred than would be possible given the time constraints of the smaller mesh size?

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REPORT

Repatriation: Progressive Negotiation and Partnership

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Abstract

Archaeology in its pursuit of the past can be seen either as a threat to indigenous peoples or as a collaborative partner in seeking to know, preserve, and celebrate the past. As such, repatriation continues to be a pivotal issue between Native American groups, government agencies, and the academy. Yet through trial and error and the sagacity of pioneers in the field, these two entities have overcome incredible obstacles in understanding and interpreting the complexity of the law and even more importantly, in understanding each other. Acknowledging previous failings, it is possible to implement a feasible program that can benefit society as whole without undermining the beliefs of other cultures (Zimmerman 2000).

This article is a brief summary of archaeology's past involvement with indigenous peoples and an analysis of current Native American perspectives regarding future negotiations with science. I humbly submit a recommendation of actions which I believe would help to advance the collaborative process between the academy, associated agencies and federally recognized tribes. The outcome of scientific research can and should benefit all parties if managed correctly. Thus, there is true value gained regarding not only ancient lifeways but also in the understanding of demography, disease and health characteristics in human populations which has implications in a modern context (DeWitte 2015).

As a member of the Duck Valley Shoshone-Paiute Tribe, I am optimistic that a middle ground can be found within the legal parameters already in place; indeed the field is already moving in that direction. It is this potential for successful partnership that I will investigate through research and survey in order to support this claim as a viable approach in understanding and mediating repatriation issues.

KEYWORDS: Native American, Shoshone-Paiute, repatriation, progressive negotiation, partnership

Anthropological Beginnings

Scientific study flourished dramatically in the wake of the Age of Enlightenment and collectively humanity has benefited. This progress, however, has come at a very high cost. As powerful nations expanded, archaeology became one of many tools used to subjugate indigenous populations on a global scale (Mallouf 2000). Within this expansion, ethnographic methodologies became the gold standard in the pursuit of knowledge and as a result humane concerns became overshadowed in this quest (Thomas 2000). These ethnographies reflect a Western ethnocentric bias which justified expansion and conquest (Bieder 2000), and it was not until the last century that a reversal of this trend finally began.

Tim Ingold in *The Perception of the Environment* astutely observes that the categorization of people by a purely historical sequencing of events is an extension of our “colonial conquest and state formation” (Ingold 2000:151). While the practice of dominating indigenous populations (even among indigenous groups) had been in play long before contact in the Americas, the extent to which it played out had far greater consequences after contact. It is important to recognize that this mindset was not the province of only the sciences and should be considered in time and place (Plew 2014). Regardless, the unconscious (and conscious) act of domination through resulting archaeological practices in the past has fostered distrust of any scientific undertakings in the present (Wilson 2008; Zimmerman 2000).

Indeed, this wariness of encroachments upon native peoples and their land is a very real concern to this day. The Fallon Paiute-Shoshone Tribe states, “As people (archaeologists, hikers, collectors, etc.) take things that are not theirs, such as human remains, burial items, arrowheads, and baskets, it violates the sacred Indian way of life, which is our religion. The markings of our past are there for everyone to enjoy and appreciate, however, as people continually take what is not theirs, eventually there will be nothing left for our future generations” (Nevada State Museum 2014). Thus, government agencies, the academy and indigenous groups all have a deep and vested interest in the vestiges of our past but are divided in how these antiquities are to be protected and managed. It should also be noted that antiquity preservation is subject to internal exploitation by groups seeking to benefit monetarily through the sale of antiquities in the open market and/or black market (Ede 1998; Mallouf 2000). This problem continues on a local and an international scale and is beyond the scope of this paper.

The field of archaeology, despite good (and admittedly sometimes bad) intentions in acquiring sound data, ignored consideration for the descendants of the populations they studied (Thomas 2000; Trope & Echo-Hawk 2000; Bergman & Doershuk 2003). This lack of consultation resulted in a “disconnect” between these two entities, both of whom were seeking to protect and preserve the very same artifacts. More recently, in response to a growing concern by indigenous groups over ‘ownership’ of burial remains and their associated artifacts, the National Museum of the American Indian Act (MNAIA) and the Native American Graves Protection and Repatriation Act (NAGPRA) were enacted. While NAGPRA is an attempt to rectify repatriation lapses, the law is fairly ambiguous and prone to protracted litigation due to interpretation. In addition, NAGPRA only applies to federally recognized tribes (Watkins 2003), which creates another divide not addressed in this article, but which remains a divisive concern. Regardless, since the passage of these laws, the balance of power between the scientific community and federally recognized tribes has become incredibly complex and controversial (Smith and Burke 2003; Watkins 2003; Zimmerman 2000).

The case of Kennewick Man, *Bonnichsen, et al. v. United States, et al.*, became the first highly publicized legal battle between these entities, highlighting the differing perspectives and the intense emotion associated with ownership of ancestral remains and their associated

assemblages. A long and complicated litigious process is proof that success in future collaborations between science and federally recognized tribes will also require a foundational and relational platform upon which the two may interact. Although the archaeological community has made an effort to correct past practices by establishing the Society for American Archaeology (SAA) Code of Ethics and the Vermillion Accord among others (Smith & Burke 2003; Zimmerman 2000), it does not address the underlying issue of developing trust built on established relationships. Without such trust, any serious attempt to foster productive collaboration is undermined. Therefore, forging a partnership built on trust between tribal entities and archaeology is fundamental to gaining knowledge of ancient lifeways while also providing a means of increased protection and preservation of antiquities collectively (Zimmerman 2000).

Archaeology: Moving Forward

Anthropology, archaeology, and the sciences in general are essential to our knowing our past, but it is becoming increasingly evident that these are not the only tools available. Partnership and consultation with tribal entities create another avenue to augment current studies while also advancing indigenous cultural preservation efforts. As a member of the Shoshone-Paiute Tribes, I am responsible for honoring and protecting tribal interests, and as a scientist, I must be objective yet respectful in my research. Recognizing and balancing these two seemingly opposing stances is a personal challenge and at the same time a matter which the academy must address to advance productive collaboration.

As such, mutual trust should be held in the highest regard if a productive relationship is to be fostered. Accordingly, implementing such a relationship would require maintaining open and honest dialogue between all parties, developing a history of dialogue long before situations arise, involving tribal members in research and development, and if possible, implementing a memorandum of understanding (MOA) which would clearly address protocol in repatriation negotiations. Typically an MOA would outline a standard plan of action, which addresses each party's interests, giving all parties an agreed upon groundwork that ensures more productive and successful outcomes within established parameters.

Furthermore, Native American expertise must be incorporated in the earliest stages of research, as Dr. Pei-Lin Yu emphasized in her experience working with the Confederated Salish and Kootenai Tribes of the Flathead Reservation and the Blackfeet Nation in the Ice Patch Archaeology and Paleoecology Project in Glacier National Park. Yu's expertise in NAGPRA issues, as well as her highly consultative approach to indigenous issues resulted in a successful collaboration between California State University, Sacramento and local tribal entities (the Buena Vista Rancheria Miwoks, the Ione Band of Miwoks, the Northern Valley Yokuts, the Tachi Yokuts, and the Tubatulabals of Kern Valley) in repatriating more than 500 burials dated to c. 3,000 BP and 1,500 BP (Pei-Lin Yu, personal communication, November 2014).

In Idaho, the Wings and Roots program became a forerunner as a vehicle of open communication between tribal entities, the academy, and government agencies regarding negotiations on a variety of levels, including repatriation. This program was innovative in fostering a relationship of collaboration and accountability, and it continues to be a bridge of communication. The accountability aspect of Wings and Roots "evens the playing field" in negotiations for wary tribal entities and allows for a meaningful dialogue to begin (Ted Howard, personal communication, March 6, 2015). Building trust through partnerships such as Wings and Roots and efforts like Yu's across the country is precisely the type of proactive engagement which will foster long-term mutual trust and provide the foundation for future

negotiations.

David Hurst Thomas argues that this type of cooperative negotiation has been implemented successfully in recent years (2000). The rebuilding of the Mashantucket Pequot of Connecticut and the Confederated Tribes of the Umatilla epitomizes the resourcefulness and tenacity of tribal entities, employing modern technologies to protect and preserve their cultural identity. Amy Steffian's respectful negotiations with the Afognak of Kodiak Island, and likewise, Terry Fifield's work among the Klawock Cooperative Association of Tongass Forest of Alaska are stellar examples of tribal concerns being addressed by the scientific community in a productive and respectful manner (Thomas 2000). The Navajo Nation has had an even longer history of working with archaeologists. In 1986 the Navajo Nation Historic Preservation Department (NNHPD) was established by the tribe and consequently is able to exert some control over cultural resource management (CRM) issues (Watkins 2003).

In addition to implementing open communication, recognition of obstacles in the interpretive process can facilitate meaningful discourse. One major obstacle is understanding and acknowledging how indigenous peoples view their role through an environmental perspective. Typically the Western perspective views man and nature in opposition, with man controlling and dominating nature according to his needs (Ingold 2014; Watkins 2003). The Western dualistic 'man versus nature' manner in which knowledge is procured and disseminated has undermined the value of scientific inquiry in many non-Western societies. Traditionally, the non-Western perspective of 'being' is embedded within the environment; thus, extracting elements from the environment essentially strips away a vital component from tribal identity (Wilson 2008). This concept is a difficult chasm to bridge, but acknowledging that this mind-set is deeply embedded within Native American ideology helps scientists to understand and hence to respectfully collaborate on sensitive repatriation issues.

I would suggest that the academy seek to address specific topics of cultural interest as indicated by each tribe, perhaps incorporating tribal assistance in data collection, sharing the results of findings, and giving a voice to tribal entities regarding interpretation. Likewise, I would suggest the tribe seek to remain open to scientific inquiry and ask itself how science can be put to use to verify or validate traditional tenets. These concerted efforts can act as a catalyst of tribal empowerment by synthesizing tribal oral history and the sciences, and in many cases, offering tribal members a hands-on experience in delving deeper into their own ancient heritage (Thomas 2000; Hall & Wolfley 2003). Cooperation and collaboration in themselves will lend support to the notion that we share a common goal.

Operating under a system which acknowledges and respects that traditional indigenous belief systems are an integral aspect of interpreting pre-history is one step in bridging the divide between science and indigenous ideology. Thus, this methodology has the potential to work within a mutually agreed-upon construct that acknowledges indigenous belief systems as holding merit within a larger framework (Zimmerman 2000). I emphasize that acknowledging and respecting a belief system does not imply a subsumption into an existing theoretical framework but rather finds value therein. Additionally, NAGPRA considers traditional forms of knowledge such as oral history and origin stories as evidence having equal weight with scientific knowledge in making determinations of cultural affiliation, although this guidance has not always been acknowledged in making those determinations (43 C.F.R. 10.14 (e)).

However, I would also point out that as tribal identity melds with modern technologies and ideologies, this mind-set will reflect these progressive changes. Although the developmental divergence may be slow due to the remote locales of some reservations, the process is unavoidable and perhaps inevitable. Since antiquity protection and preservation of cultural identity remain critical Native American issues, it would be in the best interest of

indigenous tribes to actively seek to expand collaboration in an effort to effect balanced and productive outcomes. Of equal importance is the academy's role in building and fostering a relationship built on cultural understanding and trust which invites feedback of tribal entities.

In the quest to procure an understanding of the past, acknowledgment of and respect toward non-Western thought processes is an objective which will allow the academy and tribal entities to achieve mutually satisfying results. This flexible open-mindedness can be the catalyst to a better means of achieving the knowledge we seek in the future (Fine-Dare 2012). Ignoring the need to move forward in productive collaboration results in continued deadlock. This type of collaboration does not nullify either party's viewpoints but rather is an ongoing synthesis of "knowability through respectful partnership" (Fine-Dare 2012). Not all tribes are at this stage of trust owing to the long history of abasement by government agencies and academia, yet this issue should be addressed if productive collaborations are the end goal.

Survey and Methodology

There is a real need to understand the root of the divide between science and indigenous interests and recognize these barriers as critical to the negotiative process. I am interested in isolating the obstacles leading to the disconnect between tribal and archaeological interests. To access this topic at a local level, I examined Native American perspectives of archaeology through my affiliation with the Western Shoshone Tribes and Boise State University's Inter-Tribal Council (Native American student club). To facilitate collection of local indigenous insights regarding archaeology, I administered an anonymous random survey during two separate indigenous events and also gained perspective during a separate interview with a tribal member involved in this area of study. I also acknowledge my personal bias in interpretive and analytical methodology but maintain a sincere interest in striving for good science, and thus, finding value and significance in both arenas.

The survey queried respondents regarding how they perceive archaeology in relation to its benefits to mankind, its potential for harming belief systems, barriers between Federal agencies and tribes, and input regarding how such barriers might be overcome. Even more importantly it asked respondents how they perceived the possibility of future successful collaboration. In the survey I did not restrict access only to Native Americans; however, due to indigenous associations at the functions, an indigenous bias in all survey results is assumed. However, the intent of the survey was to collect data regarding Native American perceptions of the sciences/archaeology. The surveys were administered randomly and primarily represented the viewpoints of a small sample of indigenous people, although not exclusively from the Great Basin region. Sample size was small given the size of the population at both events. All sampling was anonymous to ensure privacy.

The first survey (n=7) was administered at Boise State University's Intertribal Native Council (INC) on November 11, 2014. The members of this organization and one advisor completed surveys anonymously. The average age set of the membership of this organization ranges from eighteen years to the mid-thirties, which may factor into differences between this and the second survey results. The second survey (n=12) was administered at a Thanksgiving dinner held by the Native American Coalition of Boise (NACOB) on November 22, 2014. The average age set of this function ranged from infants to elders. The participants who elected to complete the survey ranged from approximately late 20s to Elders. The two sample surveys represent a distinct dichotomy in "age sets," allowing for comparative analysis. The grand total of completed surveys was n=19. The results are as follows:

SURVEY #1

	YES	NO	INCOMPLETE	%YES	%NO
1. Do you consider yourself a descendant from indigenous peoples of the Great Basin area?	2	5	0	28.6%	71.4%
2. Do you believe that archaeology in general is beneficial in regards to knowing the past of mankind?	6	1	0	85.7%	14.3%
3. Does science have the potential to threaten 'mindsets' of the past (ancient legends)?	4	3	0	57.1%	42.9%
4. Do you have an understanding of NAGPRA and how it pertains to protocol on federal lands? If no, go to question 7. If yes, go to next question.	3	4	0	42.9%	57.1%
5. What do you see as barriers to understanding protocol between federal agencies and tribes? (continued next page)	1. Interpretation of law. 2. Culture/religion is a barrier & safe guard. 3. Lack of communication. Accountability and prosecution of private landowners is lacking. Language & culture. Protecting turf.				
6. How might federal (and/or state) and tribal entities find balance in such a controversial issue?	1. Talk to one another. Include the tribes, if at first you don't succeed in creating relationships, try, try again. 2. More collaboration in Arch procedures. 3. The item can be studied, but need(s) to be place(d) back where it came from. Common sense.				
7. Do you feel that respect for both artifacts and indigenous culture can be achieved in archaeological research?	7	0	0	100%	0%
Would you like to elaborate on how you came to this decision?	See below				

Additional comments included:

"Do it with positivity and intentions must be good. Learn a lot from older artifacts."

"Find young minds who (sic) understand the importance of sharing and preserving but willing to bend."

SURVEY #2

	YES	NO	IN-COMPLETE	%YES	%NO
1. Do you consider yourself a descendant from indigenous peoples of the Great Basin area?	4	8	0	33.3%	66.7%
2. Do you believe that archaeology in general is beneficial in regards to knowing the past of mankind?	12	0	0	100%	0%
3. Does science have the potential to threaten 'mindsets' of the past (ancient legends)?	8	2	2	66.7%	16.7%
4. Do you have an understanding of NAGPRA and how it pertains to protocol on federal lands? If no, go to question 7. If yes, go to next question.	5	7	0	41.7%	58.3%
5. What do you see as barriers to understanding protocol between federal agencies and tribes? (continued next page)	Gov't has very little understanding of Native ways. None. Indians do not understand Indian culture (?) and Federal agency employees have no knowledge of tribes. Lack of personal friendships (which would) resulting in genuine connections.				
6. How might federal (and/or state) and tribal entities find balance in such a controversial issue?	White people wouldn't desecrate their graves (and) it would be nice if the gov't obeyed their own laws. Attend Indian history classes. Keep on keeping on with contacts.				
7. Do you feel that respect for both artifacts and indigenous culture can be achieved in archaeological research?	8	1	3	66.7%	8.3%
Would you like to elaborate on how you came to this decision?	See below				

Additional comments included:

"Without our past, we wouldn't be who we are today" (yes to #7)

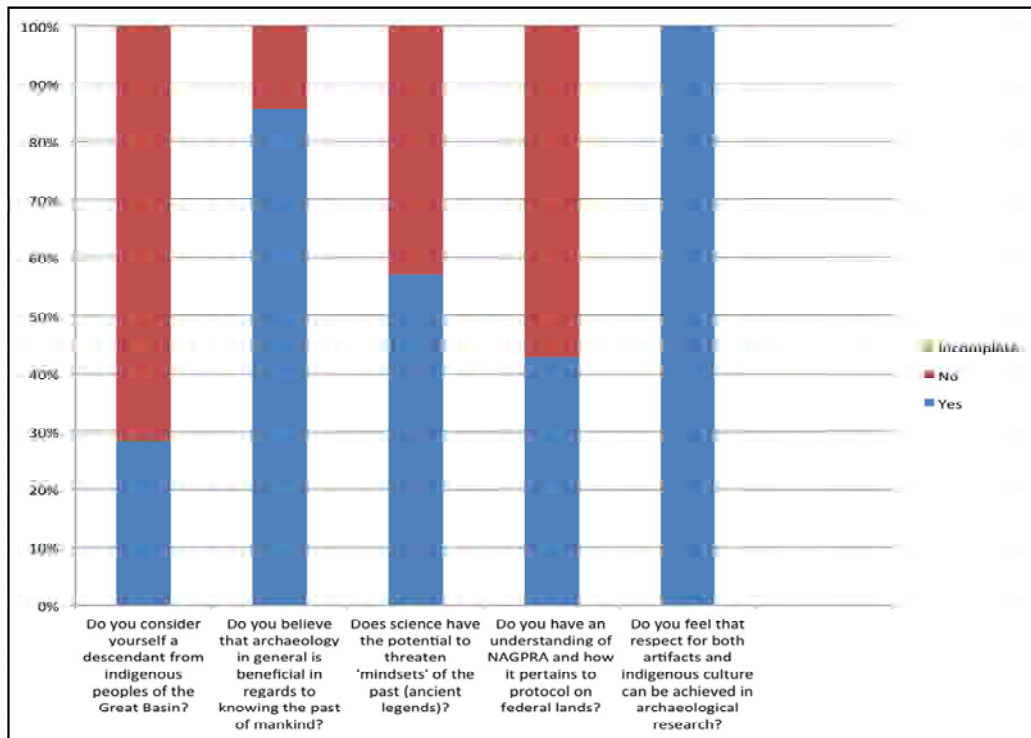
"Those items and artifacts (sic) of knowledge belong first to the ancestors (sic), then their descendants (sic)" (yes to #7)

"I worked in conservation efforts for Dept. of Agriculture" (yes to #7)

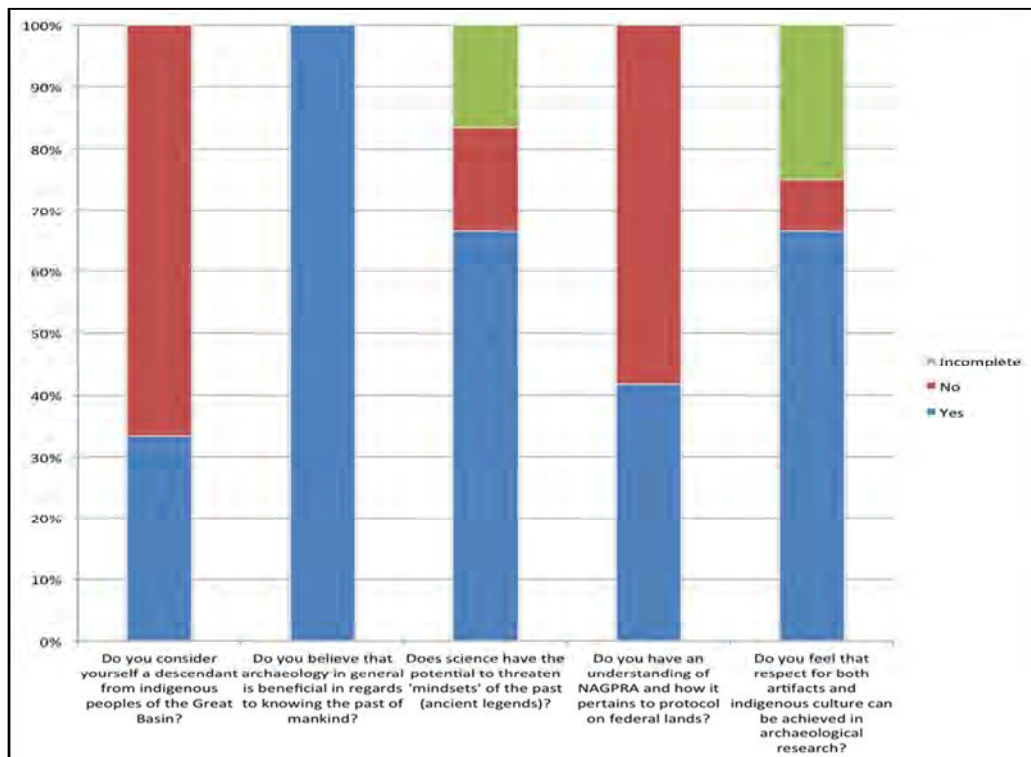
"There are barriers (sic) that elders know of but will not tell, so it would be hard to dig and respect remains and culture" (no to #7)

"Personal academic knowledge of such people plus the opinion of the late Vine Deloria Jr., a friend" (yes to #7)

SURVEY #1. Boise State University Native Students: November 11, 2014



SURVEY #2 Native American Coalition of Boise: November 22, 2014



Survey Analysis

A comparison of the two surveys reveals that 28.6% to 33.3% identified as descendants of Great Basin ancestry, with the higher percentage representative of the NACOB survey. Question 2, "Do you believe that archaeology in general is beneficial in regards to knowing the past of mankind?" resulted in a 100% positive response outcome in the NACOB survey as opposed to the INC survey, which scored 85.7% positive. Several of the respondents additionally commented on the value of scientific inquiry but with the caveat of employing respectful scientific inquiry. I believe this indicates the growing acknowledgment that anthropology/archaeology, despite its short-comings in the past, is still too important to Native respondents to be discarded. Question 3 considers if science has the capability of upsetting mindsets (ancient legends). The NACOB results appear to consider science more threatening to cultural mindsets (66.7%) compared to INC (51.1%); however, these results may be skewed because three of the NACOB surveys were incomplete (backside of survey). Acknowledging and respecting this concern should be addressed with great care.

The most encouraging result came from question 7, "Do you feel that respect for both artifacts and indigenous culture can be achieved in archaeological research?" The INC survey resulted in 100% positive whereas the NACOB results were only 66.7% positive. This is somewhat surprising, especially considering the results of question 2, in which the NACOB results were higher in indicating that archaeology was indeed beneficial in knowing the past of mankind. However, given the fact that three surveys in the NACOB sample were incomplete, the overall small sample size could account for this discrepancy. A common theme was a general misunderstanding between cultures and a call for increased communication, yet there is still a general consensus in favor of pursuing academic investigations. The concern regarding respect and good intentions toward tribal communities is a bridge that can successfully be accomplished, and in fact that has been implemented in the recent past (Thomas 2000).

Another obvious trend revealed in both surveys is a real concern for maintaining cultural histories (legends) as an important part of cultural identity. Again, this is an issue that should be addressed carefully and respectfully. Additionally, one respondent's suggestion indicated the need to involve younger tribal members, which was a method employed by several agencies successfully (Thomas 2000). The results of this survey reflect a growing indigenous belief in Idaho, and likely reflected nationwide, that science and Native American ideologies can partner to know our past.

Conclusion: Partnership in Repatriation

As we move further into the twenty-first century, the academy, government agencies, and tribal governments will continue to engage in repatriation issues, and certainly continue to disagree, but by taking the time to understand each other and working from a common platform, together they would then be empowered to take productive strides into the future. Keeping the lines of communication open allows for an exchange of ideas between these entities. It is important to recognize that past successful partnerships cited were forged through years of communication, innovative leadership and developed trust. As Yu states, "The combination of science and indigenous perspectives on the past can be a powerful tool for research. This fusion can be realized when trust and respect flow in both directions. Often it's up to scientists and managers who are tasked with the implementation of NAGPRA's requirements, to create that first opening for Native inquiry, discussion, deliberation, and

acknowledgment of different worldviews in the consultation process” (Yu, personal communication December 2014).

The survey results corroborate this stance, indicating a general consensus in finding value in scientific pursuits as a means of knowing the past (question #2- 85.7% BSU, 100% NACOB) with the stipulation of ‘respect.’ Additionally, there was a positive response for potential to create a respectful alliance between the academy and the tribes (question #7- BSU 100%, NACOB 66.7%). The results in general reflect a Native American perspective acknowledging the importance of scientific research within legal parameters and in conjunction with a respect for cultural identity and ideologies embedded within research methodologies.

It is no longer feasible to practice in this field without implementing an atmosphere of respectful collaboration, and results of this survey indicate that there is a real opportunity in Idaho. It is now up to us to foster an atmosphere of openness and trust with tribal entities. It is up to us to show the value of scientific inquiry and preservation within agreed legal parameters, while employing respect for tribal entities. This type of mutual understanding is imperative to achieve a successful and productive partnership in the pursuit of knowledge and preservation. It is a means which embodies both objective and subjective, emic and etic, and a balanced and inclusive alliance in the understanding of humanity’s prehistory—our prehistory.

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REPORT

Grizzly Bear-Related Artifacts from Caribou County, Idaho

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Abstract

This paper describes four artifacts (bone and antler) recovered from open sites in Caribou County, Idaho that are associated with grizzly bear (*Ursus arctos*) (Nowak 1991) and relates the discussion to a fifth object previously reported from the Blackfoot Reservoir (Miss 1974). Bears have been important in the lives of prehistoric peoples for at least 40,000 years as European cave paintings attest. In North America, bears—both black and grizzly—co-existed with people and were held sacred by many groups. Grizzlies were revered for their strength, courage, great wisdom, invulnerability and similarities to humans. As omnivores they may have led early people to food sources (Craighead 1979).

KEYWORDS: Grizzly bear-related artifacts, Eastern Idaho, Blackfoot Reservoir pendant

Introduction and Background

The importance of bears was manifest in several ways. Bear cults were present in most tribes. Members held feasts and ceremonies to honor bears, doctored the sick and injured ones, and were aggressive participants in war parties (Mails 1991). A bear dance appeared in the Great Basin, apparently originated by the Utes. In late pre-contact times it spread north and was performed by the Lemhi, Northern and Eastern Shoshones. These were multi-band celebrations that lasted for up to 10 days, for the purposes of propitiating bears, ensuring successful hunts and improving human fertility (Lowie 1909; Steward 1943; Jorgensen 1986). Bears were utilized as clan symbols, totems and as shamanistic spirit helpers as people sought to utilize their supernatural powers. Grizzly parts used for personal adornment or for ceremonial purposes were often important in these activities (Mails 1991).

The importance of bears is also suggested by their presence in regional rock art. Bear paws and/or tracks are a recurrent theme in both pictographs and petroglyphs from different time periods. These stylized tracks often show prominent claws or claw marks which may

represent grizzlies (Merrell and Johnson 2011). Bear track representations usually exhibit two transverse lines distally. Murie (1981, fig. 3) graphically illustrates the dark, broad, furry band that separates the foot pad from the toe pads and the more subtle band that separates the toe pads from the claws, that these lines represent. Bear tracks are common motifs wherever grizzlies ranged, from the plains through the intermountain area (Merrell and Johnson 2011) and the Plateau (Keyser 1992; Boreson 1998) but are rare in the Owyhee country (Murphy 1994; Plew 1996) and much of the Great Basin (Schaafsma 1986). It is noteworthy that there appears to be no written record of grizzlies in Nevada (Schneider 2004:2).

Grizzlies were common, and commonly encountered, over most of their range (Russell 1955, Townsend 1978). The significance grizzlies held for the native people has been summed up thus (Keyser and Klassen 2001:174):

“No stronger magic could be found across the Northwestern Plains that of the Grizzly (sic) Bear, whose supernatural powers embodied both the warrior’s ideal and the healer’s arts” (as quoted in Merrell and Johnson 2011).



Figure 1. Map showing the location of artifacts on the upper Portneuf River in western Caribou County, Idaho.

Artifacts

Grizzly remains are sometimes found in archaeological contexts as apparent food remains or, rarely, having had some other use, usually in rock shelters. Fowler (1986) has documented grizzlies being used for food by the Bannock and Northern and Eastern Shoshone, among others. Bear remains, both black and grizzly, were found in Mummy Cave (McCracken 1978), and grizzly remains, from food remnants, were reported from Weston Canyon (Miller 1972). Canine tooth pendants appear usually not bear (e.g. Aikens 1970), but a bear canine pendant was recorded from the Blackfoot Reservoir (Miss 1974).

In March 1983 the author discovered three drilled claw cores within a few meters of each other on a low ridge above riparian meadows on the west side of the upper Portneuf River in western Caribou County, Idaho (Croney 1983). Subsequently the site produced mostly late (Rose Spring) projectile points but no more claw cores. After their discovery the cores were

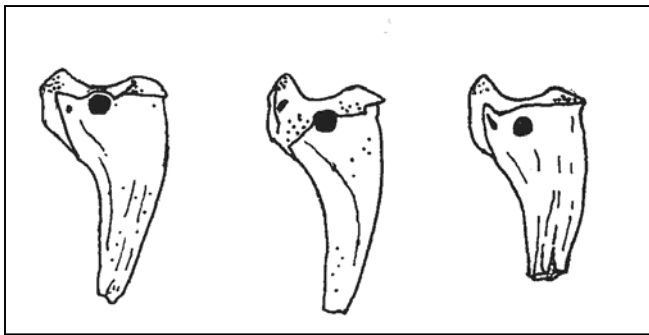


Figure 2. Grizzly claw beads.

gently cleaned of clinging mud and were allowed to slowly air dry at room temperature. They stabilized well and remain in good condition.

An initial identification was made by Lars Eidnes and later verified by B. Robert Butler when he compared the cores to grizzly cores from the Idaho Museum of Natural history collections (Butler 1985). The rather straight shape of the cores is diagnostic when compared to strongly curved black bear claws. Butler's initial

observation of the cores related to the cylindrical nature of the suspension holes, which he said were drilled with a metal bit. This suggests the claws may date to the 19th century. The holes are not perfectly cylindrical however, and two appear to have been drilled from both sides. Diameters vary (at the bone surfaces) from 3.1 to 4.1 mm so it appears the bit may have been hand held. Steel bits were available to the Indians through almost all the 19th century. For example, a tool inventory for the Astorians (1811-1813) lists braces and bits (Russell 1967). They would also have been available later at Forts Hall and Bridger as well as at the annual trappers' rendezvous. The suspension holes accept a modern 1/8-inch bit.

The three grizzly claw "beads" consist of the claw cores (including the articulating "knuckles") only, the keratin portion having decomposed. They are from a grizzly's front foot. Lengths range from 3.66-4.38 cm, widths 2.31-2.49 cm, and thickness 1.30-1.45 cm. One is a slightly more weathered than the others. The suspension holes were placed high, 2.0-3.8 mm below the articulating surfaces. The cores retain some of the thin bone of the knuckle bulge. The drilled claws were probably destined to be parts of a necklace. Whether they actually were worn is unknown. There are no obvious signs of wear from suspension, but wearing away of thinner bone around the holes may have caused loss of wear evidence. No other items of adornment (associated glass or bone beads) were found on-site. Grizzly claw necklaces were prized possessions of men in Plains and some Intermountain cultures, conveying aspects of power and status to their wearers. Claws were strung in different ways, sometimes with bone or glass beads only, often further embellished with otter fur. Mails (1991:373) illustrates a pair of plains claw and otter fur necklaces which he describes as "magnificent."

In May 1990, a carved deer antler pendant was collected from the channel of a spring-fed tributary of the upper Portneuf River about a mile east of the site that produced the grizzly

claws (Croney 1990). The antler tine appears to have been carved to represent a grizzly claw. There is evidence that an extensive late Shoshonean campsite was present both in the meadow and on the low ridge adjacent to the south side of the tributary. This evidence includes Desert Side-notched arrow points, pentagonal Shoshoni knives (Frison 1991), and Shoshone pottery. No contact items have been found.

The pendant was made from the tip of a substantial deer antler tine (species uncertain). A facet segment on the proximal end suggests that the tine was grooved around its circumference, and then snapped off the antler. It was subsequently heavily carved, especially on the ventral (concave) side, the cortical bone being pared down, leaving a prominent “knuckle” on the proximal end. On the ventral side the knuckle stands ca. 6 mm proud of the curved “claw.” This side of the pendant was carved flat as well, while the lateral and dorsal sides were smoothly rounded. The object was then polished, polish and fine transverse striations being visible on most surfaces. A metal knife may have been used in the carving process. A suspension hole was bi-conically drilled through the lateral sides of the knuckle, using a stone drill very near the proximal end of the pendant. It was then decorated. Four circular pits, arranged in vertical pairs, were conically drilled in each lateral face of the “claw,” and a series of transverse lines was incised between the pairs of pits using a thin sharp tool. A series of shorter, broader lines is present on each side toward the acute tip.

The pendant is 12.70 cm long around the dorsal curve (11.28 cm straight line), the knuckle is ca. 1.20 cm long, 1.80 cm wide and 1.63 cm thick. The knuckle is backset ca. 6 mm to mimic the shape of an actual claw. The flat ventral face of the pendant also resembles actual claw shape. The paired decorative pits were done with a stone drill, average ca. 4 mm in diameter and 3 mm deep. The upper pairs are placed ca. 1.50 cm below the knuckle, the lower pairs 2.50–2.70 cm below the upper ones. Paired pits are spaced 4–6.5 mm apart. Incised lines placed transversely between the pairs number 10 on one side, 14 on the other. A few are Y-shaped. Broad, shorter grooves toward the tip run together and are harder to interpret.

The suspension hole, placed very high on the pendant, has broken or worn through on one side and is completely broken away on the other, exposing the cancellous interior. Polish and very fine transverse striations are visible on most surfaces. There is a small amount of calcium carbonate present in the incised lines on one face, indicating that that side faced downward when the object was buried in the stream bank (Owsley et. al. 2014)

Blackfoot Reservoir Pendant

During the same spring run-off that produced the antler pendant, a right mandible and extreme posterior portion of a grizzly skull were recovered from Blackfoot Reservoir. These remains (Croney 1990) were identified using the morphology of the mandible (Glass 1951, Gilbert 1990). The mandible is 21.8 cm long and possesses all its cheek teeth except PM 4 (PM 1-3 were lost long before or were never present—common among older bears [Glass 1951]). All are heavily worn. Grizzlies are strongly sexually dimorphic, males being considerably the larger. Cranial measurements reflect this. Murie (1981) lists the length of a male Alaskan grizzly skull as 15.8 inches, that of a female 13 inches. Measurements are available for two male skulls from the southeast Idaho region,

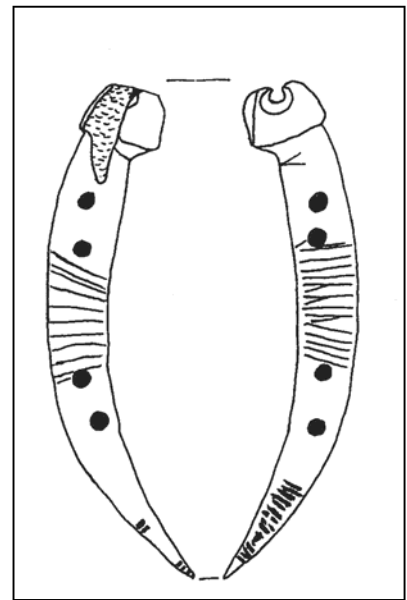


Figure 3. Blackfoot Reservoir pendant.

one set derived from Old Ephriam (Paradiso 1965), Utah's last grizzly, from Logan Canyon, Cache County, a few miles south of the Idaho line (Haynes and Haynes 1966, Schneider 2004), the other from a Caribou County, Idaho skull found eroding from a stream bank in 2002 (Morris and Wells 2004). The crania are virtually the same size, 39.3 cm long and 21.6-21.8 cm zygomatic breadth. Records indicate these bears were large but not huge for the species (Reneau and Spring 2011), probably close to the average size for males of the local race. The last grizzlies disappeared from the southern Caribou National Forest about 1920 (Varner 1945), around the time Ephriam was killed in northern Utah (1923). The Caribou County bear is believed to predate the 20th century (Reneau and Spring 2011).

Gilbert (1990) illustrates a grizzly skull and mandible apparently from a female. Cranial length is 32.4 cm, that of the mandible is 21.66 cm. Basic math shows that the mandible is precisely 2/3 the length of the skull. If proportions are similar in males, a bear's mandible would be ca. 26.2 cm long. Since the Portneuf mandible is 21.8 cm long, the cranial length would be ca. 32.7 cm. These remains are almost certainly female.

In 1973, during a survey of archaeological sites around the perimeter of the Blackfoot Reservoir, in central Caribou County, Christian Miss (1974) recorded a private collection made in the 1960's. Part of the collection came from an apparent eroded burial on a usually submerged island at the south end of the reservoir. Among the numerous associated artifacts was a large canine tooth pendant (ibid., Fig. 59-b) which Miss described as "probably bear." It exhibits 3 longitudinal grooves and a groove around the circumference of the root tip for suspension purposes. It was hoped that some aspect of measurement or morphology of the Portneuf canine might shed further light on the Blackfoot specimen. Unfortunately this hope was not realized. Although measurements are similar (Portneuf canine 6.86 vs Blackfoot 6.94 cm, width 2.16 vs 1.79, thickness 1.41 vs 1.28 cm), the Portneuf tooth is somewhat more robust than the Blackfoot specimen. It was originally longer as well, having lost length due to splintering and heavy canine-on-canine wear. The Blackfoot canine definitely comes from a bear. If it is grizzly it is not from an adult male but could originate from a smaller female or a juvenile. Since measurements of male black bear skulls, and presumably those of canines as well, overlap those of female grizzlies (Morris and Wells 2004), the pendant could originate from a large male black bear. Although species remain indeterminate, the pendant does illustrate another way in which local Native Americans acknowledged these formidable animals that were so much a part of their culture.

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