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## MODELLING ALTERNATIVE SUBSISTENCE STRATEGIES FOR THE MIDDLE SNAKE RIVER

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### ABSTRACT

This article models acquisition costs and nutritional returns for Late Archaic (post-A.D. 1200) peoples of the Middle Snake River. It is an attempt to demonstrate probable deficiencies in the ethnographic record relating to storage for winter consumption and to provide for the generation of hypotheses which may explain diversity in the recent archaeological record. The article proposes three alternative subsistence strategies: relatively sedentary river dwellers who maintain fishing equipment, including weirs, and are the primary exploiters of the riverline resources, particularly anadromous fishes; transhumant groups who rely upon high yield, low cost root crops; and highly mobile groups placing minimal emphasis upon root crops or salmon, electing to pursue large game during winter months. Finally, it is proposed that hunters and gatherers who store for winter prefer high yield resources with low acquisition costs obtainable over extended periods of time.

This article proposes alternative winter subsistence strategies for the Late Archaic (post-A.D. 1200) period of Southern Idaho. Its purpose is to model a resource base that can be shown to equal or surpass the nutritional values of large quantities of stored salmon which are ethnographically depicted as constituting the major winter staple of the Snake River Shoshoni (Murphy and Murphy, 1960:319-323; Steward, 1938:167-168). Using principles of acquisition cost analysis (O'Connell and Hawkes, 1984; Sims, 1985; Smith, 1983) and optimal foraging theory (Webster, 1985; Winterhalder and Smith, 1981), the intent is to assess acquisition, preparation and storage costs of salmon and other resources with regard to nutritional values and storability during winter months.

It is proposed that some Shoshoni groups did not process or store large quantities of salmon, electing to use alternate resources during winter as

nutritional values were equal to stored salmon and involved reduced acquisition costs. Further, acquisition during winter months of large and small game is viewed as an important aspect of the storage strategy.

## THE ETHNOGRAPHIC PATTERN

The ethnographic pattern of the Snake River Shoshoni suggests separation of larger summer-fall populations into several small winter encampments scattered along or near the Snake River and its major tributaries (Murphy and Murphy, 1960:322; Steward, 1938:165). These encampments were in some cases as much as six miles (10 km) from the river (Steward, 1938:165). Domestic units consisted of two or three lodges housing single families and a few relatives (Murphy and Murphy, 1960:322; Liljeblad, 1957:35-36). In early summer, after the spring salmon run, groups migrated to the Camas Prairie, approximately 50 miles (80 km) north of the river, where they collected camas and other roots as well as hunted the grey ground squirrel called *paiup* (probably *Citellus townsendii*) (Steward, 1938:167). During this time large quantities of camas were gathered and prepared for winter storage. Preparation techniques included boiling in clay pots, grinding, and drying without cooking. Some roots were then placed in birch bags and buried, while much was transported to the Snake River Canyon for storage in the rocks in canyon walls (Steward, 1938:167). Returning to the vicinity of the Snake River, groups took the so-called summer salmon *tazu agai* in the Snake and its tributaries. During these excursions, people collected roots and berries, but also fished for suckers (*magudi*) and probably the northern squawfish (*Ondiavox*). Occasionally, people wintered on the South Fork of the Owyhee River, choosing not to return to the Snake.

Beginning in September, individual families collected chokecherries in the hills south of Camas Prairie, mashing and drying them into cakes. A variety of seeds also were collected and parched prior to storage.

With the beginning of the fall salmon run which consisted largely of Chinook salmon, locally called *Yu:va agai*, families returned to the river to harvest and process fish for winter storage. Spearing, trapping, netting, and using weirs were common (Steward, 1938; Liljeblad, 1957; Murphy and Murphy, 1960) with cooperative efforts coordinated by a director (Steward, 1938:169). There was no ownership of the major fisheries below Shoshone Falls, the upper limit of anadromous fish in southcentral Idaho, though Murphy and Murphy (1960:321) note that mounted and more powerful peoples may have occupied the choicest locations in the Protohistoric period.

During winter months people continued to fish (Steward, 1938:168) and would have continued to hunt animals aggregating in or around the canyon or near stored foods.

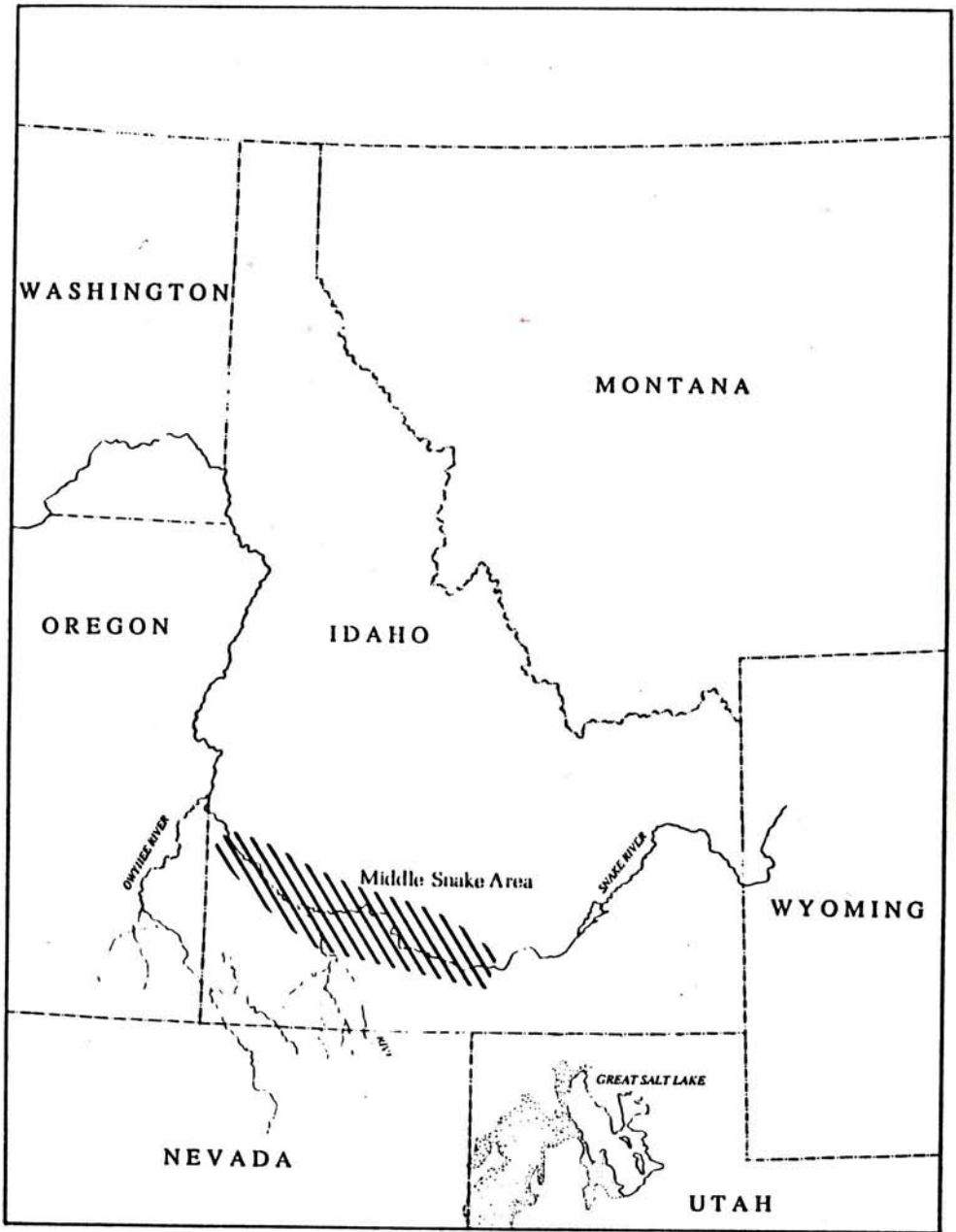


Figure 1. Map delineating the study area.

## ANADROMOUS FISH RESOURCES: HARVEST, PREPARATION, AND STORAGE

Historic harvesting potentials for the Middle Snake River previously have been documented (Plew, 1983:59-61). It is clear that the abundance of salmon noted by explorers and ethnographers (Fremont, 1887; Murphy and Murphy, 1960; Steward, 1938) is accurate. Further, its use is archaeologically documented over a period of 6000 years (Pavesic, Follett and Statham, 1987; Plew, 1980; 1981; 1987; Webster, 1978). In this regard, the Historic Liberty Millet's fisheries near Upper Salmon Falls produced some 13,023 pounds (5907 kg.) of fish during thirty days of fishing by two men utilizing a technology not unlike that employed by the aboriginal population (see Evermann, 1896:265; Steward, 1943).

Documenting by historic analogy the abundance of anadromous resources does not address the problems of aboriginal storage strategies. Schalk's (1977:231) contention that anadromous fish exploitation becomes an all-or-nothing strategy in northerly latitudes is largely championed by this article, as is the recognition that it may involve radical changes in the cultural system. That anadromous resources are available at specific times of the year and during short intervals requires a high rate of productivity or return given the adjustments of the subsistence strategy to the singular resource (see Table 1). This is particularly true with transhumant populations. In some instances, the value of a resource, given time and energy expenditures to collect or harvest, prepare and store, would result in a lower ranking of the resource. The "handling time" (Sims, 1985) must be taken into account with regard to abundant resources. Exploitation is based upon the ranking of resources, not upon their abundance (McArthur and Pianka, 1966).

While the archaeological, ethnographic and historic records attest to the abundance and existence of technology to harvest, process and store salmon, the size of domestic units and the time required to process fish has been largely ignored (see, however, Schalk, 1977). By example, Laguna's (1972:400-444) description of Tlingit drying and smoking preparation documents extensive time and effort invested in salmon processing. In this regard, the availability of processors, presumably women (Schalk, 1977), are essential as fish requires immediate processing. While Snake River Shoshoni fished cooperatively, it seems doubtful that population densities would have provided sufficient labor to process the large quantities of fish characteristic of the Plateau (Schalk, 1986). Indeed, it seems probable that salmon was stored on the basis of the small domestic units characterizing the winter settlement pattern, with a single unit probably consisting of ten to twelve people.

The caloric needs of the domestic unit for the mid-December-mid-March winter period is approximately 1,980,000 calories (c. 704 calories per pound of fish), requiring a harvest of 2,800 pounds (1270 kg.) of fish constituting

Table 1. Weight Summary of Chinook Salmon Catch at Liberty Millet's Fishery, Upper Salmon Falls, Idaho: September 29 to November 1, 1894

<i>Date</i>	<i>Males</i>	<i>Females</i>
October 2	176.25	20.00
October 3	32.50	
October 4	128.00	
October 5	155.75	
October 6	93.00	
October 10	201.75	
October 11	281.00	34.00
October 12	158.50	42.00
October 13	287.00	80.50
October 14	712.00	88.00
October 15	324.50	70.00
October 16	552.25	178.00
October 17	451.50	88.00
October 18	437.00	125.25
October 19	1,003.00	342.50
October 20	1,153.50	213.75
October 22	906.25	117.00
October 23	1,387.00	967.25
October 24	148.24	12.00
October 25	360.00	175.25
October 26	417.00	149.75
October 27	495.75	130.50
October 31	149.00	105.50
November 1	93.50	
<hr/>		
TOTAL	10,104.25 lbs. (4583 kg.)	2,919.25 lbs. (1324 kg.)
		13,023.50 lbs. (5907 kg.)

Source: Evermann, 1896.

c. 1,970,000 calories. The estimate of required poundage is based upon a minimum daily requirement of 2,200 calories per day for adult males (National Research Council, Food and Nutrition Board, 1973), a reasonable estimate in the context of ethnographic nutritional studies (Lee, 1979; Leslie, Bindon and

Table 2. Macronutrient Values of Native Foods Per 100 Gram Samples<sup>a</sup>

<i>Food</i>	<i>Calories</i>	<i>Protein</i>	<i>Fats</i>	<i>Carbohydrates</i>
Bitterroot	338.5	4.5	0.1	83.5
Camas	375.0	33.6	0.5	62.9
Biscuitroot	325.0	6.2	1.0	79.7
Smoked Salmon	176.0	21.6	9.3	0
Deer	126.0	21.0	4.0	0

<sup>a</sup> Source: Watt and Merrill, 1963; Schrimsher, 1967:67-69.

Baker, 1984; Hill and Hawkes, 1987; Hurtado and Hill, 1987) and estimated food values of salmon (Watt and Merrill, 1963) (see Table 2). The average daily catch at the Historic Liberty Millet's fishery was 421 pounds (191 kg.) per day.

Using the Historic Liberty Millet's example of 421 pounds (191 kg.) per day (see Table 1), approximately fourteen days would be required to harvest enough salmon for winter use. In addition, seven to ten days may have been required to prepare fishing equipment, including weirs, not commonly in use prior to the fishing period. Further, given ethnographic data (cf. Laguna, 1972), fourteen to twenty-one days may have been required to process the fish and prepare storage facilities. Harvesting and processing may have required forty to forty-five days and constitute a significant allotment of time for what are otherwise transhumant hunters and gatherers (see Figure 2).

However, in regard to exploitable area and density of resources (cf. Keene, 1985:162), all areas of the Snake River are not equally valuable for fishing; indeed, all aboriginal technologies could not be utilized in the same manner at all fisheries.

Further, the total yield is also of relevance in so far as total usable meat per fish is probably no more than 50-60 percent of total raw weight, excluding that which was consumed and pounded into pemmican. The distinction between gross and usable weight could double the size of the raw catch, thereby increasing the harvest and processing time.

Nutritional deficiencies in migrating salmon (Hunn, 1981; Idler and Clemens, 1959; Plew, 1983) and fluctuations in productivity (Schalk, 1977:224-227) must also be considered as they relate to time-gain ratios. Finally, preparation and storage losses must be taken into account, though drying does not seem to affect the nutritional value of salmon (Cutting, 1962; Taarland et al., 1958). In addition, storage losses due to physical conditions and scavengers may account for a 10-50 percent loss (Keene, 1981; Reidhead, 1976:305-307).

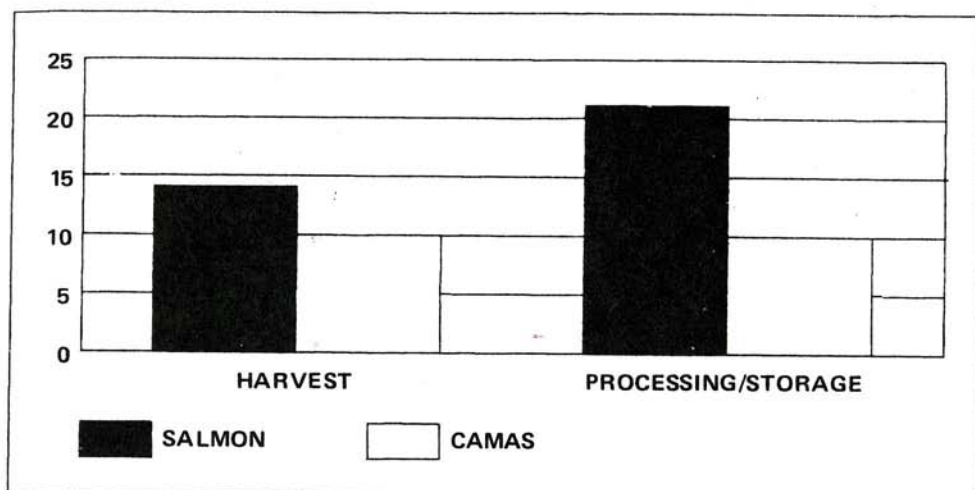


Figure 2. Harvest and processing time for camas and salmon.

## CAMAS RESOURCES

Perhaps the best known of Middle Snake River resources, camas has been documented by numerous researchers (e.g., Liljeblad, 1957; Murphy and Murphy, 1960; Steward, 1938; Statham, 1982). As noted, camas (*Cammasia quamash*) was collected, boiled or dried for winter storage. It is a prolific and predictable resource, and its distribution is associated with soil types and elevation as a consequence of moisture (Statham, 1975). It is predictable in years of less than normal snowpack, as elevational shifts offset low yields in individual fields. Further, camas has an extended period of yield or harvest, beginning in June or July and lasting three or four months, thereby permitting flexibility in the round. Its acquisition costs are low, as no specific technology, short of digging sticks, is required for procurement. Collection does not require group cooperation, and the time and effort expended are minimal. Since drying could coincide with root digging, all members of the domestic unit might be involved in acquisition.

In 1979, the author harvested camas from several locations in the Owyhee Uplands of southwestern Idaho. While not comparable to the magnitude of the Camas Prairie localities in southcentral Idaho, seventy to eighty bulbs were easily collected using unmodified sticks in the course of forty to fifty minutes of activity. In this context, one individual could easily collect several hundred bulbs per day.

Nutritionally, camas and other root crops have high caloric, protein, fat and carbohydrate content per 100 gram units (see Table 2). Camas has a caloric value of 375 and a protein value of 33.6 per 100 grams. A weight estimate based upon similar bulb weights of plants having comparable diameter dimensions of

2.5–3.8 cm. (Downing and Furniss, 1968; Statham, 1975; 1982), suggest an average bulb weight of ten to twenty grams, depending on season and water content. Calculating the caloric value of a harvest by seven to eight members of a ten to twelve person unit, based upon an estimate of 800 bulbs per person per day, a seven to ten day collecting period would provide the total caloric needs of the typical winter unit. Owing to an extended period of collection, gatherers could make decisions regarding when and how much to collect (see Figure 2).

Perhaps equally important is that camas and other root crops, such as biscuitroot, require a minimal amount of preparation. Indeed, the bulbs could have been dried during collection with no more than seven to ten days required for extraction and processing. The overall storage strategy would have been relatively simple in contrast to salmon preparation, where forty to forty-five days might be expended in harvesting and processing. In addition, the usable weight is nearly 100 percent.

Two additional aspects are significant. An important dimension of the resource is its transportability. Dried or boiled camas bulbs could have been transported or carried over long distances, making caching near winter encampments relatively easy. An additional consideration is that camas might be stored or cached for periods beyond normal winter use, providing some greater surplus for late springs. In general, camas may have been a significant alternative to salmon storage for many groups.

## DEER AND OTHER RESOURCES

Critical to winter subsistence is the availability of fresh foods, particularly meat. Optimizing strategies clearly document the preference for large game over small animals (Alland, 1968:95; Webster and Webster, 1984:281), a function of return relative to energy expenditure. This equation undoubtedly characterizes the Snake River Shoshoni wintering pattern. Most important in the strategy are mule deer (*Odocoileus hemionus*), which aggregate along canyon streams in the open desert (Larrison and Johnson, 1981:122), making the Snake River canyon an ideal location. Mule deer weigh on average 200 pounds (91 kg.). If only 100 pounds (45 kg.) of usable meat were recovered, a conservative estimate, the caloric value of ten deer is in excess of 124,000 calories. More important is the introduction of fresh meat into winter consumption (see Table 3). Low winter temperatures and the availability of ice would have made possible the indefinite storage of kills during the winter period and increased needed protein as regards energy-protein ratios (Reidhead, 1976:315).

Traditionally, survival during the winter period was viewed as contingent upon storage (e.g., Murphy and Murphy, 1960; Steward, 1938). Recent archaeological investigations at the Baker Caves near Minidoka, in southcentral Idaho (Plew, Pavesic and Davis, 1987), suggest hunting of large game during the mid-December

Table 3. Seasonal Availability of Resources

<i>Resources</i>	<i>Months</i>											
	<i>JAN</i>	<i>FEB</i>	<i>MAR</i>	<i>APR</i>	<i>MAY</i>	<i>JUN</i>	<i>JUL</i>	<i>AUG</i>	<i>SEP</i>	<i>OCT</i>	<i>NOV</i>	<i>DEC</i>
Salmon			X	X		X			X	X	X	
Camas						X	X	X	X	X		
Deer	X	X	X	X	X	X	X	X	X	X	X	

to mid-January period north of the Snake River. The select portions of seventeen bison were butchered (Miller, 1987) and possibly stored in a small lava tube. Such discoveries suggest that Late Archaic peoples may have continued to hunt during the winter period as is suggested by Liljeblad (Butler, 1971a:10).

In addition to large mammals such as deer and perhaps bison, small game including rabbits, non-salmonid fishes including suckers and sturgeon, and mussels would have provided considerable nutritional values, harvestable throughout the winter.

## ALTERNATIVE SUBSISTENCE STRATEGIES

This article proposes alternative subsistence strategies for the Middle Snake River Shoshoni, emphasizing the utilization of root crops, salmon and live animals as the major food items in the storage strategy. The first strategy suggests that some Snake River Shoshoni constituted more or less residential units which did not wander far from the Snake River and focused upon riverine/aquatic resources. It is argued that these populations, owing to greater residential stability, were more likely to utilize larger quantities of salmon in the strategy, particularly as it regards winter storage. Resource weighting was less important as relatively resident populations easily maintained fishing equipment and storage facilities which would not have required disruption of the schedule.

A second strategy involves transhumant hunters and gatherers whose use of Snake River resources was seasonal and periodic. Such groups were constantly scanning the range of resource possibilities. Because acquisition/storage costs and return ratios are heavily weighed by highly mobile groups (Sims, 1985), resources of short duration which require extended pre- and post-processing time as regards technology, preparation techniques and storage facilities are not optimal. Rather, highly mobile populations utilize high total yield resources having extended periods of availability, requiring minimal preparation, and being easily transported and stored. Such groups utilized salmon, perhaps storing some, but depending upon stored tubers, which provided a significant protein source.

A third strategy is one of relatively mobile groups whose winter subsistence is based upon minimal storage of root crops and salmon, emphasizing instead the use of large game during winter months. This strategy, while highly flexible and characterized by low acquisition costs, involves greater risk in regard to meeting winter energy requirements.

The strategies described here are similar to but distinct from the settlement-subsistence regimes proposed by Ames (1982:6). In general, the ethnographic record may represent aspects of several different subsistence patterns.

Selections are based upon relative abundance, predictability and the nature of the individual settlement-subsistence regime. Root crops were particularly valuable in terms of storage and transportability and acquisition costs in time, technology, processing and scheduling relative to nutritional returns. In contrast, the labor intensive production costs associated with salmon, plus protein and caloric deficiencies (Plew, 1983:62), infrequent occurrence and short-term availability reduced the relative importance of salmon in the winter subsistence strategy. In addition, during the Late Archaic and Protohistoric periods (Murphy and Murphy, 1960:320), increased pressure on local fisheries may have made optimal the use of other resources.

Understanding Middle Snake River subsistence requires recognition that Snake River Shoshoni were hunters and gatherers. The extensive use of salmon as part of a winter storage strategy, with high production costs, implies a more sedentary pattern. This article argues that in northerly latitudes hunters and gatherers will be more likely to use, in the context of winter storage strategies, high yield, low cost resources whose collection coincides with processing which may be extended over several months, thereby retaining scheduling flexibility.

The processing and storage of quantities of salmon great enough to support large Shoshoni groups seems improbable given the nature of Shoshoni settlement-subsistence patterns. Many Shoshoni may have simply utilized the resource during periods of abundance while others processed and stored substantial quantities, though most probably less than implied by ethnographic accounts and that needed for winter subsistence.

Finally, it is argued that Southern Idaho hunter-gatherers' winter storage strategies took into account resources available during the winter. This is particularly true of larger game found within the extended catchments of winter encampments, as evidenced by Givens Hot Springs (Green, 1982). The availability of foods which could be exploited and easily stored must be considered an element of the winter pattern.

## CONCLUSION

The traditional view of Middle Snake River Shoshoni winter subsistence is based upon ethnographic and ethnohistoric accounts (Steward, 1938; Murphy and Murphy, 1960; Fremont, 1887), which emphasize the importance of stored salmon. This article suggests that other resources, particularly camas as it regards

return/energy-expenditure ratios, are equal to or more important in value than salmon in the winter strategy. In fact, abundance and predictability are of considerable importance in the ranking of these resources with respect to storage strategies. In particular, the extended period of availability, the simple technology required for exploitation, both in collection and preparation, and its transportability, make most root crops preferred resources for the small domestic units which characterized the winter pattern.

This article further notes the importance of continued hunting during the winter, thereby emphasizing the need to view the aboriginal storage strategy as a more dynamic system involving hunting, collection and storage during the winter period. The article does not imply that all Middle Snake River Shoshoni were primarily camas collectors; rather that some groups consistently and perhaps others occasionally ranked resources differently than implied by generalized ethnographic accounts, a pattern of "switching" not uncommon among hunters and gatherers (Earle, 1980:4). In this regard, three alternative winter storage strategies are suggested. These include relatively sedentary river dwellers who maintain fishing equipment and fish weirs and for whom construction and maintenance of storage facilities for large scale salmon exploitation need not affect scheduling of other resources; traditional transhumant groups relying upon high yield resources such as camas which may be collected and prepared over a period of time and easily transported and stored; and highly mobile groups who place minimal emphasis upon root crops or salmon and elect to pursue large game during winter months.

Finally, the generation of alternative views of winter storage strategies raises fundamental questions regarding hunters and gatherers in northerly latitudes, as it relates to emphasis upon "abundant" resources and the assumption that small transhumant populations necessarily alter strategies to accommodate abundance with respect to winter storage. It is suggested that high yield resources with low acquisition costs, obtainable over extended periods of time are preferred by hunters and gatherers who store for winter consumption, as it increases scheduling flexibility with low costs and minimizes disruption of the transhumant lifeway.