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# FISH REMAINS

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Several regional syntheses (e.g., Ames et al. 1998; Schalk and Cleveland 1983) have noted the presence of fish remains at Marmes Rockshelter. However, until the current project, fish bones from the site had not been studied in any detail. Given that many questions about regional human subsistence change turn on establishing the relative importance of fish vs. terrestrial mammals, the changing role of salmon, and whether Holocene environmental change affected salmon abundance and distribution, studying the fish remains from this early site is extremely worthwhile. The recovery of fish remains from the Marmes Rockshelter and adjacent floodplain provides an opportunity to explore some of these questions. The remains described represent some of the earliest, well documented archaeological fish remains from the Columbia Plateau and as such, provide a very important record of fishes in regional streams as well as human resource use patterns.

### Methods and Materials

The fish remains collected from the rockshelter and floodplain areas of the site were sampled in very different ways. Remains from the rockshelter were recovered during all four of the 1960s excavation field seasons. Excavated matrix was sieved dry, through ¼-inch mesh screens. However, during 1968, sediments in the upper strata were quickly removed and not screened and faunal recovery was limited. Given these recovery concerns as well as time and budgetary constraints, only a sample of the fish remains from the rockshelter were selected for study (see Chapter Two, *Sampling* for description of the sample).

At the floodplain locale, detailed excavation focused only on the Late Pleistocene/early Holocene sediments. Larger artifacts and faunal items recovered by the excavators were bagged separately, but most of the excavated sediment was water screened through 1-mm mesh. The screen residue retained from each unit level was dried and bagged as a bulk sample. For the

current study, many of the bulk samples were sorted (Gustafson and Wegener 1998) and found to include fish remains along with other cultural material.

Stratigraphic unit information was used in this analysis where available. In many cases, however, field assignments were not made. Using depth, spatial coordinates and redrawn stratigraphic profiles for reference, Hicks assigned these materials to stratigraphic units and suggests these represent only provisional records of vertical position because they are not based on field observations (see Chapter Two).

Remains were identified to the finest taxonomic level using Butler's comparative collections from the Columbia Basin and adjacent regions in western North America. Because of their very small size, most of the floodplain faunal remains were identified using low power magnification (10-20x). Fish remains were quantified using Number of Identified Specimens (NISP) (Grayson 1984). For Cypriniformes (minnow and sucker) vertebrae, the first two and last vertebrae on the column were distinguished; definition of abdominal and caudal vertebrae, which represent most vertebrae on the column, follows Wheeler and Jones (1989). Salmonid vertebrae were assigned to four categories based on morphological difference associated with position on column (Butler 1993).

To estimate variation in body size of fishes represented, the width (measure labeled as diameter, shown in Casteel (1976:84) was measured using digital calipers or a micrometer within the microscope.

All of the specimens were examined for evidence of burning. For several of the specimens from the floodplain, it was difficult to determine whether a dark color reflected burning or staining that might result from absorption of minerals in the surrounding matrix. The decision to call a specimen burned was based on conservative criteria: only those specimens which were uniformly black or calcined (white/blueish cast) were called burned.

## Descriptive Summary of Fish Remains

The following information describes the criteria used in assigning the specimens to taxonomic category as well as information on ecology and habitats. Descriptions are provided for each order of fishes identified. Appendix N presents the analysis data.

### Class Osteichthyes - Bony Fishes.

#### Order Acipenseriformes

##### Family Acipenseridae - sturgeons

##### *Acipenser* sp. - sturgeon

Materials: *Rockshelter*: 1 scute.

Remarks: Two species of sturgeon are known for western North America, *A. medirostris* (green sturgeon) and *A. transmontanus* (white sturgeon). Green sturgeon are known today only from brackish waters of the lower 40 miles of the Columbia and fully marine environments, while white sturgeon are documented throughout the river system, including the upper Columbia and Snake Rivers. Based on habitat preference and modern distribution, the scute (or bony body scale) is most probably from the white sturgeon.

#### Order Salmoniformes

##### Family Salmonidae—Salmons, Trouts, and Whitefish

Materials: *Floodplain*: 1 indeterminate vertebra type, 2 vertebra type-3.

##### *Oncorhynchus* sp. - Salmon and Trout

Materials: *Rockshelter*: 1 basipterygium, 2 vertebra type-1 or atlas, 13 vertebra type-2, 10 vertebra type-3, 2 vertebra type-4, 1 indeterminate vertebra type, 65 vertebra fragments: 94 specimens.

*Floodplain*: 2 gill rakers, 10 vertebra fragments: 12 specimens

##### *Prosopium williamsoni*—Mountain Whitefish

Materials: *Floodplain*: 1 vertebra type-3

Remarks: There are ten species of salmon, trout and whitefish with records for the Columbia basin upriver of the estuary. The genus *Oncorhynchus* is represented by six species of anadromous and resident forms. The *Oncorhynchus* specimens from the site were assigned based on their large size, or, for the vertebrae, distinctive shape and fenestration pattern. A single vertebra was assigned to *Prosopium williamsoni*; the centrum of this

species bears a series of horizontal struts, rather than the fenestrations characteristic of *Oncorhynchus*. A second species of *Prosopium* known for the Columbia basin, *P. coulteri* (Pygmy whitefish), reaches much smaller adult size than *P. williamsoni*. The archaeological specimen was assigned to *P. williamsoni* based on its large size.

Two vertebrae (inventory numbers 18987 and 18953) of very similar shape and size could not be identified below the family level. They are from a small salmonid (vertebra diameter is about 1.5 mm). As an indication of body size, a modern fish of *Salvelinus malma* (Dolly Varden) measuring 216 mm in total length has vertebra type-3 with widths that range between 2.5 and 3.0 mm, suggesting that the archaeological samples are from fish smaller than 200 mm. Both vertebrae have very large openings for the notochord (diameter of opening is about .5 mm), which is not characteristic of *Oncorhynchus* or *Prosopium*. The specimens most closely match *Salvelinus*, which includes the Bull trout, *S. confluentus*, and Dolly Varden, *S. malma*. However, the notochord opening for the archaeological specimens is larger than that found on available comparative specimens, and thus the materials were assigned to the family level.

Historically, the Snake River and several tributary rivers and streams provided extensive spawning habitat for migratory species of *Oncorhynchus*, particularly *O. tshawytscha* (chinook), *O. nerka* (sockeye), and *O. mykiss* (steelhead or rainbow trout) (Parkhurst 1950). Vast numbers of spring and summer runs of chinook used the Snake River upriver from the Palouse River as a passage way to spawning grounds in tributary rivers and streams; the fall run chinook used extensive spawning habitat in the main stem Snake River between the Palouse River and Hells Canyon (Fulton 1968). According to fishery documents, the Palouse River itself, however, was, at least historically, not used by spawning salmon (Fulton 1968). In his fisheries survey and historic overview of Snake River Basin anadromous fishes, Parkhurst (1950) did not survey the Palouse River. He notes that a high falls (Palouse Falls) located about 10 km above the mouth "renders the stream inaccessible to migratory fish" (1950:5).

Ethnographic records show that salmon fishing was extremely productive at the confluence of the Palouse and Snake Rivers (Ray 1975). Lewis and Clark and later explorers describe a very large village at the mouth of the

Palouse River. Ross Cox, who spent time in the village around 1812, noted that in early August, people there were engaged in catching and drying salmon in large numbers (Ray 1975). Historic documents also show fishing camps and villages along the Palouse River itself (Ray 1975). Ray refers to two such locales in particular: *A'patap*, which was located at the foot of Palouse Falls, and *Claxo'pa*, about four miles above the mouth. Unfortunately, the documents do not indicate whether the Native American fishery along the Palouse River targeted resident freshwater fishes or anadromous salmon and trout.

The falls have been a barrier to migratory salmonids at least since the late Pleistocene and Holocene periods, thus it is clear that the Palouse River itself was not a passageway for fish migrating to headwater areas to spawn. It is possible of course that the Palouse River channel below the falls was used by salmon for spawning and thus a fishery might have developed to target such fishes. One would need to evaluate the potential stream conditions (bed morphology, temperature, flow patterns) to establish whether the lower Palouse once provided suitable spawning habitat. For now, the pre-dam records for fish distribution lead to the conclusion that the Palouse River never supported large salmonid populations.

#### Order Cypriniformes

##### Family Cyprinidae—Minnows

Materials: *Rockshelter*: 1 basioccipital, 1 basisphenoid, 1 exoccipital, 1 interopercle, 4 endopterygoids, 3 metapterygoids, 3 opercles, 3 parasphenoids, 3 preopercles, 1 prootic, 1 pterosphenoid, 6 cleithra, 1 coracoid, 3 basiptergia, 11 pharyngeals, 5 1<sup>st</sup> vertebrae (atlas), 4 2<sup>nd</sup> vertebrae, 4 abdominal vertebrae: 56 specimens.

Floodplain: 3 articulars, 2 basioccipitals, 2 ceratohyals, 2 epihyals, 1 hyomandibula, 4 opercles, 1 parasphenoid, 1 pterotic, 2 quadrates, 1 urohyals, 6 cleithra, 97 pharyngeals and pharyngeal teeth, 17 1<sup>st</sup> vertebrae (atlas), 9 2<sup>nd</sup> vertebrae, 11 1<sup>st</sup> or 2<sup>nd</sup> vertebrae, 2 abdominal vertebra: 161 specimens.

##### *Ptychocheilus oregonensis*—Northern Pike Minnow

Materials: *Rockshelter*: 2 basioccipitals, 4 ceratohyals, 1 dentary, 8 hyomandibulae, 2 maxillae, 1 palatine, 1 urohyal, 1 vomer, 9 pharyngeals: 29 specimens.

Floodplain: 5 dentaries, 3 pharyngeals: 8 specimens.

##### *Acrocheilus alutaceus*—Chiselmouth

Materials: *Rockshelter*: 1 dentary, 2 hyomandibulae, 1 prootic.

Floodplain: 1 dentary, 1 pharyngeal.

##### *Mylocheilus caurinus*—Peamouth

Materials: *Floodplain*: 5 pharyngeals.

##### *Richardsonius balteatus*—Redside shiner

Materials: *Floodplain*: 1 pharyngeal.

##### *Rhinichthys* sp.—Dace

Materials: *Floodplain*: 2 pharyngeals.

##### *Rhinichthys/Richardsonius*

Materials: *Floodplain*: 2 pharyngeals.

#### Family Catostomidae

##### *Catostomus* sp.—suckers

Materials: *Rockshelter*: 1 basioccipital, 1 exoccipital, 1 hyomandibula, 3 endopterygoids, 3 metapterygoids, 1 palatine, 1 parasphenoid, 1 parietal, 1 preopercle, 2 prootics, 1 sphenotic, 1 urohyal, 1 vomer, 9 cleithra, 2 coracoids, 5 pharyngeals, 3 1<sup>st</sup> vertebrae, 6 2<sup>nd</sup> vertebrae: 42 specimens.

Floodplain: 3 basioccipitals, 3 ceratohyals, 2 dentaries, 1 epihyal, 1 hyomandibula, 1 metapterygoid, 2 opercles, 1 palatine, 1 quadrate, 1 urohyal, 1 vomer, 8 cleithra, 15 pharyngeals and pharyngeal teeth, 15 1<sup>st</sup> vertebrae, 5 2<sup>nd</sup> vertebrae: 60 specimens.

##### *C. macrocheilus*—Largescale sucker

Materials: *Rockshelter*: 2 dentaries, 1 hyomandibula, 2 maxillae, 3 palatines, 1 quadrate: 9 specimens.

Floodplain: 1 maxilla.

##### *C. columbianus*—Bridgelip sucker

Materials: *Floodplain*: 1 maxilla.

#### Cyprinidae/Catostomidae

Materials: *Rockshelter*: 105 abdominal vertebrae, 66 caudal vertebrae, 3 indeterminate vertebra type, 11 vertebra fragments: 185 specimens.

Floodplain: 2 hyomandibulae, 2 scapulae, 5 pharyngeals and pharyngeal teeth, 5 1<sup>st</sup> or 2<sup>nd</sup> vertebrae, 418 abdominal vertebrae, 374 caudal vertebrae, 14 ultimate vertebrae, 24 indeterminate vertebrae type, 659 vertebra fragments: 1,503 specimens.

**Remarks:** Nine species of Cyprinidae are known historically for the Columbia Basin (Lee et al. 1980). Several elements of the jaw, pharyngeal arch (toothed bone at the rear of the mouth) and lateral face are extremely distinctive and species or generic assignments of sufficiently complete specimens was possible. Six species of *Catostomus* are known for the Columbia-Snake River Basin (*C. macrocheilus*, *C. columbianus*, *C. platyrhynchus*, *C. catostomus*, *C. discobolus*, *C. ardens*). The specimens assigned to species very closely matched the reference material. However, reference material was lacking for *C. discobolus* (known in the Snake River only above Great Falls) and *C. ardens* (found in the Snake River above Shoshone Falls) so the assignment of remains to *C. macrocheilus* and *C. columbianus* is somewhat provisional.

Except for the first and second vertebra on the column, which can be distinguished as Cyprinidae or *Catostomus*, vertebrae from these taxonomic groups cannot be distinguished, so the joint category, Cyprinidae/Catostomidae, was used. In a few cases, abdominal vertebrae were fused to the second vertebra and these abdominal vertebrae could be identified to a finer taxonomic level. Finally, several extremely eroded cranial and postcranial specimens could not be identified more precisely than Cyprinidae/Catostomidae.

Fishes in the Cypriniformes order occupy a wide range of habitats but in general terms tend to occupy more slowly moving, warmer waters than salmonids. Of the cyprinids identified at Marmes, *Ptychocheilus oregonensis* (northern pike minnow) favors slow to moderate currents in streams and prefers the warmest temperatures in the waters it occupies (Wydoski and Whitney 1979). *Acrocheilus alutaceus* (chiselmouth) also prefers warmer areas of streams in moderately fast to fast moving waters (Wydoski and Whitney 1979). Most studies of *Mylocheilus caurinus* (peamouth) have focused on lake populations. In Lake Washington (Seattle, WA), peamouth tend to occupy the warmest water, favoring deep water during the winter and moving inshore during spring and summer (Wydoski and Whitney 1979).

*Catostomus* species are bottom fishes, feeding on algae or bottom dwelling invertebrates. Both *C. macrocheilus* and *C. columbianus* occupy quiet areas in the backwaters or edges of the main current of streams (Wydoski and Whitney 1979). During spawning season of largescale sucker, which occurs usually in April or May, large schools are found along river edges. Spawning usually

occurs in shallow water along the downstream ends of pools.

## Results

Before reviewing results of analysis, it is important to consider several aspects of archaeological recovery and curation that have biased the fish assemblage available for this study. Early reports on excavation procedures note that ¼-inch mesh screens were used during each of the four field seasons at the site (Gustafson 1972). The effects of screen size on fish faunal recovery in the rockshelter cannot be directly documented given that bulk samples are not available for analysis. However, the presence of *very small* fish remains from the floodplain bulk samples (see below) and abundant research elsewhere (Butler 1987a; Casteel 1972; Gordon 1993), suggests that use of large mesh screens in the rockshelter has biased the sample in favor of relatively large-bodied fishes. Besides screen size bias, however, which can be estimated to some extent, other recovery practices suggest the collected sample may bear a very poor relationship to the target population of fish remains in the rockshelter deposit. An early document describing field procedures notes that "not all bone fragments were saved during the early seasons of excavation" (Gustafson 1972:54). Unfortunately, field records are not available that indicate the extent of this practice or which excavated areas are particularly affected, thus it is difficult to control for this problem.

Also, there are discrepancies between this author's records of fish taxa and relative abundance and those of previous researchers (Gustafson 1972), which suggest that the sample available for this study may be different from that originally excavated. Gustafson notes "Salmonid vertebrae and other fish remains sometimes are abundant (particularly in the storage pit areas—Units VI and VII)" (1972: 106). As noted below, salmonid remains in the recently analyzed sample are most common in Stratum V, where they represent over 60% of the fish fauna; in Stratum VI, a *single salmonid* specimen was identified and in Stratum VII, about 15% of the fish remains are from salmonids (emphasis mine). In addition, there is a discrepancy in the species reported in Gustafson (1972) and identified in the current study sample. Gustafson sent a sample (from unknown provenience) of fish remains to

William Taylor (U.S. National Museum) who identified two species positively: *Ptychocheilus oregonense* (= *oregonensis*) and *Mylocheilus caurinus*. This author identified *Ptychocheilus* in the Rockshelter sample and other cyprinids, but not *Mylocheilus*. *Mylocheilus* has extremely distinctive jaw and pharyngeal morphology; it is unlikely that the discrepancy reflects analyst identification error. Given all of the other documented losses—both of specimens and provenience—associated with the rockshelter assemblage (Hicks and Moura 1998), it appears likely that the differences in reporting result from the current study's sample not including all of the fish remains that Taylor and Gustafson examined. It appears that parts of the recovered fish assemblage have become misplaced or lost over the 40+ years since the inception of the project.

In sum, given the documented and indirectly suggested biases associated with the fish bone sample for this study, it would be unwise to assume the materials reported on here are representative of the fish bones in the rockshelter deposits. In terms of quantification, it is most appropriate to treat the fish assemblage at the nominal scale only rather than ordinal or ranked scale. That is, it is best to view the fish record as a list of taxa present rather than use NISP values to examine relative taxonomic importance. Similarly, given that there is no control over

field recovery loss or curatorial loss across the site deposits, interpretations about changing frequencies of fish taxa within the site will be tentative, since the changes could result from sampling problems.

#### Rockshelter Fish Remains

A total of 688 fish remains were identified from the rockshelter (Table 11.1). About 60% of these (420 specimens) could be identified to a taxonomic level below fish and eight taxa are represented. Freshwater minnows and suckers (Cyprinidae, Catostomidae) dominate the assemblage. *Ptychocheilus oregonensis* (northern pike minnow) is the dominant freshwater species represented; *Catostomus macrocheilus* (largescale sucker) is the sole species of sucker present. Large-bodied salmonids (*Oncorhynchus*), almost certainly from migratory runs, represent 13.7% of the collection and a single specimen from sturgeon is present. As noted above, it is problematic to assume the relative abundance of fish taxa in the rockshelter is representative of the target population of fish remains in the site deposits. For now and until better control of the biases is achieved, it is best to treat these data at the nominal scale.

Table 11.1 Frequency of fish remains by taxon, rockshelter.

Taxon	Rockshelter	
	NISP <sub>i</sub>	%
<i>Acipenser</i> sp.		
<i>Oncorhynchus</i> sp.		
Cyprinidae		
<i>Ptychocheilus oregonensis</i>		
<i>Acrocheilus alutaceus</i>		
<i>Catostomus</i> sp.		
<i>Catostomus macrocheilus</i>		
Cyprinidae/Catostomidae		
Unidentifiable		
Total		

**Taphonomy and Origin of Fish Remains.** In evaluating the significance and meaning of a faunal assemblage in cultural terms, it is first necessary to establish that the remains in fact result from human activity (Grayson 1991; Lyman 1994). Geological study of the site matrix suggests that the source of the site deposits is primarily eolian, with endogenous roof fall and human occupational debris contributing matrix as well (see Chapter Five). There is no evidence for fluvial deposition in Stratum I and above, so the possibility that fish remains represent flood rafted carcasses can be eliminated. Potentially nonhuman terrestrial or avian scavengers or predators of fish could have brought whole fish or fish parts to the rockshelter. It is unlikely that the salmon (*Oncorhynchus* sp.) remains entered the rockshelter this way, however. As noted previously, the Palouse River probably never supported anadromous salmon runs; the nearest source of these fish would be over a mile away in the Snake River. It is unlikely that nonhuman scavengers would have transported the salmonid carcasses or parts this distance. Perhaps significantly, Gustafson (1972) recorded specimens from *Canis cf. latrans* (probably coyote) in each of the rockshelter strata (1972:Table 5.1), which suggests that at least one carnivore that is known to eat fish (Butler and Schroeder 1998) lived in the vicinity of the rockshelter. However, Gustafson does not note any evidence for carnivore damage on the large mammal bones (Gustafson 1972; Gustafson and Wegener 1998), although, the absence of this observation may indicate this surface attribute was not examined, rather than a real absence of carnivore damage. Time and budgetary constraints prevented carrying out a detailed study of surface modification of fish bone for the current study. However, a small grab sample of fish remains (about 15 specimens) was examined under 10-20 power magnification and did not reveal any patterns indicative of digestive process (Butler and Schroeder 1998—dark staining, rounding, erosion, vertebra compression). One specimen showed sign of rodent gnawing but none exhibited sign of carnivore processing.

Sometimes burning is used to link a faunal assemblage to human activity (Balme 1980; Butler 1990). Burned bone can result from natural fires, but if widespread burning is not indicated (multiple artifacts and sediments do not show evidence of burning), then it is reasonable

to argue that cultural agents burned the bone in question. It is of course possible that even if cultural practice is responsible for the burning, the burning *postdates* the natural deposition of faunal remains. These concerns are moot for the Rockshelter fish remains; only one specimen from the rockshelter (Inventory No. 9199, in Stratum I) was burned, so this in itself does not provide particular support either way.

Another potential way to examine fish bone origin and site formation processes would examine spatial distribution of fish bones relative to other classes of animal remains and clearly modified objects or feature context. If fish bone abundance varied in concert with abundance or distribution of modified objects or feature context, then it would be possible to argue for a common source, humans. Unfortunately, given the variation in collection procedures across excavation units and strata, it will be difficult to use fish bone abundance and distribution to evaluate taphonomic questions.

In sum, while a definitive conclusion about the origin of the fish bones in the rockshelter is not possible, several factors and conditions support the human role in forming the fish deposit, including the lack of carnivore damage on the sample examined, the lack of discussion of carnivore damage in previous faunal reports (Gustafson 1972; Gustafson and Wegener 1998), and the presence of fish taxa that were likely not available in the nearby river.

**Intra-site variation.** Table 11.2 shows the frequency of taxa across the 14 strata (and aggregate strata as assigned in the field and laboratory) in the rockshelter. Table 11.3 shows the frequency of taxa for the three stratum units that contained most of the fish remains—V, VI, and VII. For temporal reference, Mazama tephra underlies Stratum V, which is a mixed deposit containing some Mazama tephra along with other windblown sediments and provided a single radiocarbon date (4250 ± 300 B. P.). A number of radiocarbon dates were obtained from Strata VI and VII, providing radiocarbon ages ranging between 1940 and 660 B. P. (Sheppard et al. 1987). In general terms, the earliest Stratum V likely represents a time span from about 6,800 years ago to about 4,000 years ago. Stratum VI likely spans the time period from 1300 to 1940 B. P. and Stratum VII represents an age of between 660 and 1600 B. P. (Sheppard et al. 1987; Gustafson and Wegener 1998).



As shown in Table 11.3, there is some striking variation in taxonomic representation across the three stratigraphic units, particularly in the relative frequency of *Oncorhynchus* sp. Unit V is dominated by *Oncorhynchus*, which represents over 60% of the fish remains in the unit. In Unit VI, *Oncorhynchus* is represented by a single specimen and resident freshwater fishes comprise most of the collection. In Stratum VII, freshwater fishes still dominate (with about 85%), but the abundance of *Oncorhynchus* is greater than in Stratum VI. A Chi Square contingency test shows that these differences are significant ( $X^2 = 129.70$ ,  $p < .0001$ ); all of the resident freshwater taxa in each stratum were aggregated to compensate for small sample sizes. These differences might reflect site based or region-wide changes in the organization of subsistence and settlement activities. It is widely accepted that sometime after 5,000 years ago, people made increasing use of salmon as a stored resource. Perhaps the higher frequency of salmon in Unit V signals the stored use of this resource. The presence of storage features in Units V and above suggests that the rockshelter was serving as a place where resources were cached. If it is accepted that the Palouse River never supported much of an anadromous salmon population, then the prominence of salmon remains may reflect the capture of salmon in the main stem Snake River and transport of dried fish to the Rockshelter. This reasoning follows Chatters (1987) use of "geographic displacement" as an indicator of food storage. When remains of organisms are recovered some distance from their known habitat or distribution, their presence indicates resource transport. Given the costs associated with food transport, efforts to reduce weight, through bulk processing and drying, would be promoted. Interpreting the changing taxonomic frequency in this way, however, could be in error, given the sampling problems discussed earlier, and the suggestion remains tentative.

**Body size.** Vertebrae were measured to roughly estimate the sizes of fishes present and whether there were any changes in the body size of fish over time. Casteel (1976) showed that vertebral size and linear dimensions like length were highly correlated. This study did not rely on

regression analysis, but rather simple comparisons of vertebra measures of fishes of known length to identify change in body size represented.

For *Oncorhynchus*, only eight vertebrae were complete enough to measure. Values range between 6.2 mm to 10.7 mm (Table 11.4). The small sample size prevents examining any temporal changes in body sizes represented. Based on comparison of vertebrae from fish of known length (Table 11.5), the rockshelter samples come from a range of body sizes, ranging between about 350 and 800 mm in standard length (the distance from the tip of the snout to the base of the tail or end of hypural).

Over 100 vertebrae from minnows and suckers were complete enough to measure. As seen in Table 11.6, mean diameter varies little (between 5.4 and 7.1 mm) from the lower strata to the upper units, suggesting there is little variation in the sizes of freshwater fish that were deposited throughout the rockshelter. Taking into account the standard deviation, most of the vertebrae range between 4 and 8 mm in size. Based on comparison with modern fish body size and vertebra size (Table 11.7), vertebra measures this size are from fish that range in size between about 250 and 500 mm standard length.

**Summary.** The rockshelter fish fauna shows that a range of fish taxa were used by people occupying the rockshelter. Fish remains were identified in each of the stratigraphic units spanning the Holocene record of occupation, indicating that fish played some part in subsistence activities for the 10,000 years the site was used. Both resident freshwater and anadromous fishes are present, suggesting that past people were generalized in their fishing practices. The resident freshwater fish would have been available in the river adjacent to the site. The Palouse River, however, probably did not support a migratory salmon run throughout the Holocene. The presence of large-bodied salmon, likely representing migratory fish in the site, suggests that people traveled to the main stem Snake River for this resource.

There has been little study of the life history and habitat requirements of the resident freshwater fish species in Plateau rivers and streams that are prominent in the rockshelter.

**Table 11.2 Frequency (NISP) of fish taxa by strata/unit<sup>1</sup>, rockshelter.**

Taxon	<I	I	II	I-II	III	IV-V	V	V-VI	VI	VI-VII	VII	VII-VIII	VII I	Intru VII	Unass
<i>Acipenser</i> sp.															
<i>Oncorhynchus</i> sp.		3			6	8	62		1		13	1			
<i>Cyprinidae</i>					1		5	3	26		17			3	
<i>Ptychocheilus oregonensis</i>							1	4	16	1	4			3	
<i>Acrocheilus alutaceus</i>							1	2							
<i>Catostomus</i> sp.		2	1		5		1	3	17		10			2	
<i>Catostomus macrocheilus</i>								3	5					1	
<i>Cyprinidae/Catostomidae</i>	1	16	1	3	3	1	27		66		44			7	11
Unidentifiable	4		5		15		64	6	61		84			29	
<b>Total</b>	<b>5</b>	<b>21</b>	<b>7</b>	<b>4</b>	<b>30</b>	<b>9</b>	<b>161</b>	<b>22</b>	<b>193</b>	<b>1</b>	<b>172</b>	<b>1</b>	<b>45</b>	<b>12</b>	<b>5</b>

Note: some stratum assignments were made after fieldwork was completed and should be considered provisional

**Table 11.3 Frequency (NISP) of fish taxa across three strata/units, rockshelter.**

Taxon	V		VI		VII	
	NISP	%	NISP	%	NISP	%
<i>Oncorhynchus</i> sp.	62	63.9	1	0.7	13	14.8
<i>Cyprinidae</i>	5	5.2	26	19.7	17	19.3
<i>Ptychocheilus oregonensis</i>	1	1.0	16	12.1	4	4.5
<i>Acrocheilus alutaceus</i>	1	1.0	1	0.7		
<i>Catostomus</i> sp.	1	1.0	17	12.9	10	11.4
<i>Catostomus macrocheilus</i>			5	3.8		
<i>Cyprinidae/Catostomidae</i>	27	27.8	66	50.0	44	50.0
<b>Total</b>	<b>97</b>	<b>100.0</b>	<b>132</b>	<b>100.0</b>	<b>88</b>	<b>100.0</b>

Note: some stratum assignments were made after fieldwork was completed and should be considered provisional

**Table 11.4 Mean width of *Oncorhynchus* vertebrae across strata/unit, rockshelter.**

Strata	Mean Vertebra Width (mm)	N	Std. Deviation
VII-VIII	7.8	1	--
VII	10.7	1	--
V	9.6	3	1.4
III	6.2	1	--
I	7.8	2	4.2

Note: some stratum assignments were made after fieldwork was completed and should be considered provisional



Table 11.5 Standard length<sup>1</sup> and vertebra widths of selected species of *Oncorhynchus*.

Taxon	Vertebra Width (mm) <sup>2</sup>	Body Size Standard Length (mm)
<i>Oncorhynchus tshawytscha</i> (VLB 92-6-8)	11.5	825
<i>O. tshawytscha</i> (VLB 86-20-4)	10.1	630
<i>O. kisutch</i> (VLB86-4-1)	8.7	575
<i>O. mykiss</i> (VLB 86-6-12)	8.2	670 <sup>3</sup>
<i>O. clarki</i> (VLB 91-10-1)	6.1	365

<sup>1</sup> length from tip of snout to end of hypural bone

<sup>2</sup> measure is an average width of six vertebrae arbitrarily selected from each skeleton

<sup>3</sup> measure is fork length

Thus it is difficult to glean detailed insight on the paleoenvironmental significance of the archaeological remains. The species identified occupy a range of river, stream and lake habitats, including slow and fast moving water, deep pools and shallows; their preference is relatively warm water. Perhaps the most that can be said is that the presence of several species of freshwater fishes throughout the Holocene sequence of human occupation at the site suggests the adjacent river provided adequate habitat for these fish throughout the Holocene. Given that the record for region-wide and local environmental change is clear, it may be significant to note that the river was capable of supporting fish populations for the 10,000-year period.

#### Floodplain Fish Remains

As noted previously, the fish remains come from a large number of bulk samples that were retained in 1-mm mesh in the field and sorted under a controlled setting in the laboratory. Use of fine mesh and controlled sorting insures minimal loss of small bone specimens, and in turn, minimal loss of remains of small-bodied fishes if they are present in the site deposits. Significantly, during the excavation and field screening process, some items, including faunal remains, were removed from the screen and bagged separately. Unfortunately, if this included fish remains, none of this material was located during this study, nor were any records

Table 11.6 Mean width of cyprinidae/catostomidae vertebrae across strata/unit, rockshelter.

Strata	Mean Vertebra Width (mm)	N	Std. Deviation
VIII	5.5	6	1.5
VII	5.7	33	1.6
VI	6.4	36	1.6
V	5.9	14	1.1
III	7.1	1	—
I-II	5.9	1	—
I	5.4	2	0.1

Note: some stratum assignments were made after fieldwork was completed and should be considered provisional

Table 11.7 Standard length and vertebra widths of selected *Cypriniformes*.

Taxon	Vertebra Width (mm) <sup>1</sup>	Body Size Standard Length (mm)
<i>Catostomus macrocheilus</i> (VLB 92-5-6)	7.4	425
<i>Catostomus columbianus</i> (VLB92-7-10)	5.1	315
<i>Catostomus fumeiventris</i> (UMMZ181667)	4.2	260
<i>Catostomus macrocheilus</i> (VLB 92-5-9)	3.8	239
<i>Mylocheilus caurinus</i> (VLB87-10-3)	2.6	192
<i>Gila bicolor</i> (VLB89-1-25)	2.7	160
<i>Catostomus platyrhynchus</i> (VLB92-10-7)	2.5	147
<i>Rhinichthys cataracte</i> (VLB92-7-5)	0.9	65

<sup>1</sup>measure is an average width of three abdominal and three caudal vertebrae arbitrarily selected from each skeleton

found which indicate the extent of this practice. Presumably, if fish remains were selectively bagged during field screening and ultimately lost, they would have been relatively large specimens. In short, there exists the real possibility that the floodplain fish sample available for this study is biased *against large-bodied fishes* and in *favor of small-bodied fishes*. Obviously, these problems introduce difficulties in interpreting the fish faunal record in the deposit. As with the rockshelter fish sample, sampling and curation problems mean that the fish remains provide a nominal record of fish taxa and body sizes present. As relevant, the following discussion reviews the extent to which these biases affect this study's interpretations of the spatial and vertical patterning in fish remains.

**Results.** As shown in Table 11.8, 2,481 fish remains were recovered from the floodplain bulk samples. About 70% of these (1,762 specimens) could be identified below class fish. Fourteen taxa were identified; resident freshwater fishes absolutely dominate the assemblage, with seven different species represented. Remains of cyprinids (identified to family and species) are more abundant than catostomids (suckers). The salmonids represent a very small fraction (less than 1%) of the assemblage.

**Taphonomy and Fish Bone Origin.** How did the fish bones come to be in the floodplain deposit? Do they represent the remains of past human subsistence or could they reflect natural deposition of fish by floodwaters or nonhuman scavengers or carnivores? As noted previously, sorting out the agents responsible for a faunal deposit is essential before one can identify cultural activity patterns. Given the very old age of the Marmes floodplain deposits as well as the potential and realized significance of the site to our understanding of human occupation of the region (e.g., Ames et al. 1998), it is necessary to carefully review the agents responsible for the fish remains found there.

Geoarchaeological analysis of the early Holocene sediments that were the focus of study shows that they are horizontally stratified fluvial deposits left by low energy flooding (see Chapter Five). Radiocarbon dates from the deposits suggest they were deposited about the same time as Unit I and II in the Rockshelter (between 10,000 and 8500 radiocarbon years ago). Unequivocal human use of the riverside location is indicated by stone tools, several features, and human remains found in the stratified deposits.

Table 11.8 Frequency (NISP) of fish taxa, floodplain.

Taxon	Floodplain	
	NISP	%
Salmonidae	3	0.1
<i>Oncorhynchus</i> sp.	12	0.5
<i>Prosopium williamsoni</i>	1	0.0
Cyprinidae	161	6.5
<i>Ptychocheilus oregonensis</i>	8	0.3
<i>Acrocheilus alutaceus</i>	2	0.1
<i>Mylocheilus caurinus</i>	5	0.2
<i>Richardsonius balteatus</i>	1	0.0
<i>Rhinichthys</i> sp.	2	0.1
<i>Richardsonius/Rhinichthys</i>	2	0.1
<i>Catostomus</i> sp.	60	2.4
<i>Catostomus macrocheilus</i>	1	0.0
<i>Catostomus columbianus</i>	1	0.0
Cyprinidae/Catostomidae	1,503	60.6
Unidentifiable	719	29.0
<b>Total</b>		

Overbank deposition was episodic, as the sedimentary record shows a series of weakly developed A horizons (see Chapter Five). A very general site formation model suggests that humans engaged in a variety of activities in the area below the rockshelter and next to the river, organic horizons formed, and then low-energy flood water periodically over topped the bank allowing fine sediments to settle out of suspension and bury remains on the surface. Given such a model, it is conceivable that fish were swept by floodwaters onto the bank where they became trapped and ultimately buried. Several factors and lines of evidence suggest this is not the case, however.

One challenge to the fluvial origin considers the likely season of the floods, the body size of the fish in the deposit and the life history and demography of the source fish populations that would generate such a deposit. First, river flooding along streams and rivers in the Plateau is associated with the melting snow pack, which occurs in the spring and early summer. The source population for a natural fluvial fish deposit would be fish in the river during spring and early summer. Importantly, across western North America, the numerous species of cyprinids and catostomids spawn during this time of year (Moyle 1976; Sigler and Sigler 1987; Wydoski and Whitney 1979). While specific mating behavior and habitat preference

varies from species to species, for all taxa, spawning entails reproductively mature adults aggregating for days or weeks at a time, in pools or shallows in the river. I suggest that the source population for a natural flood-rafted deposit of freshwater fish should include adults – representing a range in age or size classes. The body size and age of reproductively viable individuals as well as the maximum size and age reached is highly variable across species; several small-bodied, short-lived cyprinids *Rhinichthys*, *Richardsonius*, become mature when they are less than 100 mm and then rarely reach over 100 mm in size. Several cyprinids and catostomids (*Ptychocheilus oregonensis*, *Mylocheilus caurinus*, *Catostomus macrocheilus*) become sexually mature when they are over 100 mm in length and often attain lengths of over 300 mm and ages of over 15 years. The Marnes Rockshelter vertebra measurements provide independent evidence that relatively large cyprinids and catostomids were present in the early Holocene in the site vicinity. As noted previously, vertebra from cyprinid/catostomid fishes over 300 mm in standard length are most commonly represented.

In short, if the floodplain fish remains are the remnants of flood-rafted carcasses, a range in body size should be present in the fish assemblage, reflecting the range in body size of a

spawning population. As shown in Table 11.9, about 400 vertebrae from the floodplain were measured, with samples from each horizon documented. The mean size is very small (1.9 mm) and remarkably consistent for each horizon or aggregate horizon, suggesting first that the body size represented is quite small and second overall uniformity in size class represented. Comparing these vertebra sizes to modern fishes (Table 11.7) suggests that the mean size of fish is considerably smaller than 200 mm in standard length. It might be suggested that the small vertebra size results from the deposition primarily of the small-bodied genera such as *Richardsonius* and *Rhinichthys*. While these genera are noted in the deposit, their remains are much less frequent than the larger-bodied cyprinids (Table 11.8). Overall, the scarcity of large fishes in the floodplain deposit does not match the expectation for a fluvial deposit of spawning adults, which should include a range in body sizes, including relatively large individuals. The best explanation for this narrow and relatively small body size is some kind of selective mortality, notably human selection of small fishes.

Of course this explanation presumes that the scarcity of "large" vertebrae in the deposits is real and not a sampling problem (e.g., selective field bagging and subsequent loss of such vertebrae). Given that it is not possible to rule out this bias, statements about body size distribution and frequency must remain tentative.

It would be useful to have supporting evidence for a human role in the form of cut marks or patterned burning. Cut marks were not seen on any of the specimens. Importantly, cut marks have only rarely been noted on archaeological fish remains (cf. Barrett 1997), and none to this analyst's knowledge have been reported on fish remains in Plateau or coastal archaeological sites. Thus, the absence of evidence for cut marks should not be used to undermine the argument for a human source for the fish bones.

As noted previously, presence or absence of burning can be useful in sorting out taphonomic agents responsible for a bone deposit. In the case of the floodplain faunal remains, however, burning is not helpful largely because the incidence of burning across the site and vertebrate classes is so high. Reporting on the nonfish assemblage, Gustafson and Wegener (see Chapter Ten) note that most of the bone

shows sign of burning. This includes an estimated 60,000 fragments from unidentified taxa as well as bones from animals that are likely noncultural in origin (i.e. surface dwelling snakes, burrowing rodents). Some of this burning may result from human fires (cooking or trash fires), but the ubiquity of the burning across most of the vertebrate classes (including taxa likely of noncultural origin) makes it difficult to use burning per se as good evidence for a human source.

Regarding the fish remains, over 30% of the remains altogether show clear sign of burning (Table 11.10). This proportion is much lower than that noted for other vertebrate classes by Gustafson and Wegener, which quite likely reflects different criteria used in identifying burning. Table 11.10 also shows the frequency of burning across the horizons in the floodplain. For the three horizons with sizeable counts, Harrison, Marmes, and joint Marmes/Harrison, the frequency of burning is very similar, suggesting that whatever agents are responsible for the burning, they acted consistently over the course of site formation. Fish body part representation also might be useful in sorting out taphonomic origins (Butler 1990, 1996). In particular, if the fish represent natural, flood-rafted carcasses, the entire skeleton should be represented. Further, if burial was swift, specimen fragmentation should be minimal and the specimens should be in good condition. The first expectation is met, but not the second. A review of skeletal element representation (Table 11.11) shows that numerous elements of the head, fins and vertebral column are present. Given that many elements of the skeleton could not be identified below the combined family taxon, Cyprinidae-Catostomidae, this review considers all of the elements from these freshwater fishes together. [The quantity listed in Table 11.11 is the minimum number of elements (MNE; Bunn 1982) which selects the best represented section of each element and counts the number of times it occurs. Using this quantity rather than NISP controls for the problem introduced by specimen fragmentation. With MNE, a single skeletal element will be counted one time, no matter how many fragments it may have been broken into; with NISP, a single element could be broken into several fragments and if all of the fragments were recognizable, all of them would be counted]. One element from the head

Table 11.9 Mean width of *Cyprinidae/Catostomidae* vertebrae across horizon, floodplain.

Horizon	Mean Vertebra Width (mm)	N	Std. Deviation
Marmes	1.9	28	.6
Mixed Marmes-Harrison	2.0	51	.4
Harrison	1.9	264	.5
Beneath Harrison	4.6		
Unassigned	1.9	40	.4
<b>Total</b>	<b>1.91</b>	<b>384</b>	<b>.5</b>

Note: some stratum assignments were made after fieldwork was completed and should be considered provisional

Table 11.10 Frequency of burned specimens across the floodplain horizons.<sup>1</sup>

Horizon	burned	% burned <sup>2</sup>
Marmes	47	33.8
Mixed Marmes-Harrison	47	
Harrison	616	33.2
Beneath Harrison	0	
Unassigned	73	
<b>Total</b>	<b>785</b>	<b>31.6</b>

<sup>1</sup> some stratum assignments were made after fieldwork was completed and should be considered provisional

<sup>2</sup> represents the percent of bones in each horizon or horizon aggregate that are burned

(pharyngeal) is represented by 39 specimens; given that two pharyngeals are in an individual fish, this indicates a minimum of 18 individuals are represented in the deposit. The minimum number of fish represented by the abdominal vertebrae is 22 (based on an average of 19 abdominal vertebrae per individual) and the minimum number of fish represented by the caudal vertebrae is 21 (based on an average of 18 caudal vertebrae per individual). These very similar values of both head and trunk elements (controlling for the number of times the elements occur in the skeleton) strongly indicate that the entire skeleton was initially deposited on the floodplain. While whole body deposition is

indicated, there is evidence from these data as well for significant specimen breakage and fragmentation, especially of the head elements. Except for the pharyngeal, all of the head elements are represented by *very few* specimens. This pattern most likely is explained by bone destruction that has rendered the remains unidentifiable or so small that they passed through the 1-mm mesh. While degree of specimen fragmentation was not recorded during analysis, the author's impression of the assemblage was that except for vertebral centra, specimens tended to be fragmentary. The very low frequency of most head elements (Table 11.11) certainly supports this notion.

Table 11.11 Frequency of skeletal elements with landmarks (MNE) from *Cyprinidae* and *Catostomidae*, floodplain.

Element	MNE	%
<u>Cranial</u>		
articular	3	0.3
basioccipital	4	0.4
ceratohyal	4	0.4
dentary	8	0.8
epihyal	3	0.3
hyomandibula	3	0.3
maxilla	2	0.2
metapterygoid	1	0.1
opercle	6	0.6
palatine	1	0.1
parasphenoid	1	0.1
pharyngeal	39	4.0
pterotoc	1	0.1
quadrate	3	0.3
urohyal	2	0.2
vomer	1	0.1
<u>Paired Fins</u>		
cleithrum	13	1.3
scapula	2	0.2
<u>Vertebral Column</u>		
1 <sup>st</sup> vertebra	30	3.1
2 <sup>nd</sup> vertebra	11	1.1
1 <sup>st</sup> or 2 <sup>nd</sup> vertebra	12	1.2
abdominal vertebra	420	42.8
caudal vertebra	374	38.1
ultimate vertebra	14	1.4
<b>Total</b>		

The fragmentary condition of the fish remains is comparable to that described for much of the nonfish fauna (see Chapter Ten). Moreover, patterning in fragmentation across vertebrate groups may in fact offer clues as to the source of the destruction. Gustafson and Wegener point out that most of the approximately 1,300 nonfish specimens that they were able to identify to some taxonomic level were rodents and reptiles, taxa which they also note, are least likely to reflect cultural use and deposition. Further, it was these specimens that showed the highest degree of integrity. In other words, fragmentation is not evenly distributed across vertebrate classes, which implies that the source of fragmentation is not a ubiquitous force (like sediment chemistry or post-depositional

trampling), but a more discriminating force that was targeting particular animal groups. Humans would seem to be a likely candidate for this, in the form of cooking and butchering activities.

It is also important to consider whether nonhuman carnivore or scavenging activities have deposited or modified the fish assemblage from the floodplain. As noted for the rockshelter fauna, Gustafson and Wegener (Chapter Ten) do not discuss any sign of carnivore gnawing or other markings on the nonfish assemblage on the floodplain. Budgetary and time constraints prevented undertaking a detailed study of surface morphology that might be used to identify digestive process. The general impression is that characteristic patterns associated with digestive process (rounding, pitting, and vertebra



deformation) were not present. Most of the specimens were either darkly stained or burned. Based on available information, the faunal assemblage does not appear to have been ravaged by carnivores.

In sum, several factors suggest that humans are most likely responsible for the fish deposit. If it is assumed that there was minimal removal of large vertebrae during field screening, the narrow range and small body size present suggests a form of selective mortality was operating and humans are the most likely candidate for this. Further, the fish remains are fragmentary which would be expected if the fish were subjected to various cooking and processing activities. Certainly nonhuman agents can cause bone destruction, but the fact that fragmentation is unevenly distributed across the vertebrate assemblage suggests indirectly that the agent of modification was selective and again, humans are a likely agent for this selection. Additional support for the human role in generating the fish deposit would examine whether the intra-site frequency of fish remains is correlated with other clearly cultural items (e.g., lithics); as project reports for these data are generated it is recommended that these studies be conducted. As well, it would be useful to carry out some test excavations "off-site" to evaluate the likelihood for such natural accumulations of freshwater fish remains to occur.

**Intra-site variation.** Table 11.12 shows the distribution of identified taxa across horizons in the floodplain deposits. As shown, the bulk of the assemblage (over 75%) is from the Harrison Horizon. Given that freshwater fishes are the overwhelming dominant taxa in the locale, they of course dominate each of the horizons.

Examination of fish distribution across bulk samples shows that the distribution of fish bone is extremely uneven. Of the 240 bulk samples processed only 84 (35%) had fish bone. Furthermore, 73% of the fish bone recovered was from just six samples (Table 11.13). These data suggest that fish bone was deposited in discrete areas rather than widely dispersed across the site deposits. The pattern of clumping can be seen in the distribution of fish bone across horizons as well. As shown in Table 11.13, roughly similar numbers of bulk samples

contained fish bones in the two main horizons (Marmes and Harrison), but the overall frequency of fish bone in the two horizons is very different. The 34 samples with fish bones in the Harrison unit provided over 1,800 fish remains, while the 38 samples in Marmes provided only 139 fish specimens. Differences in volumes of excavated or sorted matrix from the two horizons do not explain this striking pattern. Rather, these data suggest that during the accumulation of the Harrison Horizon, there was greater use and deposition of fish than in the Marmes Horizon.

While these data suggest that fish use per se may have varied over time, there is remarkable consistency in the body size of fish present (Table 11.9). As noted in the taphonomy section, vertebra size is uniformly small across horizons, suggesting a consistency in fish capture and fishing activities (capture methods, and use patterns) over time.

**Summary.** The floodplain fish assemblage provides a number of striking patterns that should be reviewed. First, the record shows a dominance of freshwater fishes and extreme scarcity of salmon remains. All of the faunal remains show a high degree of fragmentation, and it is reasonable to be concerned that the scarcity of salmon bone is in part due to the high degree of bone destruction (Butler 1987b). Salmon bone is not as "dense" in terms of mineral content per volume as minnow and sucker bone (Butler 1996; Butler and Schroeder 1998). If bony tissues of both salmon and minnows/suckers were subjected to similar destructive process, then salmon bone would degrade more readily and less likely be part of the faunal record in the site. In the case of the floodplain assemblage, this scenario is not supported. All of the matrix was processed through 1-mm mesh, which is an extremely small mesh size. Fragmentary remains of salmon vertebrae or other durable cranial elements (e.g., gill rakers, teeth) should have been recovered in this fine screen matrix in greater numbers if, in fact, they had been present in higher numbers in the deposits. The virtual absence of salmon bones and teeth in the deposit suggests in fact that salmon were not used much by people that occupied the floodplain.

Table 11.12 Frequency (NISP) of fish taxa by horizon<sup>1</sup>, Marmes floodplain.

Taxon	Beneath Harrison		Harrison		Between Harrison & Marmes		Mixed Harrison & Marmes		Marmes		Unassigned		Total	
	NISP	%	NISP	%	NISP	%	NISP	%	NISP	%	NISP	%	NISP	%
Salmonidae									3	3.4			3	0.2
<i>Oncorhynchus</i> sp.			8	0.6					4	4.6			12	0.7
<i>Prosopium williamsoni</i>			1	0.1									1	0.1
Cyprinidae			122	9.1	1	50.0	3	2.1	8	9.2	27	14.8	161	9.1
<i>Ptychocheilus oregonensis</i>			5	0.4							3	1.6	8	0.5
<i>Acrocheilus alutaceus</i>			1	0.1							1	0.5	2	0.1
<i>Mylocheilus caurinus</i>			5	0.4									5	0.3
<i>Richardsonius balteatus</i>							1	0.7					1	0.1
<i>Rhinichthys</i> sp.			2	0.1									2	0.1
<i>Richardsonius/Rhinichthys</i>			2	0.1									2	0.1
<i>Catostomus</i> sp.			49	3.7			3	2.1			8	4.4	60	3.4
<i>Catostomus macrocheilus</i>			1	0.1									1	0.1
<i>Catostomus columbianus</i>			1	0.1									1	0.1
Cyprinidae/Catostomidae	5	100.0	1144	85.3	1	50.0	137	95.1	72	82.8	144	78.7	1503	85.3
Total	5	100.0	1341	100.0	2	100.0	144	100.0	87	100.0	183	100.0	1762	100.0

<sup>1</sup> some of these assignments were made after field work was completed and should be considered provisional

Table 11.13 Frequency of fish remains by horizon, floodplain.

Horizon	# Bulk Samples with Fish	Fish	
		count	%
Unassigned	2		
Above Marmes	0		
Marmes	38	139	5.6
Mixed Harrison & Marmes	2	148	6.0
Between Harrison & Marmes	2	3	0.1
Harrison	34	1,858	74.9
Beneath Harrison	6	11	0.4
<b>Total</b>			

Note: some stratum assignments were made after fieldwork was completed and should be considered provisional

There are two obvious reasons why salmon may not have been used. First, the site is located over a mile and a half from the closest source of migratory fish, in the main stem Snake River. Perhaps scheduling of other economic activities meant that local residents were only able to take advantage of very local fishery resources that were in the adjacent river. It is also possible that the lack of salmonid remains reflects the season of site occupation. Migratory salmonids would have been available chiefly in the late spring, summer and fall. If the occupation of the floodplain did not coincide with the timing of migratory runs—perhaps people occupied the site in the winter and spring—then the absence of salmon would be explained.

A third factor could be environmental, suggesting that salmonids were simply not very abundant in regional streams, because of poor spawning habitat or perhaps oceanic conditions. Chatters and others (Chatters et al. 1995) have suggested that conditions later in the Holocene would have been poor for salmon, due to warmer water temperature in spawning habitat and overall poor stream conditions. To properly evaluate this explanation for the early Holocene record on the Snake River, we need more fine-scale environmental data as well as studies of contemporary fish assemblages from other sites in the region (especially on the Snake River). Notably, given the Marmes site's location on a non-salmon producing river, it will be difficult to

use the site's fish record per se to identify the role of environmental change in affecting salmonid abundance.

The second major pattern regarding the fish remains is the small body size present. Fish body size estimation has not been carried out for other Plateau archaeological sites for any time period, so we lack a comparative basis for examining the pattern. Additionally, there is little detailed information on the life history, seasonal movements, and schooling behavior for the many freshwater species on the Plateau that could be used to model human fishing strategies. Prehistoric fishers may have used spears, hook and line, or mass harvesting such as nets, traps, or poison. Given the narrow size range, a form of selective mortality is indicated, particularly the use of mass harvesting that was targeting a particular size class of fish (Butler 1996; Greenspan 1998). There are no bone points or net weights in the site's deposits that might be used as independent evidence for fishing methods used. To develop a more comprehensive understanding of Plateau fishing strategies, especially for freshwater fishes for which we have little knowledge, the kinds of strategies used to catch certain species and body sizes, and the more general factors that affect decisions about fishing or technology selection, it would be very useful to carry out fishing experiments in local environments (e.g., Kirch and Dye 1979; Raymond and Sobel 1990).

### Comparison of Rockshelter and Floodplain Fish Fauna

Table 11.14 shows the frequency of fish remains identified in the floodplain and the lowest units of the rockshelter, which are contemporaneous. The records show a number of differences. First, the floodplain has a much richer fish fauna with 14 taxa, while the rockshelter only has four. This difference at least in part must be linked to the major difference in archaeological recovery between locales. Use of 1-mm mesh screen in the floodplain led to the recovery of several small-bodied taxa, remains of which would not be caught in ¼" (6.4 mm) mesh. The use of finer mesh also generated an overall larger sample size, which in itself would tend to produce higher richness values (Grayson 1984; Gordon 1993). Both show the presence of anadromous and resident freshwater fishes. Comparison of taxonomic identifications does not reveal any striking difference that could not be explained by recovery practices.

One can also compare the two locales based on vertebra size. Only three vertebrae from the lower units of the rockshelter were complete enough to measure (Table 11.6); these suggest a mean width of 5.6 mm. The almost 400

vertebrae from the floodplain provide a mean width of 1.9 mm (sd=0.5). Granting the very small sample size from the rockshelter, the vertebrae sizes represented in the two locales are extremely different. Recovery practices, particularly the use of ¼-inch mesh screens can be used to explain the lack of small vertebrae in the rockshelter. Possible selective removal (and subsequent loss) of "large", vertebrae during screening of floodplain sediments might help explain the scarcity of such vertebrae in the faunal assemblage. On the other hand, if the dominance of small vertebrae (and scarcity of large vertebrae) in the floodplain deposits is real, that large vertebrae are truly scarce in the floodplain deposits, then it is reasonable to examine why the two locales have such different representation of fish body sizes.

One explanation would suggest that the difference reflects differences in cultural processing between the two areas. Perhaps the same sized resident freshwater fish were captured and deposited in the two areas and that differences in butchering and cooking patterns between the areas led to higher rates of bone destruction in the floodplain. Gustafson and Wegener (see Chapter Ten) point out that the character of the mammalian fauna is very

Table 11.14 Frequency (NISP) of fish taxa in the floodplain and contemporary units of the rockshelter.

Taxon	Rockshelter				Floodplain	
	Below I	I	II	I-II	NISP	%
Salmonidae						
<i>Oncorhynchus</i> sp.		3				
<i>Prosopium williamsoni</i>						
Cyprinidae				1		
<i>Ptychocheilus oregonensis</i>						
<i>Acrocheilus alutaceus</i>						
<i>Mylocheilus caurinus</i>						
<i>Richardsonius balteatus</i>						
<i>Rhinichthys</i> sp.						
<i>Richardsonius/Rhinichthys</i>						
<i>Catostomus</i> sp.		2	1			
<i>Catostomus macrocheilus</i>						
<i>Catostomus columbianus</i>						
Cyprinidae/Catostomidae	1	16	1	3		
Unidentifiable	4		5			
<b>Total</b>		<b>21</b>		<b>4</b>		

Note: some stratum assignments were made after fieldwork was completed and should be considered provisional

different in the two areas. The rockshelter mammal bones tend to be much more complete (and unburned) than the floodplain mammal remains which are extremely fragmented and burned. They suggest that cultural processing differences may help explain this.

This explanation does not account for the fish pattern, however. The first and second vertebrae on the vertebral column of the minnows and suckers are among the densest in the skeleton (Butler 1996). Even if the larger-bodied fishes had been more aggressively processed (which would lead to a higher incidence of bone destruction), the first and second vertebrae should be present in some numbers, if such fish were caught and deposited on the floodplain. These vertebrae from the floodplain fish fauna were included with other vertebra measures and the data show overall that

mainly small individuals are represented. In short, failure to record more large vertebrae in the floodplain is not easily explained by increased fragmentation of bones of larger-bodied fishes.

The small sample size of the rockshelter fish fauna in the earliest stratigraphic units (I, II) will make it difficult to isolate the particular cultural or natural mechanisms that account for the differences between locales. Also, because the faunal records from the two areas were sampled in such different ways, it may be difficult to sort how much of the "patterning" is simply a product of our sampling. Additional comparative study of the feature and artifact record between the two locales will perhaps help shed additional light on the cultural and natural factors that account for the striking differences in faunal records.

***MARMES ROCKSHELTER* APPENDICES  
AVAILABLE ON-LINE AT WSU MUSEUM  
OF ANTHROPOLOGY WEB SITE:**

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The appendices listed in the Table of Contents, pages vi-vii, are not included in this volume. They are available for viewing on the Web site, Museum of Anthropology, Washington State University: [www.archaeology.wsu.edu](http://www.archaeology.wsu.edu).



# Marmes Rockshelter

**A Final Report on 11,000 Years of Cultural Use**

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