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Prehistoric Fishing in the Middle Rocky Mountains

Patrick M. Lubinski

ABSTRACT

Archaeological evidence for fishing continues to be rare in the Middle Rocky Mountain region despite numerous excavations in recent years. Regional fish assemblages are few, stone netsinkers rare, and other fishing artifacts virtually unknown. The paucity of fish remains may be the result of recovery methods or excavation location bias, but recent investigations along the Green River demonstrate a terrestrial subsistence focus even along major drainages. This stands in marked contrast with Reservation-era ethnographies that describe the importance of fish and other riverine resources.

Keywords: fishing; fish bone; fishhooks; notched pebbles.

Significant amounts of archaeological fishing artifacts and fish remains have been documented for several regions of the interior of western North America, primarily the Plateau (Butler 1993; Cressman 1960; Hayden 1997) and Great Basin (Butler 1996; Hunter 1991; Tuohy 1990). Relatively little evidence has been reported for the Rocky Mountain region. This paper summarizes the evidence for fishing in prehistory and ethnography, discerns patterns, and evaluates possible explanations.

THE STUDY AREA

The Middle Rocky Mountain region is a series of mountain ranges and intermontane basins encompassing much of Wyoming and portions of adjacent Montana, Idaho, Utah, and Colorado (Hunt 1967). This region contains the headwaters of a number of major river systems, including the Platte, Yellowstone, Missouri, Snake, Green, and Colorado. Since native fish species and abundances can vary widely between these stream basins, this paper will focus on a single basin, the Green River drainage (Figure 1). The Green River originates on the west and south slopes of the Wind River Range in northwestern Wyoming and flows south to join the Colorado River in Canyonlands National Park in southeastern Utah. The Green River is the longest tributary of the Colorado River system, draining about 41,000 square miles of Wyoming, Colorado, and Utah (Abeles 1995). Major tributaries of the Green include the Price, San Rafael, White, and Yampa rivers. Elevation ranges from about 12,000 feet at the headwaters of Wind River and Uinta mountain tributaries to about 4500 feet at its confluence with the Colorado.

The Green River Basin is characterized by wind, aridity, sunny days, short summers, and long winters. Mean annual precipitation varies from about 20 cm along the river to over 100 cm at the crests of mountains (Knight 1994). Permanent water sources are limited. Permanent streams generally are typical of Rocky Mountain drainages, with heavy cobble bedloads, swift currents, and wide, shallow channels. The few permanent lakes in the study area, all concentrated at the northern margin, are glacial remnants at the west flank of the Wind River Mountains. Vegetation today consists of desert shrublands at the lowest elevations, with sagebrush steppe, foothill woodlands, montane forests, and alpine tundra zones at increasing elevation (Knight 1994). The majority of the study area is in low elevation basins covered with desert shrubland and/or sagebrush steppe.

Native fishes of possible economic importance in the Green River Basin are limited to four families: Cyprinidae (the minnow family); Catostomidae (the sucker family); Salmonidae (the trout family); and Cottidae (the sculpin family). Many of the fishes present today in the region were introduced by state or federal wildlife managers in the past cen-

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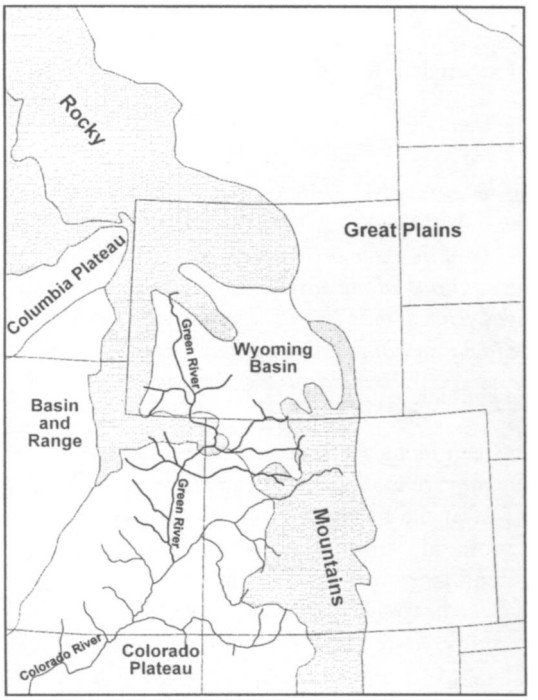

Figure 1. The Green River drainage basin in relation to physiographic provinces. Redrawn from Hunt (1967:Fig. 1.1).

tury. The primary native food fish in terms of size and abundance are chub minnows, Colorado pikeminnow, suckers, mountain whitefish, and cutthroat trout (Table 1). Many of these fishes are relatively small, but Colorado pikeminnow in excess of 25 pounds were being caught in the Green River until the 1930s (Quartarone 1995). Today, largely as a result of dam construction, four species of these fishes are endangered: the Colorado pikeminnow, bonytail chub, humpback chub, and razorback sucker (Beeny 1994).

THE ETHNOGRAPHIC RECORD OF FISHING

In the eighteenth and nineteenth centuries, the Green River basin was occupied primarily by bands of Shoshone and Ute, particularly the Eastern (Wind River) Shoshone and the Uintah and White River (Parusanuch and Yampa) Utes (Callaway et al. 1986; Shimkin 1986). According to ethnographic and ethnohistoric sources, bison was the prime food source for Shoshone groups (Hultkrantz 1961; Murphy and Murphy 1960; Shimkin 1947), and deer was the prime food source for Ute groups in the basin (Smith 1974:46). Fish were an important supplementary food resource for both groups during this period. For example, the explorer Escalante recorded in 1776 that a band of "Lagunas" (Uintah Utes) residing along a tributary of the Green River in the Uinta Mountains "depended on the said river's fishing for their more regular sustenance" (Velez de Escalante 1995:61). Fish, particularly trout, also are listed as one of five or six food staples for Washakie's (Wind River) Shoshone in the mid-1800s (Lander 1860:121-122 in Murphy and Murphy 1960:305; Shimkin 1947:265). Murdock (1967:110) estimates that the Wind River Shoshone relied on fishing for about 20% of their subsistence, while the Uintah Ute relied on fishing for about 30% of their subsistence. Rostlund (1952:206) estimates that the importance of fish ranged from a common staple to a rare supplement for Shoshone and Ute bands in the region.

Neither the Wind River Shoshone nor the Uintah Ute lived exclusively in the Green River Basin. The Wind River Shoshone spent much of the year to the east on the Great Plains or in the Wind River Basin (Shimkin 1986), while the Uintah Utes spent portions of the year to the west around Utah Lake, a productive freshwater fishery (Callaway et al. 1986; Janetski 1991). This means that the ethnographic record of fishing for these groups does not necessarily pertain to the Green River Basin. However, Escalante's account (above) specifically refers to a tributary of the Green River, and a number of Euroamerican fur trappers, explorers, and emigrants commented on the abundance of fish in several different tributaries of the Green River in the mid-1800s (Gowans 1976:144, 245; Gowans and Campbell 1975:11, 123). These ethnohistoric records imply that the general ethnographic pattern for these groups can be assumed to hold true in the Green River Basin.

Ute and Shoshone fishing methods in the 1800s included both individual and cooperative techniques. Recorded individual methods include the use of special spears and arrows, gorge and line, hook and line, and basket traps (Shimkin 1947:268; Smith 1974:61-63; Stewart 1942:249). Cooperative fishing usually involved a drive towards a constructed dam or weir, and collection of the

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Table 1. Native fishes of the Green River drainage[1]

species	common name	maximum size (cm)
Order Cypriniformes, Family Cyprinidae (minnows):		
Ptychocheilus lucius	Colorado pikeminnow[2]	183
Gila cypha	Humpback chub	41
Gila elegans	Bonytail chub	62
Gila robusta	Roundtail chub	43
Rhinichthys osculus	Speckled dace	11
Order Cypriniformes, Family Catostomidae (suckers):		
Catostomus latipinnis	Flannelmouth sucker	76
Catostomus discobolus	Bluehead sucker	46
Catostomus platyrhynchos	Mountain sucker	30
Xyrauchen texanus	Razorback sucker	91
Order Salmoniformes, Family Salmonidae (trouts):		
Prosopium williamsoni	Mountain whitefish	57
Oncorhynchus clarki pleuriticus	Colorado River cutthroat trout	79
Order Scorpaeniformes, Family Cottidae (sculpins):		
Cottus bairdi	Mottled sculpin	15

[1]Listed species after Baxter and Stone (1995), Behnke (1992), Page and Burr (1991), and Sigler and Sigler (1996). Lengths the larger of Page and Burr (1991) and Sigler and Sigler (1996).
[2]Colorado pikeminnow is the preferred name for what was previously called the Colorado "squawfish" (Nelson et al. 1998).

fish with dip nets, gunny sacks, or bare hands (Bourke 1891:341; Shimkin 1947:268; Smith 1974:62-63). Bourke's first-hand account of a fish drive completed by Washakie's band of Shoshone ca. 1876 is representative of cooperative fishing methods:

> The Shoshones were expert fisherman, and it was always a matter of interest to me to spend my spare moments among them, watching their way of doing things...[They] made the most of their opportunity to fill themselves with the delicious trout of the mountain streams. They did not bother much about hooks and lines, flies, casts, and appliances and tricks of that kind, but set to work methodically to get the biggest mess the streams would yield. They made a dam of rocks and a wattle-work of willow, through which the water could pass without much impediment, but which would retain all solids. Two or three young men would stay by this dam or framework as guards to repair accidents. The others of the party, mounted on their ponies, would start down-stream to a favorable location and there enter and begin the ascent of the current, keeping their ponies in touch, lashing the surface of the stream in their front with long poles, and all the while joining in a wild medicine song. The frightened trout, having no other mode of escape, would dart up-stream only to be held in the dam, from which the Indians would calmly proceed to take them out in gunny sacks (Bourke 1891:340-341).

THE ARCHAEOLOGICAL RECORD OF FISHING

Fish bone has been recovered at only 19 of the hundreds of excavated sites in the Green River drainage.[1] In the Wyoming portion of Green River Basin, identified fish occur in only four of 55 sites with radiocarbon-dated faunal assemblages. Of the sites with fish bone, five yielded only a single bone. Only three yielded more than 100 bones, with the largest assemblage containing almost 1000 specimens (Table 2). To put this into perspective, several sites in the Plateau and Great Basin have yielded over 200,000 fish remains each (Butler 1996:702; Cressman 1960 in Butler 1993:2). The largest calculated number of individuals at a Green River site is only nine fish (Lubinski 1999). Modified fish bone is recorded from one site (48SW304), where vertebrae of large trout were drilled and strung as beads (Frison 1971:266).

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Table 2. Prehistoric sites with fishing evidence in the Green River drainage[1]

site #	site name	notched pebbles	bone (NISP[2])	hooks	age range[3] (BP)	reference
Colorado:						
5MF1	Mantles Cave	-	-	3	1410-822	Burgh & Scoggin 1948
5MF16	Hells Midden	-	X/X	-	-	Lister 1974
5MF435	Duffy Shelter	-	1/1374	-	2437-215	Arthur 1985
5MF436	Empire State	-	976/2426	-	1610-285	Collins 1985
5RB204	-	-	X/X	-	-	Price 1978
5RB748	Edge	-	1/140	-	1020-445	LaPoint et al. 1981
Utah:						
42DA393	-	-	1/4944	1	1840-1050	McKibbin 1992
42DA685	-	-	3/231	-	1210-1120	Wilson & Loosle 1999
42UN1	Deluge Shelter	12	5/547	-	1720-945	Leach 1970
42UN57	Wholeplace Village	1	1/275	-	1360-1260	Birkedal & Hayden 1970
42UN63	Boundary Village	7	-	-	-	Leach 1966
42UN69	Cub Creek Village	2	-	-	-	Breternitz 1970a
42UN121	MacLeod	2	-	-	-	Breternitz 1970b
42UN199	Walton's Cist	-	-	1	1340-1240	Truesdale 1993:112
42UN2004	Steinaker Gap	-	66/204	-	1850-1580	Talbot & Richens 1996
42WN420	Cowboy Cave	-	-	1	1955-1435	Jennings 1980
Wyoming:						
48LN787	-	-	1/812	-	1440-1050	Sanders et al. 1982
48LN1468	Taliaferro	-	11/1265	-	1570-1110	Smith & Creasman 1988
48LN2068	Pescadero	34	170/6263	-	2010-1050	McKibbin 1995
48LN3202	-	2	-	-	-	Stainbrook 1996
48SU390	Bird Canyon	-	37/16557	-	410-40	Lubinski & Partlow 2000
48SU1006	Trappers Point	-	3/85775	-	7940-4950	Miller et al. 1999
48SU1042	Stewart Flat	-	9/1029	-	1370-1000	Hoefer 1991
48SW8	-	3	-	-	-	Day & Dibble 1963
48SW11	-	2	-	-	-	Day & Dibble 1963
48SW68	-	2	-	-	-	Day & Dibble 1963
48SW304	Eden-Farson	-	3/X	-	330-130	Frison 1971
48SW6454	Hugh	51	593/3774	-	1340-950	Kautzman 1999
48SW9251	Mann's Flat	-	21/7141	-	1620-970	Murray 1999
		118	1896	6		

[1] excludes sites with only a single notched pebble

[2] Number of Identified Specimens (Payne 1975). Numbers indicated are (fish bone specimens)/(total bone specimens) for the site.

[3] sum of one-sigma raw radiocarbon age ranges for deposits with fishing evidence

In the Green River Basin, fish identifications, if completed, normally include large numbers of unspecified sucker or chub minnow elements and small numbers of elements identified to genus or species (Table 3). Identified species include roundtail chub, Colorado pikeminnow, bluehead sucker, flannelmouth sucker, mountain whitefish, cutthroat trout, and mottled sculpin. Chub minnows and suckers dominate all assemblages. Trout and whitefish occur only in assemblages recovered from the upper, colder reaches of the system in Wyoming.

Fish generally make up small proportions of faunal remains even at sites where they occur. Of the sites with fish bone in Table 2, fish make up less than 5% of total site bone specimens in 13 of 16 cases (81%). The only exceptions are the Hugh site (16%), Steinaker Gap (32%), and Empire State site (40%). No site archaeofauna is dominated by fish remains.

Terrestrial mammals dominate regional archaeofaunas. Of 22,290 NISP (number of identified specimens, genus-level identifications) from 103 dated assemblages at 55 sites in the Wyoming

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Table 3. Summary of fish remains from sites in the Green River drainage.

site # (site name)	fish remains and recovery method	reference
Colorado:		
5MF16 (Hells Midden)	"fish bones are abundant" recovery: unspecified screen	Burgh & Scoggin 1948:28
5MF435 (Duffy Shelter)	1 NISP (unidentified) recovery: 1/4" screen	Arthur 1985:8.106
5MF436 (Empire State)	976 NISP total (719 unidentified; 91 Cypriniformes) (38 *P. lucius*; 81 *Gila robusta*) (37 *Catostomus latipinnis*; 10 *C. discobolus*) recovery: 1/4" screen	Miller & Behnke 1985
5RB204	undisclosed number of *C. latipinnis* and *Gila robusta* recovery: not reported, but probably 1/4" screen	Price 1978
5RB748 (Edge)	1 NISP (*Gila pandorae*)[1] recovery: not reported	LaPoint et al. 1981:V-106
Utah:		
42DA393	1 NISP (unidentified) recovery: 1/4" screen	McKibbin 1992:Table 27
42DA685	3 NISP (2 Cyprinidae; 1 Catostomidae) recovery: 1/4" screen	Wilson & Loosle 1999
42UN1 (Deluge Shelter)	5 NISP (including *P. lucius* and *Gila robusta*) recovery: 1/4" screen	Leach 1970
42UN57 (Wholeplace Village)	1 NISP (unidentified) recovery: unspecified screen	Birkedal & Hayden 1970
42UN2004 (Steinaker Gap)	66 NISP (unidentified) recovery: 1/4" and 1/8" screen	Richens et al. 1996:96
Wyoming:		
48LN787	1 NISP (unidentified) recovery: 1/4" screen and flotation	Sanders et al. 1982:177
48LN1468 (Taliaferro)	11 NISP (5 unidentified; 6 Catostomidae)[2] recovery: 1/4" and features 1/16" screen	Smith & Creasman 1988
48LN2068 (Pescadero)	170 NISP total (59 unidentified; 50 Cypriniformes) (6 Cyprinidae; 4 *Gila* sp.) (9 Catostomidae; 1 *Catostomus* sp.; 1 *C. latipinnis*) (1 Salmonidae; 25 *O. clarki*; 14 *P. williamsoni*) recovery: 1/4" and 5% sample 1/16" screen	Rood et al. 1995
48SU390 (Bird Canyon)	37 NISP; analysis ongoing recovery: 1/8" and 1/16" screen	Lubinski & Partlow 2000
48SU1009 (Trappers Point)	3 NISP (3 Cypriniformes)[2] recovery: 1/8" screen	Miller et al. 1999
48SU1042 (Stewart Flat)	9 NISP (8 unidentified; 1 *Prosopium williamsoni*)[2] recovery: 1/8" and features 1/16" screen	Hoefer 1991
48SW304 (Eden-Farson)	3 NISP (3 Salmonidae— drilled vertebrae beads)[2] recovery: 3/16" screen	Frison 1971

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Table 3. (continued)

48SW6454 (Hugh)	593 NISP total (249 unidentified; 238 Cypriniformes) (3 Cyprinidae; 11 *Gila* sp.) (38 Catostomidae; 15 *Catostomus* sp.) (12 Salmonidae; 27 *Prosopium williamsoni*) recovery: 1/8" and 5% sample 1/16" screen	Lubinski 1999
48SW9251 (Mann's Flat)	21 NISP total (5 unidentified; 7 Cypriniformes) (1 *Gila* sp.; 1 Catostomidae; 1 *Catostomus* sp.) (6 *Cottus bairdi*) recovery: 1/4", 1/8", and 1/16" screen	Lubinski 1999

[1] This identification is likely in error because this species is not native to the Colorado River system (Page and Burr 1991). Behnke (p.c. 1999) suggests that it is probably *Gila robusta* based on present fish distributions.
[2] Specimens reexamined and identified by the author for this paper.

Green River Basin faunal database, fish genera make up only 98 NISP (<1% of total). The five dominant genera in the archaeological record are bison (*Bison*), pronghorn (*Antilocapra*), jackrabbit (*Lepus*), cottontail (*Sylvilagus*), and ground squirrel (*Spermophilis*) in terms of ubiquity, proportion of aggregate NISP, and NISP rank order (Lubinski 1997, 2000). In terms of aggregate NISP, bison and pronghorn alone make up 14,710 NISP (70% of total), while the five top genera combined make up 20,496 NISP (92% of the total).

Like fish, other riverine animals are rare in regional archaeofaunas. Identified vertebrate riverine genera include beaver (*Castor*), muskrat (*Ondatra*), Canada goose (*Branta*), marsh duck (*Anas*), coot (*Fulica*), frog (*Rana*), and salamander (*Ambystoma*). These seven genera combined make up only 90 NISP (<1% of total). Shellfish are rarely identified or reported, but I doubt there have been more than 20 shells from the Wyoming portion of the Green River Basin. No turtles are native to the area (Baxter and Stone 1985).

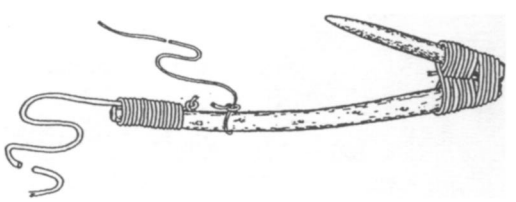

Figure 2. Diagram of a fishhook from Dinosaur National Monument (Burgh and Scoggin 1948: Fig. 11). The illustration is of a hook "about 1.5 inches long" recovered from Mantle's Cave.

Fishing artifacts include a few composite fishhooks and a number of notched pebbles interpreted as net weights. No netting, harpoons, leisters, or gorges are reported. The reported fishhooks include five complete specimens from dry caves or rockshelters (Burgh and Scoggin 1948; Jennings 1980; Truesdale n.d.) and one possible bone fishhook barb from an open site (McKibbin 1992). The complete fishhooks are made of wood or bone shafts with bone barbs bound to the shaft with cordage. The four specimens recovered from Dinosaur National Monument have curved wooden shafts and single barbs (Figure 2). All are about 3-4 centimeters in length (Burgh and Scoggin 1948:41; Truesdale n.d.). One was composed of a saltbush or shadscale (*Atriplex* sp.) shaft and flax (*Linum* sp.) cordage (Cummings 1992; Truesdale n.d.). The single specimen from Cowboy Cave, at the southern margin of the basin, consists of a bone shaft bound to two barbs in a manner resembling a boat anchor (Lucius 1980). Based on the size of these hooks, it seems likely that they were intended for larger fish. Similar composite fishhooks used by the Northern Paiute of Pyramid Lake, Nevada, in the late nineteenth and early twentieth century were about 1 cm long when intended for minnows and about 8 cm long for large trout (Fowler and Bath 1981).

Notched pebbles (Figure 3) commonly are assumed to represent fishing net weights, although some may be fishing line weights, net weights for

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non-fish nets, or other items (Rostlund 1952). In southwest Wyoming, a number of sites have yielded rather flat, rounded river pebbles and cobbles with transverse notches (McKibbin 1992; Kautzman 1999). At the Hugh site, these range from about 5 x 3 x 1 cm and 14 g to 11 x 8 x 3 cm and 287g (Kautzman 1999:Table 10.11). The largest numbers of such artifacts have been found at sites with fish remains (Table 2). Twenty of 28 known sites (71%) with notched pebbles are located along major permanent streams (Kautzman 1999). On the other hand, 21 of the 28 sites (75%) yielded only a single notched

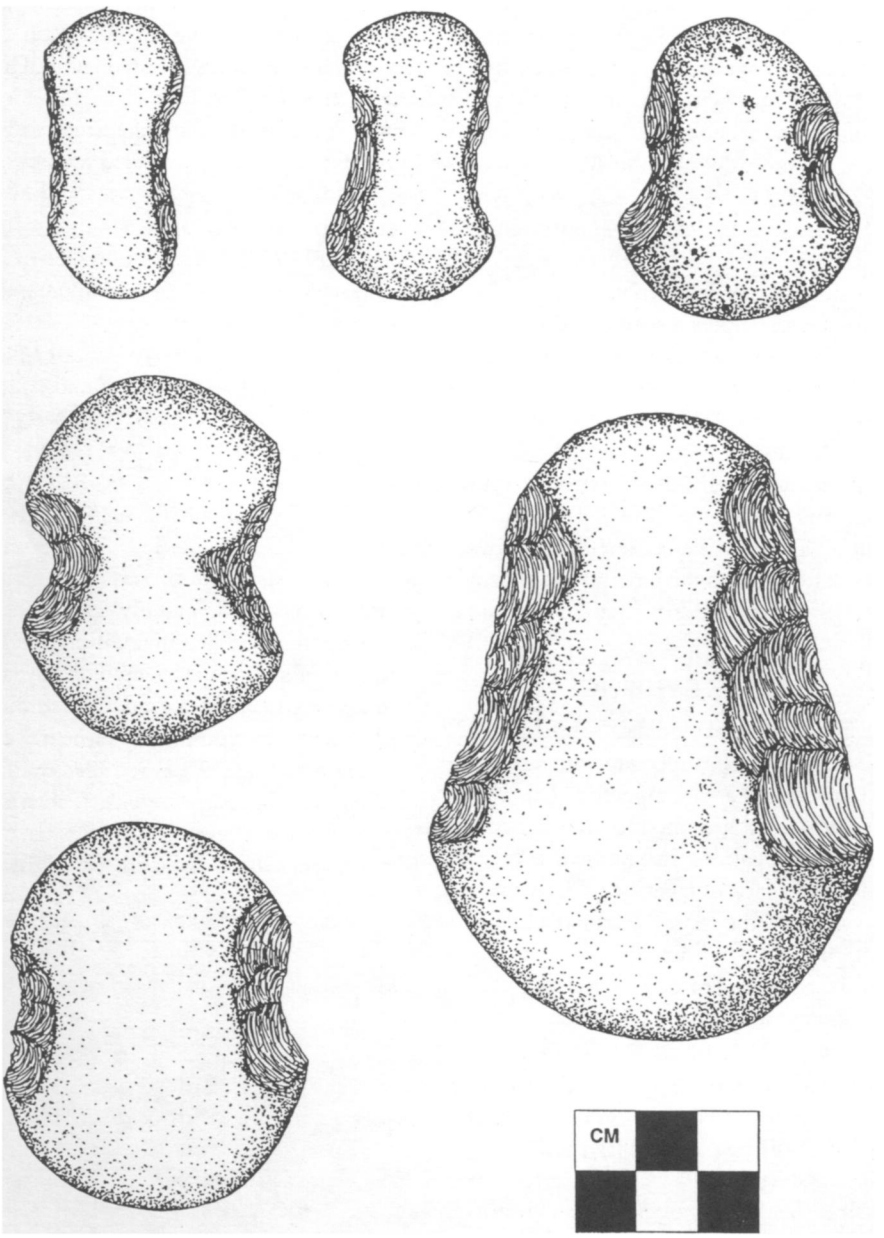

Figure 3. Selection of notched pebbles from the Hugh site in southwest Wyoming. Illustrations from Kautzman (1999).

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pebble (Kautzman 1999), and one site (48LN3202) with two notched pebbles is located over five miles (over nine kilometers) from the nearest permanent water source. Thus, it is uncertain at present whether all notched pebbles in the upper Green River drainage are in fact fishing artifacts.

No extant fishing features such as dams or weirs have been reported, but there are at least one fish pictograph and one petroglyph from northeastern Utah. The pictograph is a solid black fish outline about 50 cm long with two dorsal and two ventral fins and an upturned snout (Loosle 1999). The petroglyph is a more detailed illustration about 2 meters in length, showing a fish with two dorsal and two ventral fins and an upturned snout like the pictograph, but also a lateral line or stripe and a row of dorsal dots (Truesdale 1999). Neither depicted fish closely resembles a native species, but they may not be intended as realistic illustrations.

The prehistory of fishing in the Rocky Mountain region begins by 6300 BP, based on fish bone recovered from the Yarmony site on the upper Colorado River (Metcalf and Black 1991). Fish bone from the Trappers Point site in the Green River basin dates to about 5700 BP (Miller et al. 1999). However, all other dated sites in the Green River basin with evidence of fishing are less than 2500 years old (Table 2).

WHY SO LITTLE EVIDENCE?

Clearly, archaeological evidence for fishing in the Green River drainage basin is rare compared to the adjacent Great Basin and compared to expectations based on the ethnographic record. In fact, a recent series of excavations in southwest Wyoming has indicated a lack of riverine focus even at sites on the banks of the Green River (Lubinski 1999). Although one site within a mile of the river yielded significant numbers of fish remains, the remaining five sites, with over 18,000 bone specimens, yielded only 23 fish bones (Lubinski 1999). Possible explanations for this pattern include culinary preferences, archaeological sampling, lack of preservation, geomorphology, fishery production, and culture change.

It is possible that fish simply were rarely eaten due to cultural prohibitions or culinary preferences. For example, many Apaches reportedly avoided fish because of their smooth, scaly surface (Bourke 1891:340; Opler 1983:431); however, the available ethnographic record indicates that this is unlikely for the study area, at least for the past few hundred years.

The pattern could result simply from a combination of archaeological sampling problems, particularly the small number of excavations adjacent to major permanent streams, and the inconsistent use of fine-mesh screen that could recover large numbers of fish remains. Quarter-inch screen, the standard mesh size for the region, is simply too large for adequate recovery of Green River drainage fish bones, and fewer than 15% of regional fauna-bearing excavations have involved systematic use of eighth-inch or finer mesh (Lubinski 1997:93). The importance of screen size to fish bone recovery can be demonstrated in several ways (Figure 4). For example, excavations at the Pescadero site employed quarter-inch screening for 95% of the site matrix and sixteenth-inch screening for a 5% sample, but nearly half of the total number of fish bones were recovered from the sixteenth-inch screen samples (Rood et al. 1995:172). By comparison, at the Hugh site, where most material was passed through eighth-inch screen, a 5% sample of sixteenth-inch screened material accounted for only 8% of the total fish bone (Lubinski 1999). In addition to affecting the amount of fish bone recovered, the use of quarter-inch screen can affect taxonomic distributions, with small taxa being completely or nearly completely lost (Thomas 1969; Grayson 1984; Shaffer 1992).

Preservation has a strong affect on all archaeological materials, and it is possible that evidence of fishing is less likely to be preserved than evidence

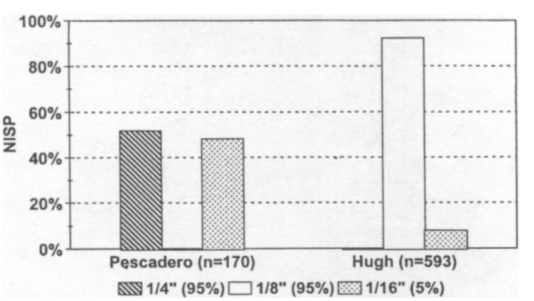

Figure 4. Effect of screen size on fish bone recovery at two sites in southwest Wyoming.

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of other subsistence pursuits. Fishing artifacts are primarily made of perishable materials unlikely to last in most settings. Fish bones are smaller, more delicate, and less dense than the mammal bones that tend to dominate regional sites.

Although differential preservation undoubtedly plays a role, this explanation is inadequate to completely explain the paucity of evidence for fishing in prehistory. First, it appears that fishing artifacts are rare even when compared to other perishable subsistence artifacts. For example, among perishables recovered from caves and rockshelter sites, there are only five hook and line specimens but 125 snares from Mantle's Cave alone (Burgh and Scoggin 1948:41). Second, all archaeological fish bones I have observed from the area have been in good condition (only slightly weathered), implying that soil conditions at those sites were amenable for preservation of additional fish bone. Third, remains of microfauna (e.g., mice, squirrels, small birds, amphibians and reptiles) similar to the size of fishes are recovered at sites with no fish remains.[2] Finally, fish bones under some conditions may actually be better preserved than larger bones. Based on some experiments, Nicholson (1996:529) argues that "after burial larger bones may sometimes be rendered unidentifiable, or even completely lost, more rapidly than smaller, apparently more fragile ones," because of potential differences in the effect of adhering tissue on buried bones. In any event, preservation should not be assumed to be the cause of the paucity of fish remains until other likely explanations have been eliminated. This should consist minimally of evaluating the effects of recovery method and sampling location.

Another possible explanation is that the major drainages in the Green River system may have seen significant geomorphic change during the Holocene, so that most ancient riverside sites are either eroded away or deeply buried and archaeologically invisible. Recent geomorphic work along the Green River in Wyoming suggests that sites in valley fan settings over 500 years old are likely to be deeply buried. Preserved river terraces seem to be less than 1800 years old. Valley bottom sites over 1800 years old are likely to have been eroded away by lateral stream movement under Neoglacial climatic regimes (Eckerle 1999).

It seems likely that part of the explanation for a general lack of evidence for prehistoric fishing is that the fisheries of the upper Colorado River system are relatively unproductive compared to other systems in western North America. For example, the upper Colorado system lacks the large concentrations of fish provided by salmon runs in the Plateau and schooling fish in Great Basin lakes (e.g., tui chub, see Raymond and Sobel 1990). Rostlund (1952:Map 45) estimates that the annual amount of available fish varied from less than 50 pounds per square mile in the Rocky Mountains and western Plains to 100-200 in certain Great Basin lake systems to 800-1000 on the Northwest Coast and Plateau. Nonetheless, this does not address the apparent shift in the importance of fish from prehistory to history.

In fact, the rift between subsistence as indicated by archaeology and subsistence as indicated by ethnography is not limited to fishing. Elk (*Cervus elaphus*) is described as a key resource in the 1800s by both Lander (1860) and Shimkin (1947), and the latter author also lists beaver (*Castor canadensis*) and mule deer (*Odocoileus hemionus*) as staples. However, fish, elk, beaver, and deer combined make up only 1.5% of specimens identified to genus in southwest Wyoming archaeological bone assemblages. On the other hand, bison (*Bison* sp.) and pronghorn (*Antilocapra americana*) are key resources in both the archaeofaunal record and the ethnographic record (Lubinski 1997).

Native subsistence changed significantly during the eighteenth and nineteenth centuries, initially as a result of the introduction of the horse (Haines 1938; Lang 1979). Later, restricted mobility as a result of the influx of hostile tribes from the east, Euroamerican encroachment, and establishment of reservations would have required additional changes to subsistence. The increased use of fish suggested ethnographically is a potential response to restricted mobility, as preferred resources become less available to people with a shrinking territory. An increased use of beaver could be explained by the same process, the development of the international fur trade, or both. The change in the use of elk and deer, however, cannot be explained by these processes, if one assumes that such large animals would have been preferred re-

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sources whenever encountered.

Based upon the present archaeological and ethnographic evidence, there appears to be a significant shift in subsistence, including an increased use of fish, from 300-100 years ago in the Green River drainage basin. The relative paucity of evidence for fishing in prehistory may be due to a combination of archaeological sampling, lack of preservation, geomorphology, and culture change. Future work involving fine-scale recovery techniques, excavation of protohistoric sites, and geomorphology will allow us to evaluate the apparent pattern and elucidate causes of subsistence change in this period.

NOTES

1. The Skull Point site (48LN317; McGuire 1977) fish bones are excluded from this discussion because they appear to be from modern rather than aboriginal contexts. There are three reasons for this interpretation. First, they were recovered from Trench 5, which is "all mixed with plastic, foil, cans, etc." according to McGuire's (1976) field notes. Second, my reanalysis of the bones indicates that they include carp (*Cyprinus carpio*), a species not introduced into the United States until 1831 (Page and Burr 1991:64). Third, although the modern Elkol reservoir is adjacent to the site, no nearby natural water source is large enough to produce large carp or large trout like those I observed in the assemblage.
2. Of course, these microfaunas may be non-cultural intrusions indicating nothing about potential preservation of cultural bone deposits.

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