

August 12, 1993

Ms. Maureen Finnerty
Superintendent
Olympic National Park
600 E Park Avenue
Port Angeles
Washington 98362-6798
U.S.A.

Dear Ms. Finnerty

Enclosed please find a written review of the information provided on the historic and prehistoric status of mountain goats in the Olympic Mountains, in accordance with National Park Service Purchase Order No. 1443-PX9500-93-324. I have forwarded a copy to Dr. MacManamon in Washington.

Yours truly

A handwritten signature in dark ink, appearing to read "Gay Frederick", with a stylized, flowing script.

Dr. Gay Frederick

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Rec'd Federal House
AUG 17 1993

**A REVIEW OF THE EVIDENCE REGARDING THE HISTORIC AND PREHISTORIC STATUS
OF MOUNTAIN GOATS IN THE OLYMPIC MOUNTAINS**

**A Report provided to the U. S. National Park Service,
Olympic National Park**

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**Submitted to
National Park Service
Olympic National Park
600 E. Park Avenue
Port Angeles, WA 98362-6798**

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A REVIEW OF THE EVIDENCE REGARDING THE HISTORIC AND PREHISTORIC STATUS OF MOUNTAIN GOATS IN THE OLYMPIC MOUNTAINS

This assessment of the historic and prehistoric status of the mountain goat in the Olympic Mountains is based on the information contained in four documents provided by the U.S. National Parks Service:

A review of the historical evidence relating to mountain goats in the Olympic Mountains. Dr. Susan Schultz; Historian, National Parks Service. Draft, May 1993.

A review of the ethnographic and archaeological evidence relating to mountain goats in the Olympic Mountains. Dr. Randall Schalk; Archaeologist INFOTEC Research Inc. March 1993.

Biogeography of the Olympic Peninsula. Dr. D.B. Houston and Dr. E.G. Schreiner; Research Biologists, National Parks Service. Draft, 1993.

"Significance for wildlife management of the late Quaternary biogeography of Mountain Goats (*Oreamnos americanus*) in the Pacific Northwest, U.S.A." Dr. Lee Lyman. In Arctic and Alpine Research, Vol. 20, No. 1, 1988.

Reviewers were asked to consider two issues:

1. "How strong is the evidence that goats were absent historically?"

and

2. "What is the likelihood that goats were absent during the late Quaternary, based on the available evidence?"

These issues have arisen because the absence of mountain goats in the Olympic Mountains prior to 1924 has recently been questioned in the above article by Dr. Lee Lyman. The following pages address the questions in the light of the information collated in the other three documents.

Question 1: Historical Presence or Absence of Mountain Goats in the Olympic Mountains

Lyman has briefly reviewed some of the historical, ethnographic and archaeological records pertaining to the Olympic Peninsula. He contends that:

1. Mountain goats might not have been reported in the nineteenth century in the region of the present Olympic National Park because the areas

explored by the early biological surveys did not cover "appropriate areas" of mountain goat habitat (Lyman, 1988:14).

2. The ethnographic record for the region may be a poor indicator of the presence or absence of native goats.

and

3. "... the archaeofaunal record for the Olympic Peninsula may not be representative of the Holocene mammalian fauna that lived there, and thus may be a poor indicator of the presence or absence of mammalian, especially alpine, taxa." (Lyman, 1988:14).

I shall address each of these points in turn.

The Completeness of the Historical Record

It is apparent that the historical records consulted by Lyman through Moorhead and Steven's (1982) review, were not exhaustive of the available documentation. Schultz's review of the historical record is considerably more extensive. While the selected surveys referenced in Lyman may not have passed through optimal goat habitat, a number of exploratory expeditions and surveys in the 1880's and 1890's did in fact pass through optimal goat habitat, areas that are now occupied by the introduced goats (Schultz, 1993:18-30). The Watkinson Exploration in the fall of 1878 may also have traversed habitat now within the south eastern part of the range of the introduced goats.

Especially interesting in this regard are the explorations and expeditions of Army Lieutenant Joseph O'Neil in the summers of 1885 and 1890 and the 1891 trip of Fisher/Hanmore. The 1885 O'Neil trip traversed areas of the Elwah drainage and as far south as Mount Anderson that now support goat populations. The 1890 trip, of a three months duration, traversed the southern Olympics, including an ascent of Mt. Olympus, through prime mountain goat habitat. In the summer of 1891 Fisher/Hanmore, a member of the earlier O'Neil expeditions, returned to the Olympics, exploring the high country near the headwaters of the Duckabush River. He specifically mentions keeping a lookout for goat and sheep. These expeditions through prime mountain goat habitat in areas now occupied by the introduced goats, recorded no evidence of mountain goats. Fisher/Hanmore in fact states that neither sheep nor goats are "found in this range of mountains" (Schultz, 1993:27). At least one of Fisher/Hanmore's exploratory trips took place in August, a time of year when the nannies and young of the year would still be congregated in small herds and easily seen. The second, three month trip of O'Neal also took place in summer when goats would have been especially easy to spot.

There would appear to be clear evidence from local inhabitants of the area engaged in hunting, guiding and trapping throughout areas of the Olympic Range, that mountain goats were not to be found in those mountains during the first two decades of the twentieth century (Schultz, 1993:31-35).

The biological and administrative surveys carried out by various departments of the United States federal government, the State of Washington government and a

number of museums in the 1880's, 1890's and the early decades of the twentieth century also fail to mention mountain goats in their listing of species present in the Olympic Mountain Range during these time periods (Schultz, 1993:36-45). For example, the Field Columbian Museum expedition in the summer and fall of 1898 reported by D.G. Elliot, ascended into the region of the headwaters of the Solduck and Bogachiel Rivers and some considerable way up the Elwah, into regions now occupied by goats. Marmot and mountain beaver were among the thirty species or subspecies for which specimens were collected on this expedition, but no goats were seen (Elliot, 1899).

It would seem that at least by the mid to late 1800's, mountain goats were not to be found in areas of the Olympic Range that are prime goat habitat and now support major herds. The evidence against which to evaluate the presence or absence of mountain goats for the earlier historical period (1750's -1850's) is less clear.

The early European exploration of this area of the west coast took place from the sea. De Fuca, the Spaniards Perez and Martinez, Eliza and Quimper, Narvaez, Galiano and Valdes, and the Englishman Vancouver all explored the waters of the Strait of Juan de Fuca and some portions of Georgia Strait during the last decades of the eighteenth century. Their explorations did not include extensive trips by shore parties into the interior of the Olympic Peninsula. Those peninsula shore areas that they did explore were not habitat where one would expect to find mountain goats.

Some of the eighteenth and early nineteenth explorers were familiar with the mountain goat, as is evidenced by Caderno's drawing of the carving depicting mountain goats found in Toba Inlet to the north and the mention of skins in use among the aboriginal inhabitants (Schultz, 1993:8). Vancouver was certainly aware of the mountain goat, having collected a skin in 1793 near Bella Bella. It is difficult to reconcile Quimper's inclusion of wild goats in the list of wildlife found along the shores of the Strait of Juan de Fuca (Schultz, 1993:5) with the extreme unlikeliness of Quimper having seen such animals along the shores of the Olympic Peninsula. As Schultz points out, there is some evidence to support the belief that the term "Strait of Juan de Fuca" was being applied to an area more extensive than the area we now refer to by that term, one that may have included areas of the British Columbia mainland to the north that were then and are still today inhabited by mountain goats (Schultz, 1993:10). Alternately, the listing of wildlife found may be a general, rather than place specific listing.

Based on the written historical evidence, it is not possible to say that there were no mountain goats in the Olympic Peninsula during this period of maritime exploration from the 1750's to the 1850's. However, given that several of the explorers were familiar with the mountain goat and intrigued by the use of its wool by the aboriginal inhabitants, had the mountain goat been directly available to the inhabitants of the Olympic Peninsula shores, and skins and wool of this animal relatively common in the villages along the shores of the Olympic peninsula, they would have been noted by these explorers. Certainly aboriginal use of the skins and wool were noted by Galiano and Valdes in Esquimalt Harbour on June 9, 1792, just one day after leaving Neah Bay (Schultz, 1993:8). It seems unlikely that had goat skins been observed among the inhabitants of Neah Bay, they would go unremarked. The suggestion here is that goat skins and wool were

not as available to and common among the western inhabitants of the Olympic Peninsula as they were in Puget Sound and across the straits on southern Vancouver Island.

In a number of instances the use of goat's wool, horn and skins is recorded for the Puget Sound/Georgia Strait region to the east of the Olympic Peninsula. In these cases the wool, horn and skins are clearly indicated as trade items originating in the Cascades or British Columbia Coast Mountains (Schultz, 1993:13,14 and 16). It is extremely likely, given the close aboriginal trade networks and interlocking social networks of the region, that goat's wool was used by the aboriginal inhabitants of the Olympic Peninsula when it was available to them. It seems that it was not as available to them as to their eastern neighbours. This would argue for a greater distance from the direct source of the wool, horn and skins. An argument regarding the complementary nature of the availability of goat's wool and the keeping of wool dogs is discussed in the section on the ethnographic record.

A cautionary note is necessary here. It is evident that as early as the 1840's, manufactured European trade blankets were rapidly displacing local manufactures of wool, feather and plant fibre. In this changing economic climate, the value and status, and therefore desirability, of goat's wool would rapidly decrease. The expected result would be an equally rapid decrease either in direct procurement or trade import of goat products and a corresponding decrease in visibility of the local manufactures in the villages. One might then not expect to find goat product items in evidence in post 1840's communities, except in areas where these items still maintained their association with prestige or still contributed significantly to the local economy.

The corollary to this mid-nineteenth century decrease in use of goat's wool might also be a significant decrease in aboriginal hunting pressure on any existing local goat populations. Additionally, after the establishment of coastal reservations for the Makah, Quileute and Quinault on the Peninsula in the 1890's, these people were prohibited from hunting outside the reservations. Had they been hunting mountain goats at this time, these restrictions would have further decreased hunting pressure on the goats. Combined with increased white hunting pressure on predator populations of cougars, bears, wolves and eagles, this would lead one to expect an increase in any local goat populations post mid-1800's. There is no evidence in the historical record of such a phenomenon in the Olympic Peninsula. It might be instructive to see if such a postulated increase in local goat populations is recorded for the Cascades Mountains in the post 1840 period.

The written historical evidence, then, tends to support the view that there were no mountain goats on the Olympic Peninsula during the 1750's to the 1850's and more strongly supports the contention of their absence for the period 1850's to early 1900's. Contrary to Lyman's contention, at least some of the 1890's explorations did pass through prime goat habitat, finding no evidence of goats.

The Ethnographic Record

The ethnographic record for the general Northwest Coast use of mountain goat wool, fat, meat, horn and skins is extensive. Schalk has competently summarised the existing ethnographic record (Schalk, 1993:4-16). Both the wool and the horn

were prized, associated with status, chiefly prestige, ceremonial functions and wealth. The horns were carved into elaborate feast spoons. Wool from both mountain sheep and goats was used in ceremonial blankets, leggings, dance aprons and other items of clothing. On the southern coast in Salishan speaking areas, goat's wool was also attached to the sheep horn rattles used in rituals and woven into bags or covers for masks and rattles. Other animal and plant fibres were often incorporated into the weavings. The high value placed on mountain goat's wool is remarked by Schalk, and as he indicates probably resulted from both its scarcity and its desirable qualities (Schalk, 1993:5-6).

There is strong historic evidence that the aboriginal inhabitants of the Puget Sound and Olympic Peninsula also raised a variety of small, long haired dog specifically for their "wool" (Schalk, 1993:6-7). Both Cook and Vancouver describe the keeping of these "wool dogs" among the Salishan and Nootkan speaking peoples of south and western Vancouver Island and Puget Sound in the late 1700's. Makah women were observed weaving dog hair blankets in 1850. There is good ethnographic evidence that the keeping of wool dogs was an activity engaged in by those groups who did not have direct access to mountain goats. The distributions of the keeping of wool dogs and the access to mountain goat hunting territories are complementary rather than overlapping (Schalk, 1993:7). While the keeping of wool dogs does not preclude the use of mountain goat's wool, it may represent the development of a socioeconomic strategy to compensate for the lack of secure access to this important fibre.

In this regard, Schalk's summary of ethnographic references to the hunting of mountain goat and the use of mountain goat products among the peoples of the Olympic Peninsula is important (Schalk, 1993:7-16). Although use of mountain goat wool, horn or skins is recorded for the Quinault, Quileute, Makah, Klallam, Twana and the Satsop, the hunting of mountain goats in these peoples' traditional territories is not described. In some instances the absence of mountain goats in the territories is specifically noted or the source of mountain goat products specifically identified as trade with a particular named group to the east or north of the Olympic Peninsula. While the ethnographic memory reflected in these ethnographies may not have great time depth, informants for at least some of the information had been children in a traditional culture. For example, Singh's informants among the Quilleutes, Quinault and Makah ranged in age from 65 to 100, placing their childhoods in the period from around the 1860's to the 1890's and early 1900's (Singh, 1966:8-9). If the elders had not themselves direct knowledge of the presence or absence of mountain goats in the Olympic Peninsula, they might reasonably be expected to have second hand knowledge through their parental and grandparental generations.

It is also significant that mountain goats do not figure in the body of myth, crest stories and legends nor the ceremonial accoutrements - masks, rattles, clothing designs - associated with those stories, among the Peninsula tribes. This is in contrast to their appearance in story and art in areas of British Columbia where mountain goats were hunted into historic times, as for example among the Tsimshian, Nisga'a and Gitksan.

The ethnographic evidence indicates the followings:

1. During the 1700's and 1800's mountain goat products were prized and used

among the inhabitants of the Straits of Juan de Fuca as they were elsewhere on the Northwest Coast.

2. Where evidence exists, trade with groups to the east or north of the Olympic Peninsula is specified as the source for mountain goat wool and horn.

3. There are no ethnographic descriptions of mountain goat hunting on the Olympic Peninsula, but there are descriptions of hunting marmots and mountain beaver, both found in prime mountain goat habitat.

4. Mountain goats do not figure prominently in the stories and art of Peninsula groups.

and

4. Dogs were raised by the groups on the Olympic Peninsula specifically for their wool for weaving, possibly to augment a shortage of mountain goat wool.

Taken together, these points are strong support for the lack of direct access to mountain goats by Peninsula tribes. While this cannot be taken as direct evidence of the absence of mountain goats from the Olympic Range, it is certainly indirect evidence of such. One must characterise the ethnographic record not as a poor indicator of the presence or absence of mountain goats in the Olympic Mountains, but as one that indirectly supports the absence of mountain goats in the Olympic Range during the 1700's and 1800's.

The Archaeofaunal Record for the Olympic Peninsula

It is certainly true that the existing archaeofaunal record for the Olympic Peninsula is likely to be unrepresentative of the Holocene mammalian fauna of the alpine regions of the peninsula interior. In this respect one would expect that the alpine species, even if exploited, would be under represented, possibly not even represented at all in the coastal midden sites that provide the greater portion of the archaeofaunal record.

Specifically, one would not expect the coastal midden sites to contain quantities of mountain goat remains, even if their inhabitants were directly hunting mountain goats from satellite camps. The distance of these shoreline sites from the mountain goat habitat makes it extremely likely that goats would be butchered where killed, in the montane hunting camps, with the meat, skins, horns, fat, sinews brought down to the coastal sites. One would not expect whole carcasses to be brought to the coastal habitation sites. One might expect, however, that if mountain goat hunting was an important economic or prestige pursuit of the inhabitants, that some mountain goat bones would turn up in the coastal habitation sites. One might expect to recover phalanges (resulting from the collection of hooves for rattles), metapodial bones and the larger limb bones that are potentially useful raw material, and skull portions, in particular the areas of the skull abutting the horn cores and the cores themselves, as well as the axis and atlas vertebrae, which are difficult to detach from the skull in the butchering process. Minimally, one would expect horn cores, metapodials and phalanges.

One would expect skeletal remains of mountain goats to be deposited at hunting camp sites located in the sub-alpine hunting territories, if goats were present and hunted. Sixty known sites, basically lithic scatters indicative of hunting activities, are recorded from Olympic Peninsula sub-alpine areas where mountain goats would have been found if present. Only one of these sites, dated 4990 ± 60 B.P., has produced faunal remains. Unfortunately, the faunal remains from this Seven Lakes Hearth (45-CA-275) are too fragmentary to be identified to species. These sites are, however, indicative of a prehistoric presence in the interior of the Peninsula dating back at least 5000 years, and possible as much as 9000 years (Schalk, 1993:32). The possibility exists, then, that if mountain goat were present and hunted prehistorically, their skeletal elements might minimally be represented in the coastal midden sites associated with those hunting camp sites.

Schalk's survey of the Olympic Peninsula archaeological record indicates that mountain goat skeletal elements may have been found at only one of 24 Olympic Peninsula coastal archaeological sites presently reported as having been at least tested and having produced some faunal remains. Mountain goat is reported as present from the 1917 excavations at the La Push Village site (45-CA-23). But it is not clear if the elements were bones, horn artifacts, or are in fact true reports of elements actually recovered from the midden at all (Schalk, 1993:22). While the faunal record from many of the other sites is scanty and not well reported, the Ozette, Hoko River Rockshelter and Hoko River sites have produced substantial (NISP's of 53,000, 3,262 and 4,367 respectively), well reported and reliably identified samples of mammal remains, although a high proportion of these samples is of sea mammal rather than land mammal remains. An additional four sites have yielded mammal samples of between 300 and 1000 skeletal elements, while another six have yielded less than 150 identified mammal skeletal elements. No mountain goat elements were identified in any of these samples. This may be a factor of small sample size, or may be a real absence.

In areas of western Washington, coastal Alaska and British Columbia where mountain goats are known to be indigenous and known to have been hunted, mountain goat skeletal elements, though not numerous, have been recovered from coastal midden sites with comparable sample sizes of mammal remains. The expected pattern of skeletal elements is reflected in a preponderance of horn cores, skull fragments, teeth, metapodial and limb bones, suggesting transportation over some distance of partial, not whole, carcasses. It is also apparent that those sites that have produced mountain goat remains are indeed closer to prime goat habitat than the Olympic Peninsula sites surveyed by Schalk. There may well be, as Schalk suggests (1993:36), an inverse correlation between distance from suitable habitat and frequency of goat remains, even where goats are regularly hunted. Yet the evidence suggests that if mountain goat hunting were an important economic or prestige activity among Peninsula peoples, one might expect at least a minimal representation of their skeletal elements in at least some of the Peninsula peoples main habitation sites, even though they are some considerable distance from the alpine and sub-alpine habitats where the hunting would take place. On the other hand, it may be that the archaeological samples from these sites are not sufficiently large nor from sufficiently extensive excavations to adequately represent all faunal remains actually deposited and preserved in those sites.

In at least one site, the Minard site, mountain beaver bones were recovered, dating around 1000 B.P. This indicates that the alpine areas that are prime goat

habitat were in fact used as hunting territory by the site inhabitants. The small size of the mountain beaver increases the likelihood of hunters bringing whole carcasses back to the main coastal site and therefore increases the likelihood of its bones being represented in a faunal sample, but one might expect at least the minimal horn cores, metapodials and phalanges of mountain goats to be present in these sites if the inhabitants hunted these animals frequently.

The wool dog distribution and time depth in the area may be seen as indirect evidence for the time depth of the absence of secure access to mountain goat wool. Although small dogs are reported from both the Cattle Point Site on San Juan Island and the Penn Cove Site on Widbey Island, only the Ozette site canid remains are reported in sufficient detail to provide solid evidence of the presence of at least two sizes of dog at the site, one within the range of the historically reported size of the wool dog (Gleeson, 1970:83). Current research into distinguishing the wool dog among archaeological canid remains, using both morphometric skeletal characteristics and the possibility of DNA analysis is presently examining the question of the time depth of this canid sub-species in the Salish region (Crockford, 1993, personal communication).

The artifactual evidence, while supporting the presence of a strongly developed weaving complex on the Peninsula at Ozette by at least 500 B.P., gives no clues as to whether or not mountain goat as well as dog wool was spun and woven with the tools recovered. It is likely that the weaving complex on the peninsula is at least as old as it is in the Gulf of Georgia, where it is definitely present by 1500 B.P. and likely as old as 4500 B.P. (Schalk, 1993:32).

While the lack of mountain goat skeletal elements in these coastal midden sites does not prove the absence of mountain goats from the sub-alpine and alpine fauna of the Olympic Mountains, it does on balance tend to support the contention that mountain goat hunting was not an important economic or prestige activity of their inhabitants. This archaeological evidence is in agreement with the above summarized ethnographic and historical evidence.

Strength of the Historical Evidence for the Absence of Mountain Goats

On balance, the historical documentation, ethnographic record and archaeological evidence all support or tend to support the contention that mountain goats were not present on the Olympic Peninsula at the time that Europeans arrived on Olympic Peninsula shores in the mid- 1700's. The evidence of absence is strongest for the post 1850's period, more indirect and negative for the earlier periods.

Question 2: Were Goats Absent During the Late Quaternary?

The archaeological evidence summarized above does tend to suggest that goats were absent on the Olympic Peninsula during the latest part of the Holocene record. While isolated finds of bison and mastodon are known from the Peninsula, the Manis Mastodon Site near Sequim is the only palaeontological site on the Olympic Peninsula that has been systematically investigated. That site, dated to 12,000 B.P., produced no mountain goat remains. The evidence simply is not yet available to prove the presence or absence of mountain goats in the Olympic Range in the

early Holocene period.

Theoretically, from a habitat point of view, there is no reason why mountain goats might not have been present on the Olympic Peninsula during the full and late glacial stages of the last glaciation. There is increasing evidence that during the full glacial stage, the Olympic Peninsula, like parts of the west coast of Vancouver Island and the Queen Charlotte Islands, acted as a glacial refugia for plant and animal species.

During late glacial times, once the ice sheets were in retreat, the Peninsula was still biogeographically cut off from the rest of Washington by the massive outflow channels feeding into what is now the Chehalis River and by the series of pro-glacial lakes filling what is now the Puget Trough. While this isolation was not necessarily complete, the outflow channels and the lakes offered some barriers to the free passage of many mammalian species, both out of the peninsula to surrounding regions and into the peninsula from surrounding regions.

To this isolation in early post glacial times are attributed the one endemic species and four endemic subspecies of mammals found only on the Olympic Peninsula (Houston and Schreiner, 1993:9). This pattern of endemism is typical also of Vancouver Island, the Queen Charlotte Islands and the Alexander Archipelago. These other "landbridge islands" also display an impoverished mammal fauna relative to the adjacent mainland areas and also lack mountain goats. Additionally all four areas lack the pika, the northern bog lemming, the porcupine and the red fox (Houston and Schreiner, 1993:Table 3-3). These other areas also contain habitat suitable for mountain goats, but no indigenous goats, suggesting that if mountain goats were part of the coastal refugia mammal populations, they would have been so only in the Olympic Peninsula. This is not impossible. It is possible that mountain goats were present in an Olympic Peninsula refugia prior to and during full glacial times and have since become extinct. There is as yet no evidence of such a survival.

It is apparent that the earlier range of mountain goats was less restricted than that reported historically for at least two areas of the Pacific Northwest, north central Washington and southeastern Oregon. Lyman reports archaeological or palaeontological sites containing mountain goat remains from these areas dating to 3000 and 2000 years ago respectively (Lyman, 1988:18). It is also apparent that the biogeographical ranges of many mammals have been altered significantly by the impact of European colonization in the Pacific northwest. Additionally, the post-glacial period has been and continues to be one of climatic change and environmental evolution, necessarily impacting mammalian ranges.

Thus it is theoretically possible that mountain goats were present on the Olympic Peninsula during and after full glacial times, and subsequently became extinct. It is also theoretically possible that although there were no goats on the Olympic Peninsula during full glacial and immediate post glacial times, they colonized the region in early postglacial times from the Cascades region, before the full development of the lowland forests separating the Olympic Range from the Cascades today, but after the pro-glacial lakes and outflow channels were sufficiently reduced to be less of a barrier to passage. They then subsequently became extinct.

What makes this hypothesis seem unlikely is that there has been no apparent lack of suitable habitat for their continued existence throughout the Holocene on the Olympic Peninsula. The introduced populations have sustained themselves and are increasing in numbers. We are then perhaps looking for a human factor to explain an extinction. The summary of the historic, archaeological and ethnographic evidence above would suggest that if a human factor has been involved in the extinction of an indigenous goat population, it must have been prior to the historic record and the ethnographic memory and yet is not so far evidenced in the archaeological record.

Summary of the Likelihood that Goats Were Absent in the late Quaternary

While there is no theoretical reason why mountain goats should not have been present in the late Quaternary in the Olympic Mountains, there is so far no biogeographical evidence that they were, prior to their introduction in the 1920's. Thus the hypothesis cannot be discounted, but requires palaeontological evidence against which to test it. That evidence is not available to date. It would be instructive to look at the complete range of plants and animals found in the Cascades ecosystem where mountain goats are a part of the indigenous fauna, to see if the constellations of other fauna and flora species associated with a long-standing goat population, are also present in the Olympics. Marmots, for example, significantly alter the local vegetation in the areas of their colonies, and the effects of their presence are readily recognizable. It may be that the coevolution of goats and other species in an ecosystem would produce an equally recognizable pattern, the effects of which would still be evident if goats had recently been part of the system.

Conclusions

Taken in conjunction, the historical, ethnographic, archaeological and biological data available at this time support the contention that mountain goats were not present on the Olympic Peninsula prior to their deliberate introduction in the 1920's. Much of this data is negative rather than positive, but the agreement between the four types of data lends greater support to the theory of absence than that of hypothetical presence. The possibility still exists that mountain goats were present in the early Holocene and became locally extinct prior to the 1750's and the beginning of the written historical record, but it seems more likely that they have not formed part of the indigenous fauna of the Olympic Peninsula in the Holocene. Palaeontological evidence for the post glacial time period from the alpine/sub-alpine regions of the peninsula is required to better evaluate the strength of this statement. Until such evidence is available, this question remains open, but present evidence supports the position that mountain goats were absent from the post glacial fauna of the Olympic Peninsula until their deliberate introduction in the 1920's.

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