Chapter 8

Prehistoric Salmon Utilization at Keatley Creek

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Introduction

This analysis of prehistoric salmon remains from near Lillooet, British Columbia shows how salmon species were differentially used within one prehistoric community and how salmon utilization has changed from prehistoric to historic times. The documentation of differential use of salmon species between housepits is one of the most important ways of investigating socioeconomic organization due to the high value of some species and the low value of others. Five species of salmon make their way up the river systems of Northwest North America each year to spawn. Each of these species played a unique role in the cultures of various peoples in the Pactfic Northwest. Within the Plateau Pithouse Tradition on the Canadian Plateau, dependence upon local salmon resources has been identified as one of the main characteristics of the culture (Richards and Rousseau 1987).

These anadramous fish exhibit very predictable behavior, at least in terms of such things as subsistence, mobility and seasonality. Each of these species of salmon exhibit unique qualities which influence the ways in which a culture might procure, process, and use the fish. Such qualities as fat content, difficulty of catching the fish, the season of spawning, the number of fish of each species which return up the river each year, the size of the fish, and even the taste are important traits. These differences can dictate which species are used, how fish are processed (drying, filleting, immediate consumption, extraction of salmon oil, pulverization) and how they are preserved and stored (Kennedy and Bouchard 1992; Romanoff 1992). Given these considerations it is reasonable to assume that certain species would be more desirable than others, and we know that ethnographically such things as status and inherited rights were related to the harvesting of specific species from owned locations (Romanoff 1985). It is the question of whether this cultural practice existed in prehistoric times on the British Columbian Plateau to which this study is oriented.

Methodology

Most fish accrete new bone material to their vertebra as they grow and develop throughout their lifespan. In temperate environments a fish will experience different rates of growth between summer and winter, creating rings which may be seen on a vertebrae. These rings are formed by the slower growth rate in winter leaving a narrower, more dense structure, and the summer growth being seen as a wider, less dense ring (Casteel 1976).

The occurrence of annual growth rings on fish vertebrae was first recognized over two hundred years ago. This trait has since been noted as a potential tool in estimating seasonality through either visual examination of the vertebrae in some cases, or by thin

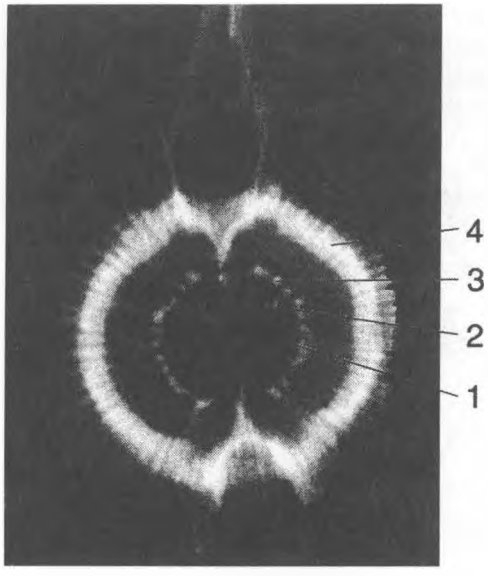

Figure 1. A four-year-old salmon vertebrae from the Keatley Creek site showing four winter growth rings.

sectioning, polishing and examining under a microscope in others (Casteel 1976). This phenomenon had not been exploited much by archaeologists until a recent study by Cannon (1988) used radiography in an attempt to differentiate species within a collection of salmon vertebrae from the Namu Site on the Central B.C. coast. The growth annuli on the vertebrae was quite readily visible with the dense winter rings appearing as white (radio-opaque), and the less dense summer rings seen as dark (radiolucent). Cannon verified that these rings were in fact measuring the age of the fish by correlating his test results on known comparative specimens of salmon, comparing ages based on vertebrae to those determined using scales, and by comparing weight estimates based on each ring to known average weights (Fig. 1). Cannon's study seems to indicate that this method is quite efficient for determining the biological age of large numbers of vertebrae. Because each species of salmon has a distinctive age range during which it will spawn, the study of large samples from riverine locations can allow inferences to be made as to the species of salmon represented and hence the season, nutritional value, and necessary fishing technologies.

Oncorhynchus sp. (Pacific Salmon)

Pink salmon *(Oncorhynchus gorbuscha* also known as Humpback), invariably spawn at two years of age during the months of September and October. They are found in most river systems from California to Alaska and are generally a weak fish, not being able to traverse more than four or five hundred miles upriver. Because they are not generally strong swimmers, pink salmon may commonly be found near the banks of fast moving sections of the river. Pink salmon are not a preferred species by natives and ethnographically these salmon seemed to be quite insignificant to the everyday diet of the Interior peoples (Romanoff 1985; Teit 1906; 1909). Often this aversion to pinks has been attributed to their small size and their lack of taste when compared to the spring and the sockeye, although it is acknowledged that they are one of the easiest fish to catch and to dry, probably second only to the chum in their qualities of preservation.

Spring salmon (O. *tshawytscha*, also known as king, chinook, or tyee) spawn at three to eight years of age, but most commonly at four or five years old. In the Fraser River the two main runs occur in March–April and in late summer (August–September). Spring salmon are also found throughout the Northwest Coast and, being strong swimmers, they may travel well over a thousand miles upriver. These salmon will almost always stick to the deeper and/or swifter parts of the river and thus are the most difficult to catch. These fish are the largest of all the salmon, and also one of the most preferred by natives. They are generally quite oily and generally require more attention in the processing and drying stages than any other species. Ethnographically among the Lillooet they were the most valued of fish and the locations at which these fish could be caught were generally owned. Because of their size, strength, and habitat, these salmon required a more complex fishing technology than any other species (Romanoff 1985).

Sockeye salmon (O. *nerka*, also called bluebacks or red salmon) usually spawn at four or five years, although they have been reported as old as eight years of age on occasion. The sockeye salmon spawn as far as 650 miles up the Fraser River from June to November, peaking in July. These salmon are relatively strong swimmers and are able to navigate quite strong rapids, similar to the spring salmon. In terms of desirability among the peoples of the Fraser River, these fish were and are second only to the spring salmon. Some individuals would argue in favor of these fish above all others in terms of their balanced oil content and rich flavor. This factor also makes the drying of sockeye difficult, and many ethnographers note that this type of salmon is often immediately consumed or traded (Romanoff 1985; Bennett 1973; Kennedy and Bouchard 1978).

Chum salmon (O. *keta* also called dog salmon) usually spawn in the northern areas of their range at five years of age, and in some central and southern areas such as the Fraser River system, they are more commonly present at four years of age, although five-year-olds may be found. Chum salmon spawn quite late, in

October and November, following the pink runs. These fish are not commonly found any great distance from the salt water, however, in the Yukon river they do travel over 2,000 miles upriver. They do not run more than 200 miles up the Fraser at the present time, although this may not have always been the case (Healy 1986). The popularity of this fish varies throughout the Northwest, some scorn it as a tasteless fish, while others praise it for its preservation qualities. Boas (1921) observed that the chum dried to the point that it resembled a board; he noted it also tasted like one.

Finally, coho salmon (O. *kisutch*, also known as silver salmon) invariably return upriver to spawn at three years of age, in November and December. This species of salmon is found in nearly all accessible rivers in the Northwest. However, they are not commonly found in the upper reaches of the Fraser, although some are occasionally caught. Coho are slightly larger than pink salmon and their preservation qualities are considered to be average (Romanoff 1985). The preceding biological data regarding salmon characteristics are taken from Healy (1986), Cannon (1988), and Bennett (1973).

The Keatley Creek Site

Based largely on ethnographies by James Teit (1906) it is assumed that the prehistoric occupants of the Keatley Creek site were moving between fishing camps by the river in the summer and the pithouse village in the winter. At present no substantial fishing stations have been identified in the immediate vicinity of the Keatley Creek site, but there are important fishing stations several miles to both the north and south of the site. The rapids located near Fountain (10 Mile Rapids), about four miles south of the site have been recognized as one of the most important salmon procurement sites in the region (Romanoff 1985). It was from here and the rapids at Bridge River farther south that both fresh and dried salmon were traded to other groups for various products, ranging from oolichan oil and dentalium shells to obsidian (Teit 1906; Romanoff 1985). The rapids here are such that a wide cross-section of the available salmon resources may be easily obtained, and there are numerous archaeological sites adjacent to the rapids, including the Fountain, Bridge River and Bell sites.

Salmon remains at the Keatley Creek site are found in three basic contexts: 1) as isolated individual bones found on occasion in floor fill, roof deposits, pits, or posthole fill; 2) as partially articulated backbones or individual vertebrae or other bones (usually post-cranial) in living floor contexts and; 3) as groups of articulated remains in pit contexts (often with ribs, rays, and sometimes cranial remains). This indicates that the salmon remains found at the site are either refuse or stored salmon which was never recovered. For the purposes of this study it was decided to examine the salmon remains from three housepits which had been completely excavated, and two housepits which had been tested, having storage pits containing large quantities of articulated salmon remains. A wide range of different size housepits was excavated in order to determine if there were any differences in wealth, resource use, or hierarchical organization in small versus large housepits. One of the possible differences between large and small housepits was postulated to be in salmon use. Two of the housepits analyzed were quite large (HP's 1 and 7 are about 20 m in diameter), two were of a medium size (HP's 3 and 6 are about 12 m in diameter), and one was relatively small (HP 12 being about 6 m in diameter). These housepits all represent early Kamloops Horizon occupations (ca. 1,200 BP).

From the three completely excavated housepits, all the remains from floor contexts as well as all remains from abandoned storage pits inside the dwelling were analyzed. By abandoned storage pit it is meant only those pits which had some of their contents remaining, including fully articulated salmon vertebral remains. Other pit and posthole fill contexts were not examined. The radiographs for this study were produced using the H.G. Fischer model FP200 portable x-ray unit in the Department of Archaeology, Simon Fraser University. After preliminary tests it was decided that an output of 80 keV x-rays, at 15 mA, at 60 cm, for 1.5 seconds would best reveal the growth annuli in the salmon vertebrae.

Salmon Age Category Distributions

Combined with samples from pit contexts associated with that specific floors, each sample from a housepit floor can be considered as an analytical unit. It is possible to consider the samples of salmon drawn from the different housepits on this site as independent of one another. It should be remembered that these housepits are not in fact sub-samples of the same deposit but are cluster samples drawn from separate and possibly unrelated housepit deposits. Therefore the data now presented will focus on the distributions for individual housepits and individual pits and floors within those housepits.

It is obvious from the first glance at the data that there is a very real preponderance of two-year-old salmon remains in most of the samples (Fig. 2). The deposits from the smaller HP's 6 and 12 are 100% two-year-old salmon. The medium sized HP 3 is over 90% two-year-olds, with the remaining vertebrae almost entirely composed of four-year-olds. It should be noted that 10 three-year-old vertebrae were found in an articulated floor context, representing a single fish. Housepits

1 and 7, the largest on the site, contained a much broader range of age categories than any of the other housepits examined. The samples from these two large housepits also differed greatly in terms of proportions of salmon species represented. Housepit 1 contained over 70% four-year-old vertebrae with the remaining vertebrae being composed of two-year-olds (although the HP 1 assemblage may not be representative due to limited testing of its deposits). Housepit 7 on the other hand revealed substantially less in the way of four-year-old vertebrae and substantially more three-year-old vertebrae. As was the case in other housepits, the majority of vertebrae in HP 7 were from two-year-olds. It should be noted that HP 7 also contained a small quantity of five-year old vertebrae. When examined more closely, HP 7 reveals interesting differences within the structure. While the distributions in feature number 4 (likely a storage pit) and the floor contexts were quite similar, having moderate quantities of two, three, and four-year-olds, the slamon age distributions of feature number 3 (also probably a storage pit) were quite different, being totally composed of two-year-olds.

When examined as raw quantities of vertebrae, as opposed to proportions, it is clear that two-year-old salmon make up the bulk of all the samples. While there are never more than 100 vertebrae from three, four, or five-year-olds in the housepit assemblages, the vertebrae from two-year-olds occur in numbers ranging from under 50 to over 1,200.

Species Inferences and Discussion

When the age distributions of salmon vertebrae found in housepits at Keatley Creek are compared with the spawning ages for each species of salmon it becomes clear that certain inferences about the species of salmon found at the site can be made. Because the only salmon to spawn at two years of age is the pink salmon *(Orcorhynchus gorbuscha)*, it is safe to assume that there are large proportions of pink salmon represented in the samples. As has already been stated, this species of salmon is small, easy to catch and process (preserve), and spawns in the early fall (September–October). Traditionally this has not been considered to be an important species to the people of this area (Romanoff 1985).

The second-most abundant age category is that of the four-year-olds. There are three species of salmon known to spawn at this age: spring, sockeye and chum. The age ranges of these species are 3–8 years, 4–8 years and 2–7 years respectively. However, we know that most of the spring and sockeye that migrate this far up the Fraser are four and five-year-olds (Healy 1986). Coho, which are not abundant this far upstream, spawn only at three years of age. Healy (1986) notes that spring salmon in the Fraser are almost always within the four to seven-year-old bracket, and that the modern-day chum salmon in the Fraser are invariably four-years-old. It would seem that much in the same way

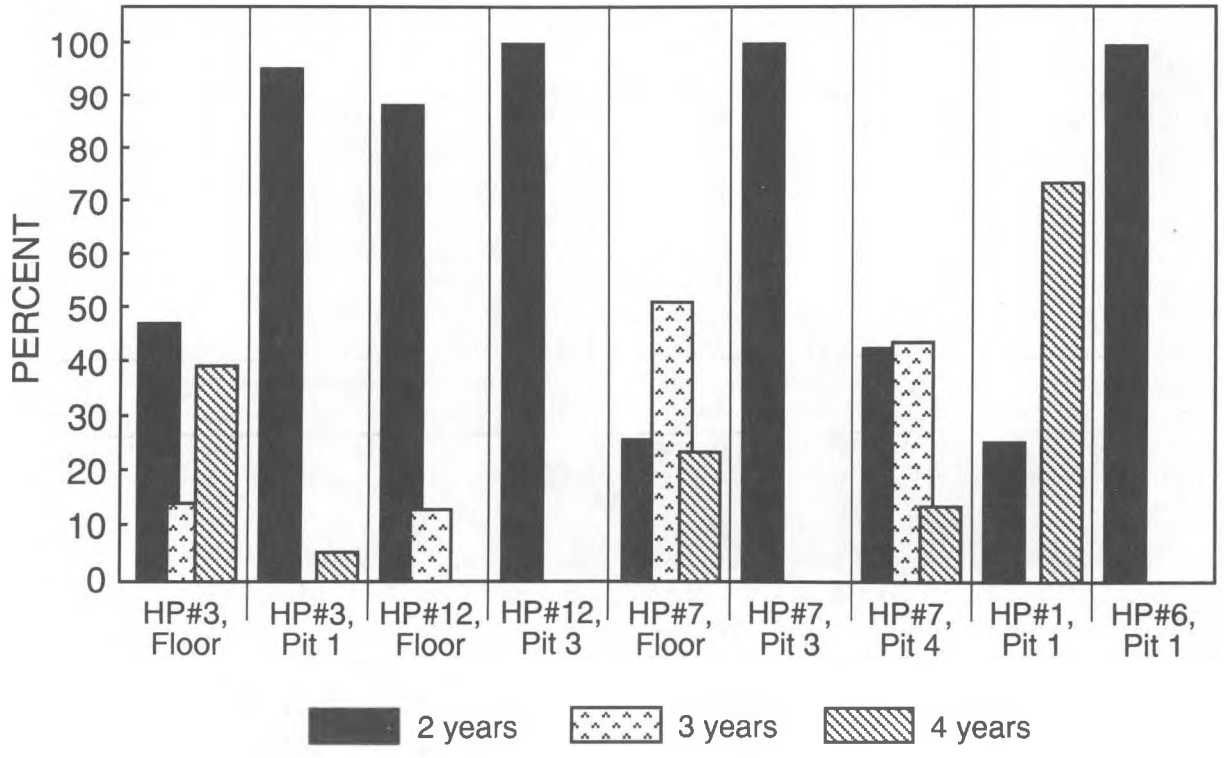

Figure 2. Distribution of salmon age-categories from within each housepit.

that pink salmon found in upriver locations are genetically selected to be stronger swimmers, chum salmon's spawning age is genetically selected in a river-specific manner (Healy 1986; Ricker 1989). Because of the complications of these overlapping age ranges, it is only possible to make a best-guess as to the species represented by the three to five-year-olds.

It was initially thought that the high proportions of three-year-olds in HP 7 might suggest the presence of coho salmon. However, Cannon (personal communication) has pointed out that despite the absence of any significant quantities of fish older than four years, these three, four and five-year-old individuals could represent spring or sockeye. He suggests that the older and larger salmon might have been more difficult to catch if they were able to travel against the stronger currents in the middle of the river channel. Romanoff (1985) also suggests that prehistoric populations in areas may not have been able to effectively exploit the populations of larger, stronger fish, given the more advanced fishing technologies required. Based on these arguments and the somewhat skewed distribution towards smaller fish it seems very likely that the salmon remains in HP 7 represent either three-year-old spring or sockeye salmon. These arguments can also be applied to the remains from the floor of HP 3.

From the seasonality of the spawning runs in the Fraser it could also be argued that only sockeye and chum runs would probably have been concurrent with runs of pink salmon. Since pink salmon are represented in greatest abundance in all housepits, it could also be argued that the other species represented were captured at the same time as the pinks, (e.g., if fish procurement was scheduled so as to take advantage of the best yielding runs). On this basis it is more likely that the salmon found in HP's 7 and 3 represent sockeye, rather than spring salmon.

Another possible way to explain the relative proportions of different species of salmon vertebrae involves different methods of processing between spring, fall, and summer runs, as well as between different species of salmon (Romanoff 1985). Romanoff relates that the early runs of salmon are more fatty than later runs and therefore are more difficult to dry. Generally, it was necessary to remove the backbone and belly sections of these fish before any attempt was made to preserve the flesh. When possible these oily, but tasty, fish would be eaten immediately, processed into salmon oil, or traded after labor intensive smoking and drying. Romanoff writes that because it was difficult to process and dry the first runs of spring and sockeye these would often be rendered into oil. Because this salmon oil production was a difficult process, only certain individuals who knew the procedure for this form of reduction could utilize these salmon. This factor may have been related to the ownership of fishing spots from where the large, oily fish could be obtained. Given such ethnographic behavior, it would be reasonable to expect early runs of spring and sockeye salmon to have a low level of visibility in the archaeological deposits at winter villages.

The proportions of species represented in HP 1 is quite different from that of HP 7. The remains from HP 1 are bimodal, with only two- and four-year-old salmon represented. In fact, although the sample is very limited, over 70% of the remains from this housepit are four-year-olds. If these remains represent spring or sockeye salmon one would also expect to see some quantity of three-year-olds and substantial numbers of five-year-old vertebrae. Since chum currently run in the Fraser at only four-years of age the high proportion of four-year-old vertebrae provide a good fit for this species, although chum currently do not run this far upstream.

Differences also exist in the seasons at which the various species of salmon spawn favoring the chum interpretation of the four-year-old vertebrae. While the majority of spring and sockeye spawn in the spring and summer (with some small runs of sockeye in November), pink and chum both spawn in the fall and would be logically procured at the same time if fall was the primary fishing season in the past—as indicated by the preponderance of pink salmon remains. If chum salmon ran farther upstream in prehistoric times we would conclude that the four-year-olds found in HP 1 were most likely chum. This inference could also be supported by the distinctive qualities of these fish. While chum and pink salmon are particularly easy to dry and preserve with the backbone intact, sockeye and spring do not usually fare well with this method although it should be noted that late fall runs of sockeye are less fatty than their counterparts which spawn earlier in the year (Romanoff 1985). However, they are still not as easy to dry as pink or chum. Because these late sockeye runs occur in November, even later than pinks and chum, the hot climate required for drying has largely passed although late catches were sometimes freeze-dried or even dried whole (Teit 1906; Kennedy and Bouchard 1992).

It should be noted that ethnographically, pithouse villages were considered to be winter villages, and were abandoned in the spring of each year. Investigations at Keatley Creek largely support this seasonal pattern (Vol. I, Chaps. 9, 10). Thus it seems most likely that the salmon being stored at the site would represent a fall fishery, as the age and species data suggest. Other species may also have been captured, but stored near the river in elevated caches as documented ethno-

graphically (Vol. II, Chap. 2; Romanoff 1985; Kennedy and Bouchard 1992).

In 1913, landslides forming high velocity rapids at Hell's Gate, north of Yale, destroyed pink and sockeye runs and weakened the spring salmon runs for many years. Pink and sockeye salmon spawneries north of Hell's Gate were not re-established until fish ladders were built in the late 1940's (Ricker 1987; 1989; Healy 1986). If a prehistoric landslide were to block the river or create large rapids, salmon populations could not be re-established upstream until natural erosion and downcutting processes made the river passable for the weaker species of salmon (i.e., pink, chum, and coho).

Hayden and Ryder (1991) have proposed that the abandonment of numerous large pithouse villages, including the Keatley Creek site, about 1,000 to 1,200 years ago, may have been the result of a large scale landslide which dammed the river and destroyed the salmon runs upon which these villages depended for food. As support for this hypothesis they cite the evidence for a large landslide affecting the Fraser River at Texas Creek, 16 km south of Lillooet. In addition to the landslide remains at Texas Creek, cache pits located on a river terrace in Lillooet, covered by thick deposits of fluvial sediments, date to around the same period (Hayden and Ryder 1991). There are also indications that there may have been massive landslides at about the same time at Jones Bench, just a few kilometres south of Lillooet (Ryder and Church 1986). The Cheam Slide on the Fraser River near Chilliwack, B.C. is a well known event which may be from the same general time period as well (Fladmark 1992).

Given the fact that these landslides could explain a shift in salmon runs along the Fraser and the similarity in seasonality and methods of processing between chum and pink salmon, it is a distinct possibility that the large numbers of four-year-old vertebrae found in HP 1 represent chum salmon.

As the location from which the fishing is taking place will often dictate what species are most likely to be caught, the differences in salmon represented at each housepit might serve to indicate ownership of fishing rocks or stations. Ethnographically ownership of fishing stations was common, and such ownership meant that individuals might have access to more species of salmon, while those not owning a fishing station would have more limited access and would have had to rely upon public fishing locations or upon other individuals who had salmon (Romanoff 1985; Kennedy and Bouchard 1992).

The possible lack, or at least under-representation of spring and sockeye salmon in the smaller housepits could mean that in these houses the fishing technology was simply not developed enough or was not being used to catch these larger, stronger fish. It also could be interpreted as meaning that the occupants of some dwellings did not have the rights to acquire these species of fish, or at least access to locations where these species could be caught, or that occupants of smaller dwellings had different processing or storage practices —although this does not seem as likely. This argument may tie in with the fact that there are currently not many good fishing stations within several miles of the Keatley Creek site making ownership of fishing stations seem plausible. It should also be noted that the lack of good fishing spots near the site may not have always been typical of the locality (Hayden and Ryder 1991).

On the basis of the radiographic analysis we have good indications that either spring or sockeye were being taken by the occupants of HP 7 and to a lesser degree, HP 3. This implies that the occupants had either: a) the rights and ability to acquire these fish; b) traded for these fish or; c) occupied the site at a time when these species of salmon were spawning. Hayden et al. (1985) and Hayden (1992) have argued that complex social structures involving priviledged access to important food resources operated in this area historically and prehistorically. Kusmer (Vol. II, Chap. 7) has also found evidence of differential use of terrestrial food resources, while Spafford (Vol. II, Chap. 11) has identified different storage capacities and spatial organization within the different sized housepits. However, it is perhaps premature to link the different proportions and types of salmon found within the different sized housepits at Keatley Creek to interpretations of socioeconomic differentiation.

There are numerous variables at play in this situation which may dictate which species and what proportions will be found in the archaeological record. A first major variable is natural and cannot be predicted or controlled at this point in time, and this is the problem of cyclical variability in the size of the run.

It has been known for some time that there are cyclical variations in the spawning runs of various species of salmon. These variations can be in two, three, or four year cycles, depending on the species, and sizes of the same runs can vary by as much as 2–42 million fish (Ricker 1987; 1989). In addition to these annual variations, there are also variations in individual runs of a single species within a river on a day-to-day basis. This means that on any given day in a prehistoric fishery the activity could be very intense or quite slow. Romanoff (1985) noted that this will in turn affect processing of the fish. When fish are running in great numbers, the processing is the main limiting factor in how much fish is actually caught. Thus minimal processing is necessary to make a fish useful and the

degree to which a fish may be butchered and processed may not be a constant.

Another factor in the degree to which a fish may be processed is the fat content of the fish. As has already been noted, the earliest runs of salmon, particularly the spring and sockeye, may need to have the backbone and belly removed before drying. In other cases, it is not desired, or even possible to dry the fish, and it is rendered into oil, salmon powder, soup, given away, or immediately consumed. In some instances backbones would be removed and stored separately, to be used as a form of insurance in the event of famine (Romanoff 1985; Kennedy and Bouchard 1978).

Variability also exists in the methods of storage. Ethnographies record storage either inside or outside the pithouse. The methods of storage outside of the pithouse were in the form of juniper-lined pits and wooden boxes built on platforms. These types of storage could be either at the village site or near the river. Romanoff (1985) notes that often the early spring and summer runs would be stored in box caches near the river. The reasoning for this form of storage was two-fold. First, since the winter pithouse village site would not normally be occupied in the summer (exceptions have been noted in the case of old or infirm individuals—Vol. II, Chap. 2) it would be inconvenient to transport the salmon to the winter village. In the case of Keatley Creek, the site is nearly 2 km away from, and 300 m above, the Fraser River. As has already been noted, at the present time the closest good fishing spots on the river are at least 5 km north and south of the site, at Pavilion and Fountain. The second advantage to caching the first catches in boxes near the river was that these oily fish would be given more opportunity to dry, as the strong winds moving up the Fraser Canyon would blow through the slat wood constructions, while the structures would keep out scavengers. These boxes could then be easily accessed in the winter, as opposed to external cache pits which might be covered with snow, and be quite frozen. The unfortunate characteristic of these box caches is that they are not preserved in the archaeological record. Thus we are confronted with the possibility that the only species of salmon which we might expect to find in the housepits in any quantity would be the fall runs of salmon (pink, coho, late sockeye, and possibly chum).

Conclusions

As this study has shown, Cannon's method of radiographic examination and species inferences can be valuable in reconstructing the prehistoric use of salmon resources in the Interior Plateau. We know that contrary to what modern ethnographies would suggest, pink salmon may have been utilized quite intensively prehistorically, as may be seen by the large quantities in the housepits examined from Keatley Creek. Conversely, the evidence examined here tends to support the ethnographic record documenting differential treatment of the various species of salmon, and possibly the differential access to such resources as well. The seasonal inferences which can be drawn from these examinations strongly suggest an active fall fishery was taking place near the time of year when the winter pithouse villages were occupied. There is the possibility that chum salmon may have run further upstream than they do currently, as seen in the salmon remains in HP 1. This certainly seems to be true of pink salmon. This also lends weight to Hayden and Ryder's hypothesis for the prehistoric damming of the Fraser and changing salmon resources being a causal factor in the abandonment of large village sites during the early Kamloops phase. Future research on other Fraser Canyon faunal collections and pithouse village sites may shed more light on some of these questions about the role of salmon in the late prehistoric Interior Plateau.

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