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A Synthesis of Historical and Recent Reports of Grizzly Bears (*Ursus arctos*) in the North Cascades Region

Natural Resource Report NPS/NOCA/NRR—2018/1662

ON THIS PAGE
Grizzly bear tracks near Mt. Baker in the Mount Baker-Snoqualmie National Forest, 1989
Photo by Roger Christophersen/NPS

ON THE COVER
The Weaver brothers' cabin, displaying a grizzly bear pelt and other assorted pelts harvested from the Stehekin River basin.
Unknown photographer.

A Synthesis of Historical and Recent Reports of Grizzly Bears (*Ursus arctos*) in the North Cascades Region

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Abstract

The North Cascades ecosystem of north-central Washington State (US) and southern British Columbia, Canada has been identified as one of six recovery zones for grizzly bears (*Ursus arctos*) that were at one time distributed across a nearly continuous range of western North America. The current low number of grizzly bears along with an apparent scarcity of historical observations obfuscates the extent to which the North Cascades and its surrounding lowlands previously supported grizzly bears. We reviewed and synthesized what is currently known about the historical distribution of grizzly bears in and around the North Cascades ecosystem to better inform possible future restoration actions. Archeological, ethnographic, and incidental evidence confirm the prehistoric and historic presence of grizzly bears in the ecosystem and surrounding lowlands.

Acknowledgments

Many thanks to the Hudson's Bay Company Archives in Winnipeg, Manitoba for providing copies of fur return records and other resources cited in this publication. We also wish to express sincere gratitude to the Stó:lô Nation (Chilliwack, British Columbia) for allowing us to review archived reports and collections of writings related to grizzly bear observations and folktales. Thanks to Paul Schullery for providing consultation, collaborative dialogue, and resources. Thanks also to the Interagency Grizzly Bear Committee North Cascades Ecosystem Subcommittee Technical Team members for their review of the document. We are grateful for the assistance of Mark Huff and Lise Grace for peer review management and document formatting, respectively.

Introduction

Grizzly bear (*Ursus arctos*) populations declined across North America over the last century due to extensive hunting, trapping, predator control, and habitat loss/fragmentation (USFWS 1993, 1997). By 1970, grizzly bears remained in only 2% of their former range within the contiguous United States (USFWS 1993, Servheen 1999). In 1975, the US Fish and Wildlife Service responded by listing the species as federally threatened under the Endangered Species Act (USFWS 1993), and subsequently prepared a Grizzly Bear Recovery Plan in 1982, which was revised in 1993 (USFWS 1993). In order to manage remaining populations, six recovery zones were established where grizzly bears were either extant or were known to have occurred in the lower 48 states. One of these was the North Cascades Grizzly Bear Recovery Zone (USFWS 1993, Braaten et al. 2013).

The North Cascades ecosystem spans the US-Canada border in north-central Washington State and southern British Columbia (BC), and contains some of the most intact wildlands in the contiguous United States. While the current population of grizzly bears in this ecosystem is unknown, there have been only four confirmed sightings in the past decade (IGBC North Cascades Subcommittee 2016); therefore, the population is considered functionally extirpated (USNPS/USFWS 2017). The extremely low density of grizzly bears in the ecosystem (Romain-Bondi et al. 2004), the species' slow reproductive rate (Nowak and Paradiso 1983, Schwartz et al. 2003), and isolation from other populations (Proctor et al. 2012, USNPS/USFWS 2017) make natural recovery unlikely.

In early 2017, the National Park Service and US Fish and Wildlife Service jointly released the Draft Grizzly Bear Restoration Plan/Environmental Impact Statement for the North Cascades Ecosystem (USNPS/USFWS 2017) and analyzed all comments submitted during the open review period that followed. Some reviewers expressed doubt that a viable grizzly bear population existed in this ecosystem prior to the onset of localized anthropogenic pressures and greater decline of the species across North America. Consequently, the broad purpose of this report is to synthesize and update disparate existing information on prehistoric (prior to 1800), historical (prior to 1950), and recent grizzly bear presence in and around the North Cascades. In doing so, we hope to further inform discussions pertaining to grizzly bear management and restoration efforts.

Estimates of historical grizzly bear distribution and density in the North Cascades have remained uncertain and even puzzling, but biologists, historians, and park managers generally maintain that populations originally extended throughout the Cascade Range and most other parts of Washington. Although the ability of grizzly bears to occupy a wide variety of habitats would have almost certainly resulted in a nearly continuous prehistoric range throughout North America (Storer and Tevis 1955, Rausch 1963, Peterson 1965, Guilday 1968, Herrero 1972, Leonard et al. 2000, Mattson and Merrill 2002), the infrequency of historical observations in Washington's coastal lowlands, Columbia plateau, and Olympic Peninsula has led to the exclusion of these areas on some historical range maps (e.g. Seton 1926, Craighead and Mitchell 1982, Servheen 1990). Further, some skeptics posit that any historical population within the North Cascades ecosystem did not exceed the scattered few that have been observed in recent years (Sullivan 1983).

It is widely cited that the decline of viable populations in Washington State primarily occurred during the North American fur trade and continued with predator control and habitat destruction as the region became increasingly developed (Sullivan 1983, Almack et al. 1993, Gaines et al. 2001). Other sources suggest that grizzly bears and other large game were depleted before this period as prehistoric human populations established dense and permanent settlements across the region's coastline and productive salmon streams (Martin and Szuter 1999, Mattson and Merrill 2002, Laliberte and Ripple 2003). Speculating on a unified history of grizzly bear distribution and abundance in the region requires the consideration of a wide timeline and multiple areas of study, including archeology, ethnography, history, and contemporary scientific analyses.

Previous inquiries into the historical distribution of grizzly bears in the region have hinged upon Hudson's Bay Company (HBC) fur return records as the main line of evidence. This collection of pelt invoices from multiple fur trading posts throughout the Pacific Northwest is certainly the most robust, systematic dataset of wildlife presence prior to the 20th century, yet it still leaves many questions unanswered. In 1983, Paul Sullivan (Washington Department of Game) produced a synoptic review of these records as evidence of a historical grizzly bear population in the North Cascades ecosystem. His evaluation included peak annual grizzly bear harvests from Fort Colville (spelled *Colvile* in historic records) and Fort Nez Percés (Walla Walla) in parts of the Columbia drainage, Fort Thompson in the upper Fraser drainage, and Fort Nisqually in south Puget Sound. He maintained that it was unclear where the hides were collected; yet, subsequent publications have consistently cited these inconclusive results in statements regarding historical grizzly bear presence in the North Cascades ecosystem. Sullivan's report also assimilated and verified the accuracy of other more recent sightings from personal interviews and written anecdotes by residents, explorers and local tribal members. Later, as a part of their 5-year North Cascades grizzly bear ecosystem evaluation, Almack and others (1993) continued compiling and ranking the reliability of grizzly bear observations made within the North Cascades.

In this synthesis report, we expand upon these previous studies to include a wider array of existing evidence from archeological, ethnographic, historical, and contemporary scientific sources relating to the prior distribution and abundance of grizzly bears within and surrounding the North Cascades ecosystem. The breadth of information is intended to be an unbiased compilation of verifiable records as well as evaluations made by experts in these respective fields.

Area of Analysis

This report focuses on the North Cascades Ecosystem Grizzly Bear Recovery Zone (US) and the North Cascades Grizzly Bear Population Unit (Canada) that span north-central Washington State and south-central British Columbia, respectively (Figure 1). In this report, we regularly refer to this collective transboundary area as the North Cascades ecosystem (or ecosystem). The US portion of the ecosystem includes areas of Whatcom, Skagit, Snohomish, Chelan, Okanogan, Kittitas, and King Counties and covers an area of almost 6.3 million acres (Braaten et al. 2013). Public lands make up 97% of this total area (over 6.1 million acres; USFWS 1997) while the remainder is privately owned (3.0%, over 191,000 acres; Braaten et al. 2013). The majority of the public land is managed by the US Forest Service (75.1%; approximately 4.7 million acres) and the North Cascades National Park Service Complex (10.9%; over 681,000 acres; Braaten et al. 2013), while the remainder is governed by various state (over 461,000 acres; 7.4%), other federal (over 164,000 acres; 2.6%), and local units (over 58,000 acres; 1.0%). The portion of the Recovery Zone administered by the Forest Service is comprised of the Mount Baker-Snoqualmie National Forest lining its western boarder and the Okanogan-Wenatchee National Forests on its eastern edge. Approximately 2.6 million acres of the Recovery Zone is apportioned across nine federal wilderness units collectively managed by the National Park Service and Forest Service (Braaten et al. 2013).

The adjoining North Cascades Grizzly Bear Population Unit (GBPU) in British Columbia spans over 2.4 million acres, including over 400,000 acres of protected lands (Gyug 2004). The Fraser River defines much of the GBPU's western border. The river, two national railroads, and the TransCanada Highway are considered to be major barriers to natural movements of grizzly bears (North Cascades Grizzly Bear Recovery Team 2004). The eastern boundary extends eastward to the Similkameen River and terminates to the north at the confluence of the Fraser and Thompson Rivers.

The landscape and climate of the North Cascades ecosystem is diverse. Snow melt and glacial run-off from the North Cascades mountains feed the Skagit, Nooksack, Snohomish, Stillaguamish, and Skykomish Rivers west of the crest, while their eastern slopes drain several tributaries of the Columbia River that include the Methow, Stehekin (Lake Chelan), Entiat, Wenatchee, and Cle Elum Rivers. The extensive lowland and subalpine forests of the western slope of the range are heavily influenced by a maritime climate. Crossing the crest of the North Cascades, the alpine meadows quickly transition to dry forests and dry lowland valleys on the eastern slope. Elevation ranges from 25 m in the Puget Sound through to peaks exceeding 3,200 m at Mt. Baker and Glacier Peak. The ecosystem is predominantly roadless; however, several major east-west highways intersect and surround the landscape. These are the North Cascades Highway (State Route 20) from Sedro-Woolley to Winthrop, State Highway 2 from Everett to Wenatchee, I-90 from Seattle to Spokane, and British Columbia Highway 3 intersecting Manning Provincial Park.

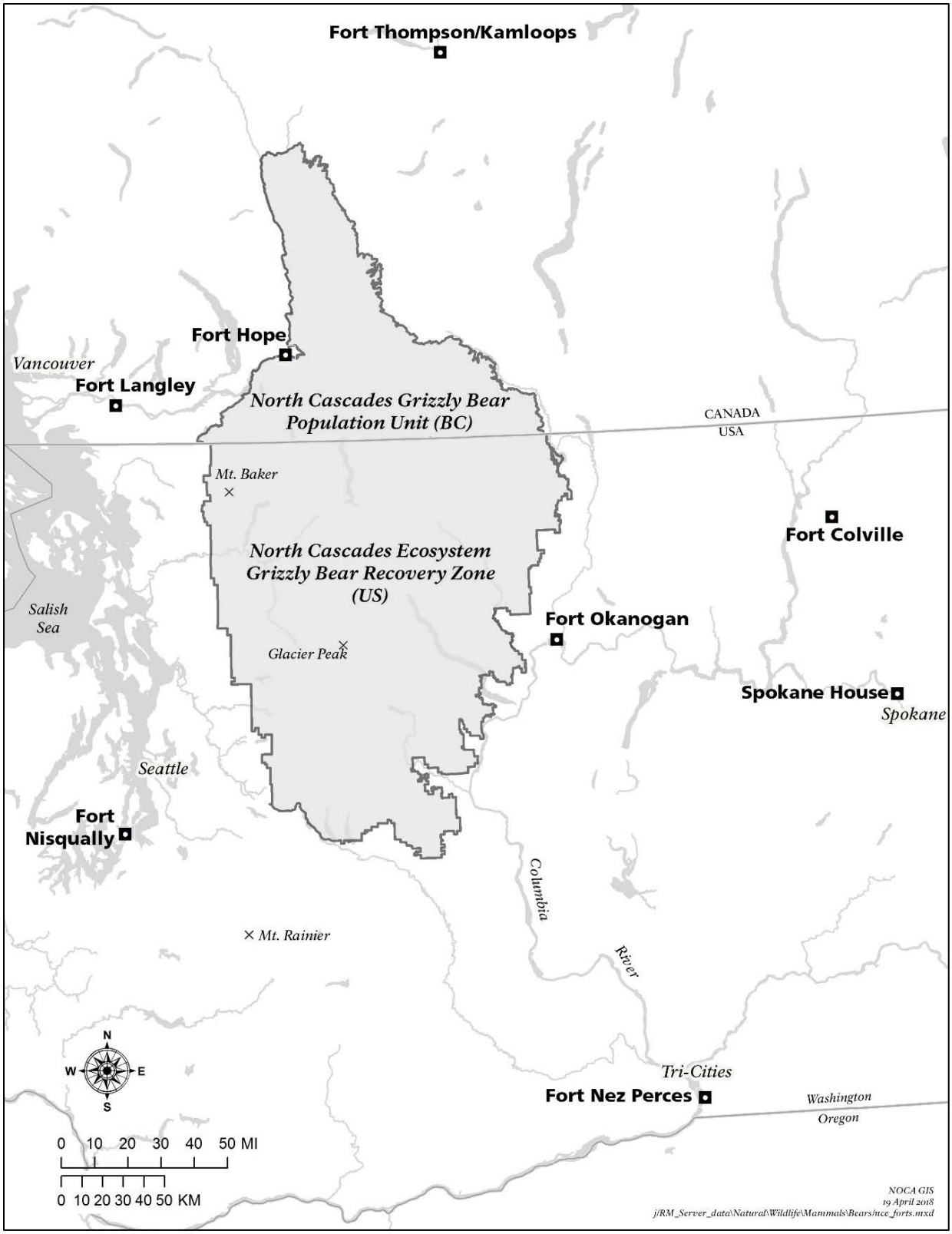

Figure 1. Locations of Hudson's Bay Co. trading posts analyzed in this report relative to the North Cascades ecosystem. The ecosystem is administrated as a Grizzly Bear Recovery Zone in the US and as a Grizzly Bear Population Unit in BC.

Methods

Review of archeological and ethnographic literature

We conducted a literature search for evidence of grizzly bear presence in and around the North Cascades ecosystem prior to the onset of Euro-American settlement (ca. 1804). We expanded the geographic scope of our search beyond the bounds of the North Cascades ecosystem to the entirety of Washington State and southern BC in order to gain a broader context for the prehistoric-historic status of grizzly bears in the region. Target literature primarily included summaries of archeological findings, original ethnographic documents, historical ethnographic studies, and contemporary meta-analyses of archeological and ethnographic findings. We also visited the Stó:lô Nation archives in Chilliwack, BC on March 7, 2018 with their permission to review a traditional ecological knowledge study on grizzly bears within the Stó:lô territory.

Grizzly bears and the region's fur trade

We reached out to multiple archival sources within the US and Canada. For this historical synthesis, our search targeted records of the number of grizzly bear furs collected from any fur trading posts that were geographically and historically relevant to the North Cascades ecosystem. We sought out any other original manuscripts (e.g. trappers' journals, interview transcripts) containing information necessary to interpret patterns in fur return data, namely harvest areas and distribution patterns for each trading post. We sought any records spanning the evolution of the fur trade in the general North Cascades area. This encompassed the operations of the Pacific Fur Company, the North West Company, and the HBC, from David Thompson's first exploration of the Columbia plateau in 1807 to the functional end of the Pacific Northwest fur trade in the 1870s.

The HBC Archives in Winnipeg, Manitoba currently maintain the vast majority of existing historical documents from the fur trade era. We received copies of all available Columbia District and New Caledonia fur return records from this facility (accessed April 19, 2017). The fur return records summarized for this report were recorded at Fort Vancouver, located at the mouth of the Columbia River. As the headquarters and the central distribution center for the West, records for all animal resources that were collected throughout the Columbia District and New Caledonia were transposed into one record book, "Fort Vancouver. Fur Trade Returns, Columbia District and New Caledonia, 1825–1857". HBC trading post clerks kept systematic records of the numbers of each species harvested each year; however, there were no associated descriptions of harvest events such as specific locations of kills and work effort.

Incidental observations in the North Cascades

In addition to analyzing fur return records from trading posts around the North Cascades ecosystem, we compiled all known reliable historical and recent accounts of grizzly bears. We chose to synthesize the following information from the original records, if available: the year and geographic location of observations, as well as their type (e.g. track, sighting) and level of reliability (described below). If only a general location description (e.g. Windy Pass) or approximate set of coordinates (i.e. township and range) were provided, we assigned Universal Transverse Mercator (UTM) coordinates (NAD83) in order to provide a map of the results. Data excluded from original reports

are names and addresses of observers and the descriptions of the animal and encounter. The source of each observation is provided so that readers may further investigate these details.

Data for this analysis are derived from the park complex's wildlife observations database, two previously published reports of grizzly bear accounts in the North Cascades (Sullivan 1983 and Almack et al. 1993), data from the Interagency Grizzly Bear Committee (IGBC), and various other written accounts (e.g. Beckey 2003), compilations of sightings collected from local newspapers, and ethnological descriptions. After all data were compiled, we identified and deleted duplicate observations by cross-checking dates, locations, and source names. If all observation parameters (date, location, observer name, observation type) between multiple observations matched, we deemed it as the same observation. Historical and recent observations compiled by Bjorklund (1980) were later integrated and confirmed by Sullivan (1983); therefore, we directly cite the latter in this report.

Sullivan 1983 and Almack et al. 1993 used a class scale (1 to 4) to rate the reliability of observations according to methods approved by the North Cascades Grizzly Bear Working Group and the IGBC (Almack 1986, 1990). Class 1 observations were confirmed as a positive identification by a biologist using a photograph or video, track, hair, carcass, dig, or food cache. Class 2 observations were characterized as "high reliability" if two or more of the following defining characteristics were confirmed: shoulder hump, concave facial profile (i.e. "dished face"), long front claws (Figure 2), and scat if it was associated with a sighting or tracks. Additional information regarding their reliability rating system is available in the methods and results sections of these two reports. We chose to include Class 1 and 2 observations but not Class 3 (low reliability) and 4 (not a grizzly bear) in this synthesis report.

Figure 2. Grizzly bear photographed near the East gate of Manning Park, British Columbia in 2015. The key morphological traits required for positive identification (long front claws, prominent shoulder hump, and a dished face) are clearly displayed. Photo by John Ashley-Pryce.

Results and Discussion

Review of archeological and ethnographic literature

Grizzly bear fossils dated from between 12,000 and 850 bp (before present) have been recovered at a number of locations in Washington State. The most notable finding occurred on the west coast of Whidbey Island in northern Puget Sound from the Late-Pleistocene epoch, dated to 9,000 years bp (Mustoe and Carlstad 1994). No evidence of human conflict or hunting was found. Other remains have been found at five Holocene archeological sites along the Columbia, Okanogan, and Snake Rivers of central and eastern Washington that were possibly linked to human hunting and cultural use of grizzly bears (Lyman 1986). This collection includes grizzly bear bones that were found among other food remains in a 1,000-year old First Nations house located at the mouth of the Wenatchee River (Lyman 1985). Archeological cave sites from southwest Alaska and western Idaho also contained assemblages of grizzly bear bones and cultural remains (e.g. spear fragments) dating from 10,300 to 8,000 years bp (Ackerman 1996, Sappington and Schuknecht-McDaniel 2001, McLaren et al. 2005), providing further evidence of prehistoric hunting of grizzly/brown bears in western North America.

Ethnological records of grizzly bears from the Upper Skagit, Sauk-Suiattle, Thompson, Stó:lô (Chilliwack), Chelan, and Methow First Nation groups demonstrate varying degrees of significance within their traditional subsistence practices, cultures, and landscapes (Table 1). These Salish tribes have long occupied regions within and around the ecosystem and possessed an intimate knowledge of the landscape and its fauna; therefore, their accounts of grizzly bears should be given significant credibility. Furthermore, the accounts accurately describe certain characteristic differences in the size, behavior, and habitat preference between black and grizzly bears (Collins 1974, Ruby and Brown 1981, Smith 1988, Bedal Fish and Bedal 2000). It is important to note that it is not clear how long ago these recounted observations and practices transpired. They are derived from relatively recent (late-1800s to 2000) transcriptions of events and observations that may have occurred from that time to many generations prior (Smith 1988). In the absence of further information, we should assume that these accounts represent traditional knowledge remaining after the initial introduction of smallpox to the Coast and Plateau Salish people (ca. 1770) and the subsequent collapse of an estimated 90% of their population (Boyd 1999). Regardless, the data summarized in Table 1 are not complete and very likely comprise only a fraction of ethnological history relating to North Cascades grizzly bears.

The consistency of the reports suggest that grizzly bears were widely integrated in the cultural and hunting traditions of Salish groups inhabiting the North Cascades and other regions of Washington and southern BC. It is difficult to infer even relative differences between the abundance of grizzly bears among different Salish territories; however, some Chelan and Sauk-Suiattle informants noted that grizzly bears were “numerous” in higher elevations of their respective drainages (Table 1). The Upper Skagit people also hunted them at higher elevations, and while the Thompson sources do not specify where they occurred, the hunting grounds were said to occur in the “tall mountains” (Table 1). Sources for these two groups do not specify relative abundances, although the Upper Skagit

people mentioned that the range of grizzly bears “did not extend much, if at all” west of the present-day North Cascades National Park boundary (Smith 1988).

Table 1. Summary of historical grizzly bear accounts by Salish people living in and around the North Cascades ecosystem. NCNP = North Cascades National Park; R = River; U = upper; L = lower; NF = North Fork; Ck = creek; BC = British Columbia.

First Nation tribe	Territory	Relationship to grizzly bear	Presence in landscape	Sources
Upper Skagit	Middle Skagit R. drainage to Newhalem, excluding Sauk drainage to the south	Hunted at higher elevations (Ross Lake area); furnished robes, wool and necklaces; guardian/hunter spirit form	Limited to higher elevations; “did not extend much if at all” west of NCNP boundary	Collins 1974; Smith 1988
Sauk-Suiattle	Sauk drainage and surrounding highlands, including Glacier Peak	Hunted by Sauk Indian tribe leader (born around 1800)	“Numerous” on ridges surrounding White, Indian passes, White Chuck meadows and the Suiattle R. high country	Bedal Fish and Bedal 2000
Nlaka'pamux (Thompson)	U. Thompson band: L. Thompson R., L Nicola R.; L. Thompson band: Fraser Canyon, across the Cascade crest to Similkameen drainage	Hunted (secondary importance); hunter and shaman spirit forms; various meanings in dreams and mythological history	Not specified, but hunting grounds included “tall mountains”, Fraser Valley and adjacent higher areas	Teit 1900; Ruby and Brown 1981; Smith 1988
Stó:lô (Chilliwack)	Mouth and L. Fraser Valley to Chilliwack R., extending south to NF Nooksack R. and east to Chilliwack Lake.	Hunted (secondary importance, difficult to secure); guardian spirit form	Seen at fishing sites and berry patches; more frequently seen on east side of territory	Duff 1952; Smith 1988; Roburn 2001
Chelan	Entire Chelan/Stehekin R. drainage into areas east of Columbia R.	Hunted; dangerous spirit form	Present from upper Stehekin Valley to south end of Lake Chelan; "fairly common" in mountains surrounding the lake	Ray 1942; Dalquest 1948; Durham 1972; Smith 1988
Okanogan	Extends from Mica Ck, B.C. to below the Chelan R., Columbia R. confluence	Name of a chief: "Walking Grizzly Bear"	Not specified	Ruby and Brown 1981
Methow	Methow R. basin	Hunted; religious and ceremonial roles	Not specified	Ruby and Brown 1981

Other accounts from recent memory appear somewhat contradictory, but generally give the impression that grizzly bears were extremely scarce on west slope and lowland floodplain forests. The Swinomish people of the lower Skagit River valley and surrounding coastline apparently utilized grizzly bear hides and skulls in rituals, but active hunting was not confirmed (Almack et al. 1993).

Naturalists Suckley and Cooper (1860) stated that they were not known to occur near the Northwest coast, although they observed that the Chinook people of the lower Columbia River had seen them in their territory and had a separate name for them (*esiamb*), differentiating them from black bears (Gibbs 1863).

By Lewis and Clark's appearance in the Columbia basin in 1805, the Coast and Plateau Salish had already experienced a massive die-off due to the introduction of smallpox in 1770 (Boyd 1999), and yet still represented the second highest population density on the continent (estimated at 102,100 to 210,100 people; Ubelaker 2006). Analysis of the party's journals confirms the highest density of human settlements and satellite camps throughout the lower Columbia Basin, Cascades, and Pacific coast relative to every other ecoregion on the trail (Moulton 1986-1996, Laliberte and Ripple 2003). Wildlife was generally more abundant in areas with a lower density of settlements, making these regions appear devoid of large game altogether (Moulton 1986-1996, Martin and Szuter 1999, Laliberte and Ripple 2003).

This apparent relationship is certainly striking and has led some paleo-ecologists to assert that human predation was primarily responsible for the lack of game in the Columbia Basin (Kay 1994, Martin and Szuter 1999). Others consider the variable but relatively low productivity of the Columbia plateau (Lyman and Wolverton 2002) and the influence of an expansive domesticated horse population (Moulton 1986-1996, Schullery 2002, Laliberte and Ripple 2003) as possible explanations. There is currently no substantive evidence supporting the significant regional depletion of game by First Nations people, and this overkill hypothesis has been largely dismissed (Jones 2013). While the high densities of prehistoric humans surely had some significant effects on wildlife population dynamics, one analysis representing over 7,000 years of archeological data did not support subsistence-based, large-scale depletion of the region's mammals and fish; rather, animal (including salmon) harvests were apparently stable and sustainable (Butler and Campbell 2004, Campbell and Butler 2010). Further, there is no evidence of extensive direct killing of grizzly bears by indigenous people, but ethnographic records (Smith 1988) leave little doubt that they were occasionally killed in defense of life or food (Smith 1988, Bedal Fish and Bedal 2000, Sappington and Schuknecht-McDaniel 2001, McLaren et al. 2005).

Any profound, landscape-level effects by First Nations people on the region's prehistoric grizzly bears probably hinged on competition for high-value foods and indirect trophic effects from subsistence practices (Mattson and Merrill 2002, Schullery 2002, Laliberte and Ripple 2003). A unique aspect of the human-grizzly relationship that may offer further insight is the significant niche overlap of multiple high-quality food resources, in particular salmon. The immense seasonal pulses of salmon and steelhead that permeated the prehistoric-historic landscape of the Northwest region is widely credited as foundational in supporting the distinctive growth and permanence of its early human settlements (Smith 1988, Matson 1992, Hayden and Schulting 1997). Fishable reaches are known to attract many predators during large salmon runs (Willson and Halupka 1995), the two most adept and dangerous of which are indisputably grizzly bears and humans. Even today, the remoteness of productive spawning streams of northern BC and Alaska allow the bears to take advantage of the valuable resource to a much greater extent. In this case salmon contribute virtually all of the

assimilated carbon and nitrogen of their bodies (94 ± 9%; Hilderbrand et al. 1996) and it was likely similar for prehistoric grizzly bears inhabiting Pacific Coast drainages farther south before significant human competition.

As increasingly effective use of the region's abundant fisheries allowed prehistoric human populations to thrive and establish permanent settlements (Matson 1992, Hayden and Schulting 1997), the seasonal spawning events likely increased the frequency and intensity of human-grizzly conflict (Mattson and Merrill 2002, Schullery 2002) and attenuated the competitive advantage of the large bears over time. In the North Cascades, the Upper Stó:lô people gathered by the thousands along the banks of the Chilliwack River to dip-net returning Chinook and sockeye (Smith 1988). The fur trader George Simpson similarly observed "several thousand Souls" of the Lower Thompson tribe at their salmon stations as he passed through the river's canyon in 1828 (Smith 1988). At the least, such domination of accessible fishing sites probably excluded grizzly bears from these high-value feeding sites and facilitated a dietary shift toward plants or terrestrial prey. At most, this dynamic may have accelerated fatal conflicts over food as well as opportunistic hunting of grizzly bears for a number of purposes such as subsistence, cultural uses, and suppression of competing predators (Schullery 2002, Campbell and Butler 2010, Lyman 2011).

Predictive spatial models that can accurately determine grizzly bear occurrence and persistence across landscapes show that human settlement and associated negative interactions can be more important in determining grizzly bear presence than habitat and food quality (Mattson and Merrill 2002, Apps et al. 2004, Mowat et al. 2013). Using historical data that approximated human densities and environmental conditions in 1850, Mattson and Merrill (2002) found that grizzly bears were actually less likely to occur where salmon range was most extensive. Rode (2005) found that even a single human can displace grizzly bears from high-value feeding sites at relatively remote spawning streams in Alaska, and that this sensitivity is profound even at a landscape level. Apart from salmon, humans and grizzly bears have historically shared other important food resources, namely ungulates, berries, and roots (Smith 1988). A similar preference for open meadow habitats, where grizzly bears can find valuable berry forage and where people typically established settlements (Thompson 1970), is also thought to have increased the rate of confrontation (Almack et al. 1993, Apps et al. 2004). Such a paradigm, where grizzly bear survival declines with proximity to human constructs and presence, likely developed over thousands of years and may help explain the apparent low density of grizzly bears throughout Washington and southern BC over the last 200 years.

Regardless of the mechanisms and timeline for grizzly bear extirpations in the lowlands surrounding the North Cascades ecosystem, it is likely that the rapid changes in the region's human populations and resource degradation, coupled with higher rates of direct killing that followed the initial appearance of Euro-American fur traders, far exceeds the cumulative effects of First Nations over thousands of years (Storer and Tevis 1955, Mattson and Merrill 2003). As human populations and their pressure on grizzly bears increased in lowland regions, so did the importance of the remote and topographically complex Cascade Range as a refuge.

Grizzly bears and the region's fur trade

The fur return records transcribed at Fort Vancouver show the HBC harvested a total of 3,188 grizzly bear pelts from five trading posts bordering the North Cascades ecosystem between years 1826 and 1857. Records from Fort Colville accounted for 85.4% of harvest efforts during this time period, followed by Fort Nez Percés (5.8%), Kamloops (5.7%), Fort Langley (2.9%), and Fort Nisqually (0.1%; Table 2). The Fort Vancouver records provide the basis for the results described below; however, it is clear that they do not account for all furs taken throughout the region and therefore should be interpreted carefully. We present some additional evidence gleaned from other historical resources in conjunction with the Fort Vancouver records.

Table 2. Number of grizzly bear furs harvested from selected Hudson's Bay Co. trading posts surrounding the North Cascades ecosystem, 1826 -1857. Source: Hudson's Bay Company Archives, Winnipeg, Manitoba.

	Trading Post				
Year	Colville	Langley	Nez Percés	Nisqually	Thompson River
1826	–	–	–	–	–
1827	9	–	–	–	–
1828	6	–	–	–	2
1829	18	–	–	–	10
1830	68	–	1	–	3
1831	49	–	7	–	12
1832	33	–	7	–	3
1833	36	–	19	–	8
1834	10	1	12	–	8
1835	33	–	9	–	7
1836	29	–	3	–	15
1837	25	–	3	–	2
1838	61	–	3	–	4
1839	66	1	4	–	5
1840	27	1	–	–	7
1841	45	3	2	1	2
1842	85	2	5	–	3
1843	107	–	21	–	3
1844	185	4	22	–	7
1845	203	2	33	–	6
1846	244	3	27	–	4
1847	160	2	3	–	5

Table 2 (continued). Number of grizzly bear furs harvested from selected Hudson's Bay Co. trading posts surrounding the North Cascades ecosystem, 1826 -1857. Source: Hudson's Bay Company Archives, Winnipeg, Manitoba.

	Trading Post				
Year	**Colville**	**Langley**	**Nez Percés**	**Nisqually**	**Thompson River**
1848	369	1	2	–	3
1849	227	1	2	–	11
1850	245	1	–	1	11
1851	188	2	–	–	6
1852	195	2	1	–	7
1853	–	2	–	–	9
1854	–	14	–	–	11
1855	–	13	–	–	7
1856	–	9	–	–	2
1857	–	30	–	–	
Totals	2723	94	186	2	183
Grand Total	**3188**	–	–	–	–

The total number of grizzly bear pelts recorded at Fort Colville during its operation (n = 2,723; 1827-52) far outnumbers that of other forts surrounding the ecosystem; however, the effort or interest in collecting pelts from bears and other large animals did not seem to begin until 1840, when returns increased dramatically to their peak in 1848 (n = 369; Table 2, Figure 3. This trend is not directly explained in the return documents but it is well known that heavy trapping of beavers and other small fur-bearers that were in high demand early in the trading era quickly diminished their populations. It is likely that the increase in harvest rates for black and grizzly bears, wolves, wolverines, and other large animals (Appendix A, Table A1) was a response to this economic vacuum.

While the main factors leading to the comparatively large fur harvest rates out of Fort Colville are not described in the fur return documents, this trading post has been cited as the center of operations for a large trapping network that included the Okanogan, Pend Oreille, Kootenai, and Flathead regions (Bancroft 1890). John Work, a leading HBC trader, noted in a report that the exact extent of trading within the Colville District was difficult to determine (Work 1830). The historian Paul Schullery (2002) speculates that most of the furs in the Colville District were taken closer to the Rockies where the majority of the posts in this district were located. However, 34 grizzly bear pelts were collectively contributed from Fort Okanogan and Spokane House between 1827 and 1829 (Work 1830, pp. 5). In addition, records show that the Kettle Falls tribe traded grizzly bear furs at Fort Colville in 1827 (n = 4) and 1828 (n = 1; Work 1830, pp. 7). These accounts present strong evidence that north-central Washington, specifically the Okanogan region, harbored at least a small population of grizzly bears (Suckley and Cooper 1860, Thompson 1970).

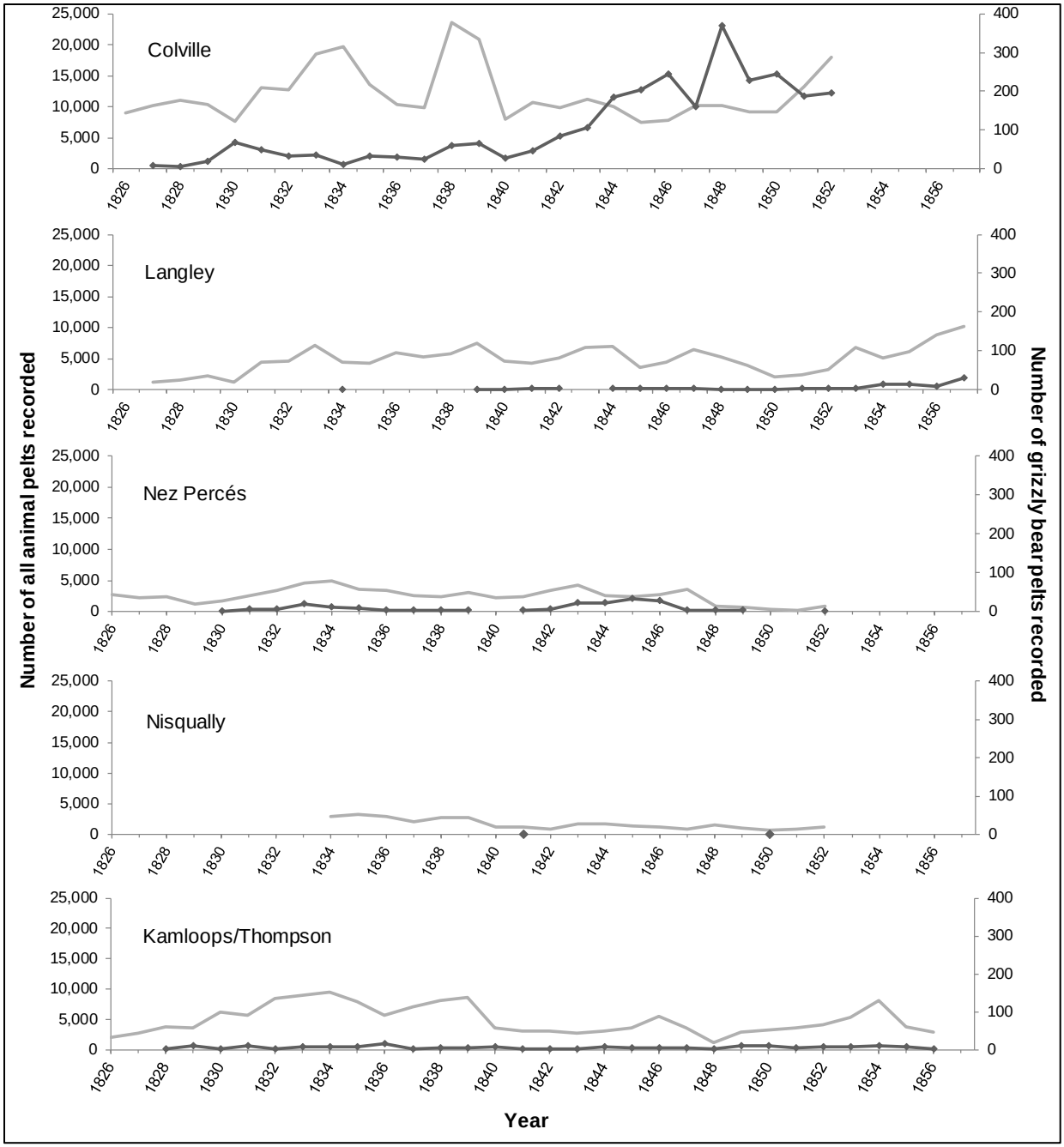

Figure 3. Interannual trends of grizzly bear (Black points, line) and total animal (gray line) fur harvests from Hudson's Bay Co. trading posts surrounding the ecosystem. Left-hand vertical axis: yearly total of all animal furs; right-hand vertical axis: yearly total of all grizzly bear furs.

Return records from Fort Nez Percés show a fairly consistent harvest of grizzly bear furs from 1830 to 1852, although at its peak year (1845) only 33 were taken (Table 2, Figure 3). The post's location was essential for staging the "Snake Party" expeditions that explored much of the land west of the Rockies, from the Flathead region to the mouth of the Columbia (Hussey 1975, Watson 2010). An account from George Simpson's journal entry in 1829 suggests that local trade at the post was not a

profitable contribution to Columbia operations because of the surrounding landscape's low productivity and unwilling Salish neighbors (Hussey 1975). Although it is possible that the trapping efforts from this post included parts of the eastern North Cascades ecosystem by way of the Columbia and overland expeditions, many of the pelts were probably collected throughout the mountains of Idaho during the Snake Party expeditions (Schullery 2002).

Kamloops trapping operations produced 183 grizzly bear furs from 1828 to 1856 (Table 2, Figure 3). A relatively small number of furs were taken each year during this time, and peaked at 15 grizzly bears in 1835. Similar to Fort Nez Percés, George Simpson explained in an 1828 journal entry that the country surrounding Kamloops was poor in furs and surrounded by a First Nations population (the Shuswap people) that was generally not willing to hunt and trap for the Europeans (Watson 2010). Kamloops trapping and hunting operations may have reached into the northern boundary of the North Cascades ecosystem approximately 70 miles down the Thompson River, although we did not find records indicating the geographic extent.

A total of 94 grizzly bear pelts were recorded at Fort Langley between 1834 and 1857. The annual returns of grizzlies stayed at four or less until the last few years of its fur trade, when 30 were collected in 1857 (Table 2, Figure 3). Langley's area of trade included the lower Fraser Valley, which likely extended into the western boundary of the North Cascades ecosystem, as well as the Puget Sound, Gulf of Georgia, and southern Vancouver Island. The Upper Skagit, Swinomish, and other tribes regularly traveled up to Fort Langley to trade (Sage 1934). It is therefore possible that some of the grizzly bear pelts recorded at this post had origins on the western slopes of the North Cascades.

Grizzly bear pelts were especially scarce in Fort Nisqually records. Only 2 pelts were harvested during the entirety of the post's operations from 1834 to 1852 (Table 2, Figure 3). Grizzly bears were not known to occur in the Puget lowlands north of the Columbia or on the Olympic Peninsula (Suckley and Cooper 1860), but a small population may have inhabited the area around Nisqually during this time. If the pelts traded at Nisqually were obtained in the Cascades, it was likely closer to Mount Rainier, the origin of the Nisqually River.

There is no substantive evidence for large scale trapping operations by the HBC throughout the core of the North Cascades Range (Thompson 1970). The only posts within the boundaries of the ecosystem, Forts Hope and Yale on the lower Fraser River, did not produce detailed fur return records because they did not contribute significantly to the region's industry. Rather, they functioned primarily as staging and supply posts between interior overland brigades and boats operating downstream (Watson 2010). The only documented exploration by a Euro-American was Alexander Ross' sole expedition over Cascade Pass in 1811 (Thompson 1970). While it appears that the core of the range was left largely untouched by the Euro-Americans during this early period, it is generally assumed that First Nation groups resident to the North Cascades hunted animals within their territories and traded the pelts at nearby posts, such as Forts Okanogan and Langley (Sage 1934, Luxemburg1986).

Record keeping by trappers and HBC clerks was generally poor and inconsistent (Nation-Knapper 2015), suggesting that the numbers here represent only a snapshot of the actual harvest during this time period. For instance, Edward Huggins, the general manager at Fort Nisqually after 1850, recorded 250 grizzly bear pelts brought in from the 1855 trades at multiple forts east of the Cascades that were not included in the HBC's Fort Vancouver books (including Fort Colville, Okanogan, and Nez Perces; Farrar 1924). This was most certainly not the only information lost in the complex and unregulated web of trapping operations.

A number of other interacting and highly variable factors probably influenced actual and apparent harvests. For instance, it is possible that relatively few grizzly bear pelts were collected because they undoubtedly required considerable risk to acquire compared to beaver and other small fur-bearers and because the HBC generally did not encourage First Nations traders to hunt bears (Work 1830). Economic dynamics likely played a large role in the harvest rates of bears. For example, it is possible that the incentive to harvest bears and other large predators may have increased during certain periods of low small mammal returns (Figure 3) in order to meet quotas and stabilize fort profits. Other sources of uncertainty include varying trade relationships among the Salish people and Europeans (Merk 1931), the spatial extent and frequency of inter-tribal trading (Thompson and Ignace 2005), and the seasonal timing of trapping efforts relative to bear activity. We conclude that the HBC records and other documents cited here show evidence of a general historical presence of grizzly bears within the North Cascades and surrounding areas. We suggest caution in interpreting the apparent lack of grizzly bears in the fur return records within and around the North Cascades as true scarcity.

Incidental observations in the North Cascades

We compiled 178 geo-referenced (Class 1 and 2) observations of grizzly bears or their signs within the North Cascades Grizzly Bear Recovery Zone that were made between 1859 and 2015. Of these, 21.9% (n = 41) were previously designated as "confirmed" Class 1 observations (Appendix B, Table B-1) and 78.1% (n = 139) were "high reliability" Class 2 (Appendix B, Table B-2).

The vast majority of observations (92.3%, n = 165) were visual sightings (Table 3), and 17 of these were associated with tracks, remains, visual media, scat, DNA, or a combination thereof. Tracks were the next most common grizzly bear sign encountered by observers (14.0%, n = 25, Table 3). Tracks can provide some of the most definitive distinguishing features between black and grizzly bears. Grizzly bear fore-claws are longer than those of black bears, and the toe and foot pad configuration of fore feet differs distinctively between the species (Herrero 1985). Sixteen sets of tracks were the sole sign at the time of observation, and the remaining nine instances were accompanied by other signs. Five observations consisted of remains (two skulls, three hides), four of which were positively identified by a biologist (Class 1; Appendix B, Tables B-1, B-2).

Table 3. Number of each observation type recorded between 1859 and 2015. More than one observation type may be included in a single account.

Observation Type	Class 1	Class 2	Total
Sightings	31	126	165
Tracks	9	16	25
Photo or video	6	–	6
Remains	4	1	5
Digs	1	2	3
DNA	2	–	2
Food Cache	1	–	1
Scat	1	–	1

Twenty separate observations noted a group of two or more bears together. Half of these cases involved a sow accompanied by 1–3 cubs, but only one observation of a sow and one cub was designated as Class 1 (1991, Moore Point, WNF; Appendix Table B-1). This cub was also the only individual, out of a total of 21 cubs, which was confirmed as a grizzly. The remaining 10 multiple-bear observations involved groups of adult or unaged grizzly bears of roughly the same size, but it is impossible to say whether these groups consisted of a sow with subadult cubs, siblings, or a mated pair. Only three of these 10 observations were rated as Class 1 (Appendix B, Tables B-1, B-2). The presence of groups is evidence that reproduction was occurring within the North Cascades ecosystem, but it is not possible to estimate fecundity, recruitment, or even a general population trend (Almack et al. 1993).

Locations of grizzly bear sightings and other signs are widely dispersed throughout the North Cascades ecosystem, but encounters were concentrated east of the Cascade crest (Figure 4) as previously found by Agee and others (1989). Their analysis further revealed that grizzly bear sightings in the North Cascades were disproportionately concentrated in whitebark pine (*Pinus albicaulis*), subalpine larch (*Larix lyallii*), and open subalpine cover types. This pattern may be determined by the importance of whitebark pine seeds as a food source (as demonstrated in the Yellowstone region) and/or the reduced presence of humans at higher elevations where whitebark pines are distributed (Mattson and Merrill 2002). However, we cannot definitively say whether the spatial patterns of these observations are truly reflective of grizzly bear distribution and density because the open canopy of their preferred habitat would probably increase the rate of sightings (Agee et al. 1989, Almack et al. 1993). The overall distribution described in this report is also influenced by the geographic coverage of research by Almack et al. (1993) and Sullivan (1983), the primary contributors to our current database. For instance, Sullivan stated that his research in the Nooksack valley north of Mount Baker, the Skykomish valley west of Stevens Pass, and British Columbia was less represented than other areas in the North Cascades.

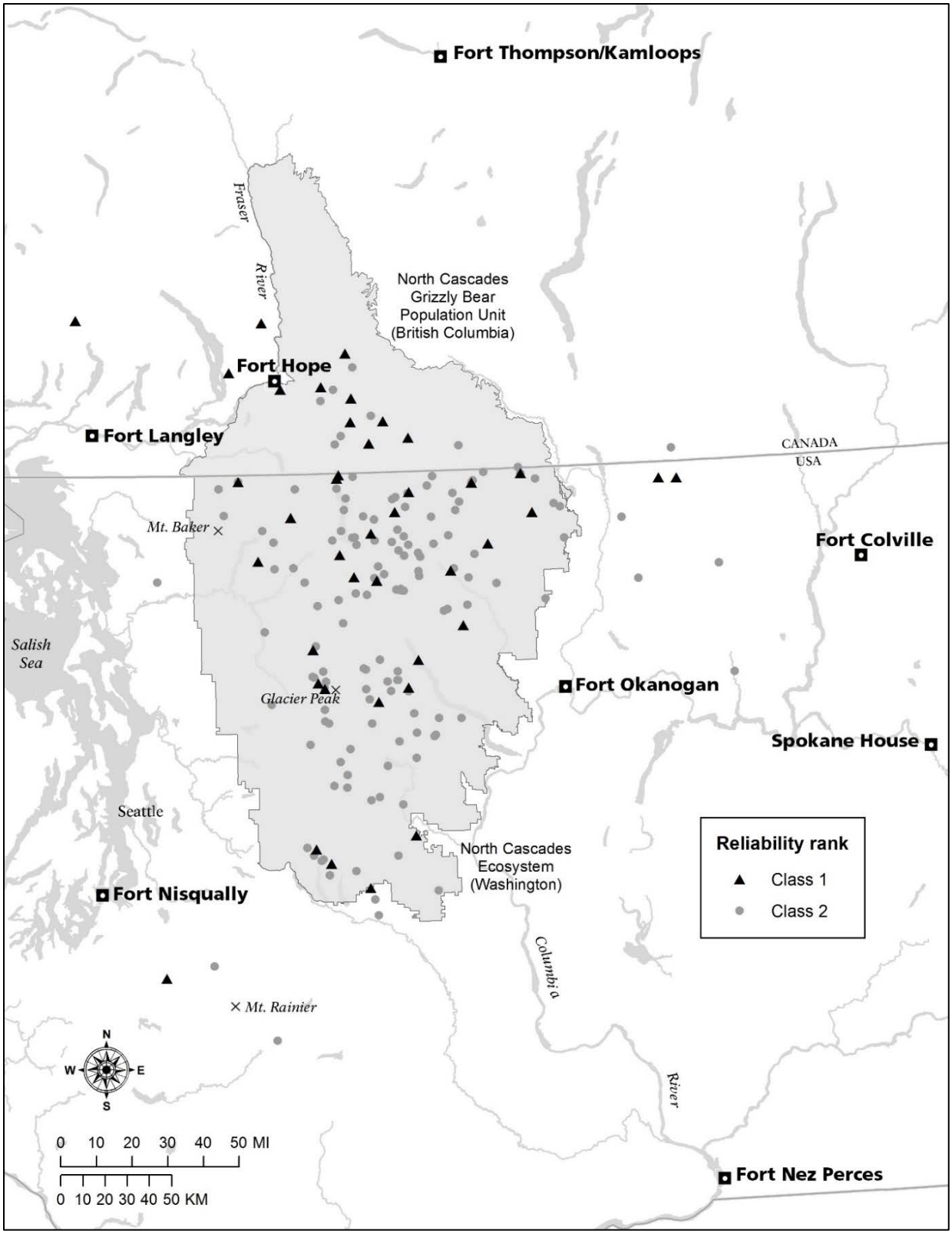

Figure 4. Locations of Class 1 and Class 2 grizzly bear observations within and around the North Cascades ecosystem, 1859-2015.

The number of both Class 1 and Class 2 observations peaked in the 1980s and remained somewhat elevated in the following decade (Figure 5). The number of Class 1 observations before 1980 remained relatively constant over time, while Class 2 observations showed a general increase up to that point. Specific explanations for these patterns are not provided in the reports by Sullivan (1983) and Almack et al. (1993), but undoubtedly stem from the disproportionately large effort to actively document these accounts through interviews throughout the 1980s and early 1990's. Indeed, only five of 35 observations in the 1990s were made after Almack and others published their observation data in 1993 (Appendix B, Tables B-1, B-2). It is therefore likely that the sudden change in sampling method, effort, and/or some aspect of the verification process caused the spikes, rather than a true lack of bears at other times (Gaines et al. 2001). The same effect can also be applied to the period before the Sullivan and Almack et al. studies, which would undoubtedly be compounded by failing memories and fewer living observers for increasingly older accounts (Sullivan 1983, Almack et al. 1993, Gyug 1998).

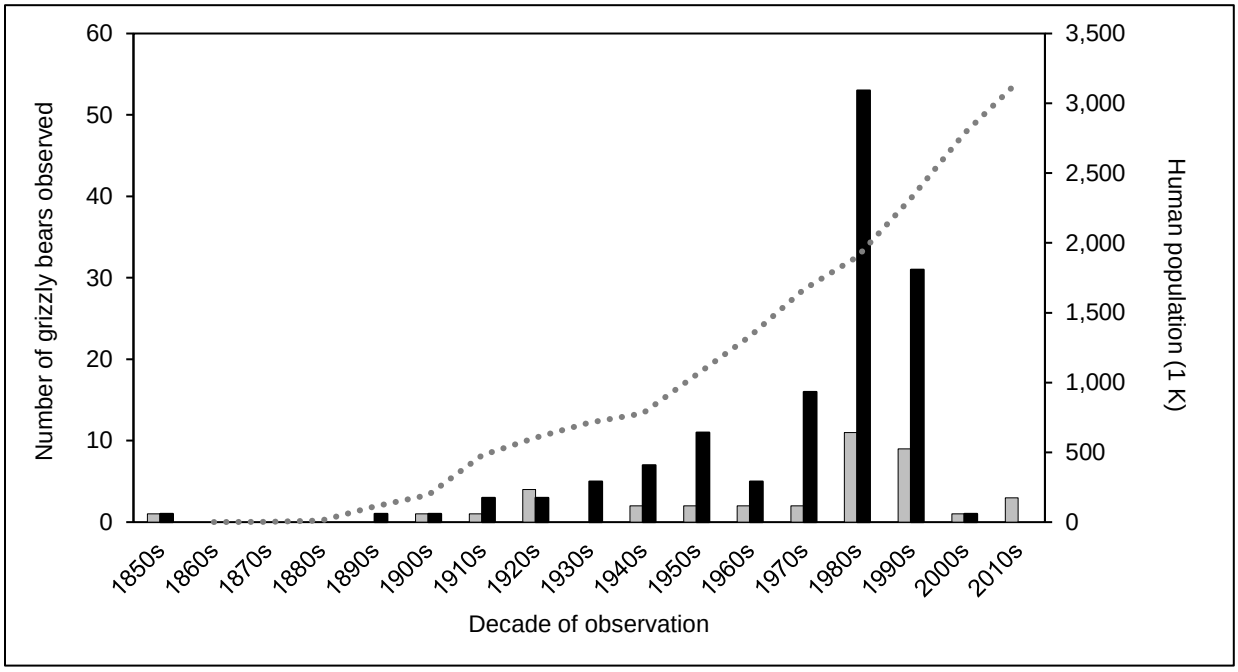

Figure 5. Number of Class 1 (gray bars) and Class 2 (black bars) observations across decades in the North Cascades ecosystem. The human population in US counties encompassing the North Cascades ecosystem (Chelan, Douglas, Kittitas, King, Okanogan, Snohomish, Skagit, and Whatcom) is provided (grey dotted line) for greater context (US Census Bureau).

In addition to the records compiled by Sullivan (1983) and Almack et al. (1993), a grizzly bear sighting interview study conducted by Gyug (1998) was compiled for the North Cascades GBPU in British Columbia. Details of individual records were not available, and therefore some of the records may be the same observations as those compiled in this report. Gyug reported that a total of 24 grizzly bear observations were made between 1993 and 1995, two of which were rated as Class 1 and 14 of which were Class 2. Between 1996 and 1997, a total of 38 records exist with no Class 1 observations and 22 Class 2 observations. Using these data he estimated the minimum population in

the GBPU to be 17 bears with a density of 10-14 bears/1640 km^2. Most sightings occurred at or near alpine areas where they were observed foraging for berries. Sightings were concentrated in four areas: Stoyoma Mountain, Central Core (Coquihalla Mountain), Ashnola, and Skagit/Chilliwack.

Conclusion

The broader history of grizzly bear distribution and abundance in the Pacific Northwest is nearly as elusive and sensitive as the bears themselves are known to be today. While we may never obtain the details needed to form a robust empirical understanding of their historical demographics and interactions prior to intensified Euro-American settlement, multiple lines of evidence confirm their presence in and around the North Cascades ecosystem. Furthermore, this synthesis has identified potential factors that have largely precluded our detection of them. We summarize relevant points below that draw upon an amalgamation of findings from previous studies in archeology, ethnography, and bear biology, as well as our meta-analysis of historical documents and recent observations.

1. **Archeological evidence confirms that prehistoric grizzly bears occurred in lowland regions surrounding the North Cascades ecosystem.** Archeological evidence of grizzly bear remains has been uncovered on Whidbey Island (northern Puget Sound) and throughout the Columbia Basin that collectively date from 12,000 to 850 years bp. Concurrent habitation in the North Cascades during this period is even more enigmatic due to lack of archeological data, but the biota of the mountain range as early as 8,000 years bp were thought to be populated with a composition of animals and plants that were much like those occurring today (Mierendorf 1986). Furthermore, because this species is able to occur in a wide range of habitats, what was likely a continuous prehistoric North American range would have most certainly included the North Cascades as well as most other lowland areas of Washington and southern BC.

2. **Grizzly bears are integrated to varying degrees in the traditional knowledge of First Nations inhabiting the North Cascades and surrounding lowlands. Hunting and other forms of confrontation may have controlled grizzly bear populations.** Ethnographic studies and other documents (e.g. Teit 1900, Collins 1974, Smith 1988, Roburn 2001) have revealed the prevalence of grizzly bears in the spiritual and hunting traditions of many First Nations groups living within the North Cascades and other areas of Washington where they have since been absent. Archeological remains align with these accounts and suggest hunting occurred throughout the Columbia plateau and on the Pacific coast as far back as the early Holocene (approximately 10,300 bp; Lyman 1986, McLaren et al. 2005). When specified, ethnographic accounts underscore feelings of respect and fear toward the bears, and that grizzly bear hunting was minimal relative to the harvest of many other animals, including black bears (Smith 1988). Any suppression of grizzly bear populations by the region's high density of First Nations people was likely manifested primarily through the competition for high-quality food sources (i.e. salmon, ungulates, berries, open canopy habitat; Mattson and Merrill 2002, Laliberte and Ripple 2003). Humans at any point in time may not have had to do much to have a significant impact on a population of large carnivores with slow reproductive rates, low human tolerance and small dispersal distances.

3. **Fur trade records confirm presence of grizzly bears in lowland regions surrounding the North Cascades ecosystem between 1826 and 1857, but the geographic extent of pelt harvests could not be determined from existing records.** The arrival of Europeans and the onset of the North American fur trade had an enormous impact in regions surrounding the North Cascades. While it does not appear that the trade reached far into the core of the range, the geographic extent of pelt harvests from each trading post could not be determined. HBC records show that a total of 3,188 grizzly bear pelts were harvested from regional trading posts between 1826 and 1857. The number of pelts recorded is in all likelihood a conservative harvest estimate, as record keeping generally seemed to be inconsistent and of poor quality.

4. **Recent observations confirm grizzly bear presence within the ecosystem, especially along and east of the crest, that was potentially associated with open habitat and/or whitebark pine distribution.** Two interview survey studies (Sullivan 1983, Almack et al. 1993) were conducted in the 1980s and early 1990s to compile records of incidental observations of grizzly bears in the North Cascades. Their results, in addition to six confirmed observations since then, show that grizzly bears persist in small numbers at apparently very low densities. It is not known whether reproduction has occurred since the last confirmed cub sighting on Lake Chelan in 1991. Because the majority of observations occurred during the years of the systematic interviews, we can assume that the results are temporally biased and that the number of confirmed sightings is conservative. During the past 10 years, only two grizzly bear observations have been confirmed in British Columbia.

5. **The North Cascades range has provided a refugium for the relict grizzly bear population.** Ethnographic and historical records confirm that in recent memory the bears were limited to alpine and subalpine elevations and rarely occurred in lowland regions, especially west of the current Park boundary.

Perception of past ecosystem conditions, especially those prior to European arrival, plays a pivotal role in contemporary conservation and restoration goals by serving as a benchmark for present ecological conditions (Lyman 1996). Understanding the timing and processes of ecological change, and especially whether the change was anthropogenic in nature, can be essential for determining the impetus of management actions and their potential outcomes. However, discussions of restoration issues and the benchmark that is ultimately chosen is not solely reliant on scientific consensus; it also depends on social, political, and economic variables that together represent a mix of theory, opinion, and fact (Jones 2013). Additional uncertainty can stem from a lack of information that prevents inferences about past populations, biased historical documents, and the fact that historical populations and their conditions were never static to begin with.

In light of these factors, wilderness managers are not attempting to reconstruct and preserve late-Pleistocene or early Holocene ecosystems. Rather, the management of protected lands is primarily focused on the conservation of extant organisms that resulted after major ecological changes during the Late Quaternary, which pragmatically translates to post-Columbian (ca. 1492) biological

conditions before direct and indirect Euro-American impacts (National Park Service 1991; Houston and Schreiner 1994).

While we cannot estimate abundance levels during this time period, we can confidently assume that habitat connectivity, resource conditions, and anthropogenic pressures would have favored the persistence of higher densities of grizzly bears than those existing today. Of all prehistoric and historic factors that have contributed to the current state of grizzly bears in the Pacific Northwest, and indeed across North America, none is perhaps more influential than simple human population growth. Given the extremely slow reproductive rate of grizzly bears and the surrounding human-developed landscapes that isolate the North Cascades ecosystem from other occupied patches, grizzly bears have almost certainly persisted decades past the tipping point of a viable population. The grizzly bear population in the North Cascades is thus highly at risk of eventual extirpation (Lyons et al. 2018). Historical and current evidence suggests that the core of the ecosystem has for many years been a refugium from human activities, yet its isolation from adjacent grizzly bear populations by surrounding unprotected regions limits natural demographic and genetic resilience. With appropriate management practices and collaboration with visitors and local residents, the North Cascades ecosystem is likely to continue as a relict of the Pacific Northwest's past biological diversity and ecosystem function.

The objective of this review was to synthesize existing information from several disparate fields of study concerning the historical presence of grizzly bears in the North Cascades region and to survey possible contributing factors to the observed dynamics. While this review was not exhaustive, it should be noted that there is certainly a lack of historical demographic data for the region's grizzly bears. The scarcity of information is in some respects puzzling and has understandably led some to doubt that Washington State was ever home to viable populations; however, we suggest that there is an intrinsic fallacy in the act of drawing conclusions based on a scarcity of evidence (Fischer 1970). Specifically, the lack of information for any given time period does not prove the absence of grizzly bears in the North Cascades. More research should be undertaken to supplement data gaps, especially during the post-Columbian historical time period. A highly valuable and relatively accessible area of research lies in the Pacific Northwest's ethnographic literature and collective traditional ecological knowledge (TEK; Huntington 2000). Time and resources permitting, we would have more fully explored this body of information that clearly represents generations of detailed and highly reliable observations.

Literature Cited

Ackerman, R. E. 1996. Lime Hills, Cave 1. Pages 470-478 *in* F. H. West (editor). In American beginnings: The prehistory and palaeoecology of Beringia. University of Chicago Press, Chicago, Illinois.

Agee, J. K. 1989. A geographic analysis of historic grizzly bear sightings in the North Cascades. Photogrammetric Engineering and Remote Sensing 55:1637-1642.

Almack, J. A. 1986. North Cascades grizzly bear project; annual report, 1986. Washington Department of Game, Olympia. 71 pp.

Almack, J. A. 1990. North Cascades grizzly bear investigations; 1987 and 1988 progress report. Washington Department of Wildlife, Olympia. 33 pp.

Almack, J. A., W. L. Gaines, R. H. Naney, P. H. Morrison, J. R. Eby, G. F. Wooten, M. C. Snyder, S. H. Fitkin, and E. R. Garcia. 1993. North Cascades grizzly bear ecosystem evaluation. Final report. Interagency Grizzly Bear Committee. Denver, Colorado. 169 pp.

Apps, C. D., B. N. McLellan, J. G. Woods, and M. F. Proctor. 2004. Estimating grizzly bear distribution and abundance relative to habitat and human influence. Journal of Wildlife Management 68(1):138–152.

Bancroft, H. H. 1890. History of Washington, Idaho and Montana, Vol. 31. History Company.

Bedal Fish, J., and E. Bedal. 2000. Two voices: A history of the Sauk and Suiattle people and Sauk country experiences.

Boyd, R. T. 1999. The coming of the spirit of pestilence: Introduced infectious diseases and population decline among Northwest Coast Indians, 1774-1874. University of Washington Press, Seattle, Washington.

Braaten, A. M., A. L. Lyons, W. L. Gaines, R. H. Naney, W. Kasworm, A. N. Hamilton, and J. Plumage. 2013. The North Cascades grizzly bear ecosystem: Administrative history, science and management, 1982–2013. North Cascades National Park Service Complex, Sedro-Woolley, Washington.

Butler, V. L., and S. K. Campbell. 2004. Resource intensification and resource depression in the Pacific Northwest of North America: A zooarchaeological review. Journal of World Prehistory 18(4):327–405.

Collins, J. M. 1974. Valley of the spirits. University of Washington Press, Seattle, Washington. 267 pp.

Craighead, J. J., and J. A. Mitchell. 1982. Grizzly bear (*Ursus arctos*). In: J. A. Chapman and G. A. Feldhamer, editors. Wild mammals of North America; biology, management, and economics. The Johns Hopkins University Press, Baltimore, Maryland.

Elliott, T. C. 1914. Journal of John Work, June-October, 1830. The Washington Historical Quarterly 5(2):83-115.

Farrar, V. J. 1924. The Nisqually Journal (Continued). The Washington Historical Quarterly 15(3):219.

Fedje, D. W. 2004. Results of 2004 excavations at Gaadu Din Cave, Haida Gwaii. Paper presented at the 2004 British Columbia Archaeological Forum.

Fischer, D. H. 1970. Historians' fallacies: toward a logic of historical thought. Harper and Row, New York, New York.

Gaines, W. L., W. O. Noble, and R. H. Naney. 2001. Grizzly bear recovery in the North Cascades Ecosystem. Pages 57-62 *in* Western Black Bear Workshop, Vol. 7.

Gibbs, G. 1863. Dictionary of the Chinook jargon, or trade language of Oregon (abridged). Cramoisy Press, New York, New York.

Guilday, J. E. 1968. Grizzly bears from eastern North America. American Midland Naturalist: 247-250.

Gyug, L. W. 1998. Assessment of grizzly bear populations, habitat use and timber harvest mitigation strategies in the North Cascades grizzly bear population unit, British Columbia. Okanagan Wildlife Consulting. Westbank, British Columbia. 38 pp.

Gyug, L., T. Hamilton, and M. Austin. 2004. Grizzly bear (*Ursus arctos*). Accounts and measures for managing identified wildlife in British Columbia. Vol. 4. Ministry of Water, Land and Air Protection.

Hayashida, F. M. 2005. Archaeology, ecological history, and conservation. Annual Review of Anthropology 34:43–65.

Hayden, B., and R. Schulting. 1997. The plateau interaction sphere and late prehistoric cultural complexity. American Antiquity 62(1):51–85.

Herrero, S. 1985. Bear attacks: Their causes and avoidance. Lyons and Burford, New York, New York. 287 pp.

Hilderbrand, G., S. D. Farley, C. T. Robbins, T. A. Hanley, K. Titus, and C. Servheen. 1996. Use of stable isotopes to determine diets of living and extinct bears. Canadian Journal of Zoology 74:2080-2088.

Houston, D. B., E. G. Schreiner, and B. B. Moorhead, Editors. 1994. Mountain goats in Olympic National Park: Biology and management of an introduced species. United States Department of the Interior, National Park Service, Denver, Colorado.

Huntington, H. P. 2000. Using traditional ecological knowledge in science: Methods and applications. Ecological applications 10(5):1270-1274.

Interagency Grizzly Bear Committee (IGBC) NCE Subcommittee. 2016. In-person communications and e-mail correspondence between members of the Interagency Grizzly Bear Committee (IGBC) NCE Subcommittee Technical Team, January–July 2016, and Mike Mayer, project manager, and Jason Medema, deputy project manager, Louis Berger.

Jones, T. L. 2013. Archaeological perspectives on prehistoric conservation in western North America. International Journal of Environmental Studies 70(3), 350-357.

Kay, C. E. 1994. Aboriginal overkill. Human Nature 5(4):359-398.

Laliberte, A. S., and W. J. Ripple. 2003. Wildlife encounters by Lewis and Clark: A spatial analysis of interactions between Native Americans and wildlife. AIBS Bulletin 53(10):994-1003.

Leonard, J. A., R. K. Wayne, and A. Cooper. 2000. Population genetics of Ice Age brown bears. Proceedings of the National Academy of Sciences of the United States of America 97:1651-1654.

Luxemburg, G. A. 1986. Historic resource study. Cultural Resources Division, Pacific West Region, National Park Service, Seattle, Washington.

Lyman, R. L. 1985. On the concepts of “significance” and “site”: Implications for inventorying archaeological resources. Pages 31-46 *in* R. F. Darsie, and J. D. Keyser, editors. Archaeological inventory and predictive modelling in the Pacific Northwest. Studies in Cultural Resource Management. U.S. Forest Service, Pacific Northwest Region, Portland.

Lyman, R. L. 1986. On the Holocene history of *Ursus* in Eastern Washington. Northwest Science 60(2):67-72.

Lyman, R. L. 1996. Applied zooarchaeology: The relevance of faunal analysis to wildlife management. World Archaeology 28(1):110-125.

Lyman, R. L. 2011. Paleozoological data suggest Euroamerican settlement did not displace Urside and North American elk from lowlands to highlands. Environmental Management 47:899-906.

Lyman, R. L., and S. Wolverton. 2002. The late prehistoric–early historic game sink in the northwestern United States. Conservation Biology 16(1):73-85.

Lyons, A. L., W. L. Gaines, P. H. Singleton, W. F. Kasworm, M. F. Proctor, and J. Begley. 2018. Spatially explicit carrying capacity estimates to inform species specific recovery objectives: Grizzly bear (*Ursus arctos*) recovery in the North Cascades. Biological Conservation 222:21-32.

Martin, P. S., and C. R. Szuter. 1999. War zones and game sinks in Lewis and Clark's West. Conservation Biology 13:36–45.

Matson, R. G. 1992. The evolution of Northwest Coast subsistence. Research in Economic Anthropology Supplement:367–428.

Mattson, D. J., and T. Merrill. 2002. Extirpations of grizzly bears in the contiguous United States, 1850–2000. Conservation Biology 16(4):1123-1136.

McLaren, D., R. J. Wigen, Q. Mackie, and D. W. Fedje. 2005. Bear hunting at the Pleistocene/Holocene transition on the northern Northwest Coast of North America. Canadian Zooarchaeology/Zooarchéologie canadienne 22:3-29.

Merk, F. 1931. Fur trade and empire. Harvard University Press, Cambridge, Massachusetts.

Mierendorf, R. R.1986. People of the North Cascades. National Park Service, Pacific Northwest Region, Seattle, Washington.

Moulton, G. E., editor. 1986–1996. The journals of the Lewis and Clark expedition, by Lewis M, Clark W, Vols. 2–10. University of Nebraska Press, Lincoln, Nebraska.

Mowat, G., D. C. Heard, and C. J. Schwarz. 2013. Predicting grizzly bear density in western North America. PLoS One 8(12):e82757.

Mustoe, G. E., and C. A. Carlstad. 1995. A late Pleistocene brown bear (*Ursus arctos*) from northwest Washington.

National Park Service. 1991. Natural resource management guidelines. NPS-77. Washington, D.C.

Nation-Knapper, S. J. 2015. N-lkwkw-min: Remembering the fur trade in the Columbia River plateau (unpublished doctoral dissertation). York University, Toronto, Ontario.

North Cascades Grizzly Bear Recovery Team. 2004. Recovery plan for grizzly bears in the North Cascades of British Columbia. Ministry of Water, Land and Air Protection. Victoria, British Columbia. 60 pp.

Nowack, R. M., and J. L. Paradiso. 1983. Walker's mammals of the world, fourth edition. The Johns Hopkins University Press, Baltimore, Maryland 2:569-1362.

Peterson, R. L. 1965. A well-preserved grizzly bear skull recovered from a late glacial deposit near Lake Simcoe, Ontario. Nature 208(5016):1233.

Proctor, M. F., D. Paetkau, B. N. Mclellan, G. B. Stenhouse, K. C. Kendall, R. D. Mace, W. F. Kasworm, C. Servheen, C. L. Lausen, M. L. Gibeau, W. L. Wakkinen, M. A. Haroldson, G. Mowat, C. D. Apps, L. M. Ciarniello, R. M. R. Barclay, M. S. Boyce, C. C. Schwartz and C. Strobeck. 2012. Population fragmentation and inter-ecosystem movements of grizzly bears in western Canada and the northern United States. Wildlife Monographs 180:1–46.

Rausch, R. L. 1963. Geographic variation in size in North American brown bears, *Ursus arctos* L., as indicated by condylobasal length. Canadian Journal of Zoology 41(1):33-45.

Ray, V. F. 1942. Culture element distributions: XXII Plateau. University of California Anthropological Records 8(2).

Roburn, A. 2001. North Cascades grizzly bear traditional knowledge study: Final report. Stó:lô Nation Aboriginal Rights and Title Department. Chilliwack, British Columbia.

Rode, K. D., S. D. Farley, and C. T. Robbins. 2006. Sexual dimorphism, reproductive strategy, and human activities determine resource use by brown bears. Ecology 87(10):2636-2646.

Romain-Bondi, K. A., R. B. Wielgus, L. Waits, W. F. Kasworm, M. Austin, and W. Wakkinen. 2004. Density and population size estimates for North Cascade grizzly bears using DNA hair-sampling techniques. Biological Conservation 117(4):417-428.

Ross, A. 1855. The fur hunters of the far west. A. Kenneth and N. Spaulding, editors. University of Oklahoma Press, Norman, Oklahoma.

Ruby, R. H., and J. A. Brown. 1988. Indians of the Pacific Northwest: A history Vol. 158. University of Oklahoma Press, Norman, Oklahoma.

Sage, W. N. 1934. Life at a fur trading post in British Columbia a century ago. The Washington Historical Quarterly 25(1):11-22.

Sappington, R. L., and S. Schuknecht-McDaniel. 2001. Wewukiyepuh (10-NP-336): Contributions of an early Holocene Windust Phase site to lower Snake River pre-history. North American Archaeologist 22:353.

Schullery, P. 2002. Lewis and Clark among the grizzlies: Legend and legacy in the American West. Rowman and Littlefield Guilford, Connecticut.

Schwartz, C. C., K. A. Keating, H. V. Reynolds III, V. G. Barnes, R. A. Sellers, J. E. Swenson, S. D. Miller, B. N. McLellan, J. Keay, R. McCann, M. Gibeau, W. F. Wakkinen, R. D. Mace, W. Kasworm, R. Smith, and S. Herrero. 2003. Reproductive maturation and senescence in the female brown bear. Ursus 14:109-119.

Servheen, C. 1990. The status and conservation of the bears of the world. In International Bear Restoration and Management. Monograph 2:32.

Servheen, C. 1999. Bears: Status survey and conservation action plan, Vol. 44. IUCN.

Seton, E. T. 1926. Lives of game animals 2:213. New York State College of Forestry, Syracuse, New York

Smith, A. H. 1988. Ethnography of the North Cascades. Center for Northwest Anthropology, Washington State University, Pullman, Washington.

Storer, T. I., and L. P. Tevis Jr. 1955. California grizzly. University of California Press, Berkley, California.

Suckley, G. J., and G. Cooper. 1860. The natural history of Washington Territory and Oregon. Bailliere Brothers, New York, New York.

Sullivan, P. T. 1983. A preliminary study of historic and recent reports of grizzly bears in the North Cascades area of Washington. Washington Department of Game, Olympia, Washington.

Teit, J. A. 1900. The Thompson Indians of British Columbia, Vol. 1. Nicola Valley Museum Archives Association, Merritt, British Columbia.

Thompson, E. N. 1970. North Cascades N.P., Ross Lake N.R.A., and Lake Chelan N.R.A.: History basic data. Office of History and Historic Architecture, Eastern Service Center, USDI National Park Service, Washington, D.C. 301 pp.

Thomson, D., and M. Ignace. 2005. They made themselves our guests: Power relationships in the interior plateau region of the Cordillera in the fur trade era. B.C. Studies: The British Columbian Quarterly 146:3-35.

Ubelaker, D. H., B. A. Buchholz, and J. E. Stewart 2006. Analysis of artificial radiocarbon in different skeletal and dental tissue types to evaluate date of death. Journal of forensic sciences 51(3):484-488.

U.S. Fish and Wildlife Service (USFWS). 1993. Grizzly bear recovery plan. U.S. Fish and Wildlife Service, Missoula, Montana.

U.S. Fish and Wildlife Service (USFWS). 1997. Grizzly bear recovery plan: North Cascades Ecosystem recovery chapter. U.S. Fish and Wildlife Service, Missoula, Montana.

U.S. Fish and Wildlife Service (USFWS). 2000. Grizzly bear recovery in the Bitterroot Ecosystem. Final Environmental Impact Statement. U.S. Fish and Wildlife Service, Missoula, Montana. 766 pp.

U.S. National Park Service and U.S. Fish and Wildlife Service (USNPS/USFWS). 2017. Draft grizzly bear restoration plan/environmental impact statement. North Cascades Ecosystem. U.S. Department of the Interior, Washington D.C., 198 pp.

Watson, B. M. 2010. Lives lived west of the divide: A biographical dictionary of fur traders working west of the Rockies, 1793-1858. Centre for Social, Spatial and Economic Justice, University of British Columbia Okanagan, Kelowna, British Columbia.

Willson, M. F., and K. C. Halupka. 1995. Anadromous fish as keystone species in vertebrate communities. Conservation Biology 9(3):489-497.

Work, J. 1830. Some information relative to Colvile District. Hudson's Bay Company Archives, Winnipeg, Manitoba.

Appendix A. Animal pelts harvested from Hudson's Bay Co. trading posts surrounding the North Cascades Grizzly Bear Recovery Zone, 1826 – 1857.

Table A-1. Fort Colville.

		Bear			Beaver			Fox										
Year	Badger	Black	Brown	Grizzly	Large	Small	Fisher	Cross	Red	Silver	Lynx	Marten	Mink	Muskrat	Land Otter	Raccoon	Wolverine	Wolf
1826	–	4	10	–	2037	969	76	2	12	–	–	141	190	5518	107	–	3	–
1827	–	13	21	9	2475	1141	114	3	43	–	1	189	230	5704	152	–	1	4
1828	–	20	12	6	1840	958	167	10	37	1	1	336	299	7157	199	–	6	6
1829	–	34	25	18	2145	1152	305	20	86	1	19	391	330	5592	217	–	12	7
1830	5	84	71	68	1810	1061	159	56	36	–	176	135	277	3465	142	1	13	33
1831	31	103	71	49	1892	1008	291	21	72	2	97	295	295	8537	225	1	20	128
1832	22	98	73	33	1682	920	190	7	51	1	61	122	279	8902	153	17	14	79
1833	13	77	86	36	2464	1073	169	9	37	1	32	189	245	13726	200	17	8	62
1834	10	66	30	10	2077	929	112	7	30	–	9	242	351	15470	213	13	7	145
1835	24	125	181	33	1550	897	271	18	40	4	4	509	281	9170	251	19	27	116
1836	5	79	65	29	1375	857	197	14	39	3	8	377	335	6564	205	9	27	83
1837	97	71	50	25	1273	665	355	46	132	6	19	703	–	5898	203	52	20	179
1838	610	56	56	61	1055	556	519	13	88	3	56	828	483	18894	163	25	18	77
1839	316	160	103	66	1315	638	613	68	183	5	263	793	626	15106	267	49	27	224
1840	184	138	96	27	1040	468	302	7	68	2	582	334	250	3990	219	24	34	132
1841	267	95	76	45	936	451	237	19	73	2	227	292	405	7111	200	54	26	175
1842	243	127	92	85	986	371	206	13	52	3	65	420	146	6568	190	35	32	159
1843	132	183	102	107	712	333	229	13	79	2	45	796	288	7691	186	22	48	275
1844	113	305	174	185	521	280	295	15	66	4	24	1269	250	5973	220	59	45	130
1845	114	218	239	203	446	326	263	35	114	5	34	1764	179	3068	144	47	65	175
1846	69	196	173	244	509	452	261	24	67	2	35	2195	144	3121	129	19	41	185
1847	234	245	224	160	405	395	328	85	233	9	44	3173	182	4016	165	68	55	175
1848	134	299	220	369	495	479	508	139	368	21	186	2301	258	3428	296	59	53	503
1849	53	278	184	227	316	246	411	57	226	5	356	1654	187	4237	176	56	29	490

Year	Badger	Bear			Beaver		Fisher	Fox			Lynx	Marten	Mink	Muskrat	Land Otter	Raccoon	Wolverine	Wolf
		Black	Brown	Grizzly	Large	Small		Cross	Red	Silver								
1850	34	264	177	245	269	169	351	28	146	2	337	1018	125	5502	127	20	48	342
1851	71	263	191	188	954*	954*	345	24	75	6	187	689	272	9360	173	27	33	380
1852	64	255	171	195	1884	34	349	38	115	8	143	605	260	13186	165	26	41	462
1853	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
1854	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
1855	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
1856	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
1857	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–

*Large and small beaver pelts were recorded as one value in Fort Colville records.

Table A-2. Fort Langley.

		Bear			Beaver			Fox										
Year	Badger	Black	Brown	Grizzly	Large	Small	Fisher	Cross	Red	Silver	Lynx	Marten	Mink	Muskrat	Land Otter	Raccoon	Wolverine	Wolf
1826	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
1827	–	2	–	–	683	228	19	–	–	–	–	–	–	–	269	–	–	–
1828	–	2	–	–	823	303	3	–	–	–	–	1	–	44	319	–	–	–
1829	–	2	–	–	1277	421	16	–	–	–	–	–	–	25	476	–	–	–
1830	–	1	–	–	417	238	9	–	–	–	27	90	88	169	151	–	–	–
1831	–	52	–	–	1477	514	20	–	–	–	76	152	828	792	518	3	1	3
1832	–	52	–	–	944	449	23	–	2	–	27	807	1178	572	460	26	1	–
1833	–	62	–	–	2063	725	36	–	–	–	8	266	1537	1596	716	56	–	2
1834	–	45	–	1	873	585	24	–	–	–	25	315	1546	567	379	122	3	–
1835	–	51	1	–	951	415	13	1	–	–	27	243	1431	654	302	178	2	1
1836	–	79	3	–	823	352	772	–	–	–	44	182	1746	970	311	724	3	1
1837	–	55	1	–	659	324	16	1	2	–	64	450	1746	1024	285	628	2	–
1838	–	72	2	–	444	183	6	–	4	–	85	516	1575	1787	248	811	3	2
1839	–	71	9	1	803	222	6	2	3	2	183	760	1436	2900	276	756	2	10
1840	–	167	10	1	568	245	12	3	5	-	423	335	1294	709	132	664	7	14
1841	–	120	7	3	419	173	124	3	3	1	378	184	813	1104	229	712	6	4
1842	–	83	9	2	520	242	37	2	5	2	181	418	939	1641	227	785	4	12
1843	–	76	7	–	529	302	26	1	6	–	69	429	866	3443	169	844	2	10
1844	–	123	10	4	428	161	26	1	3	–	66	483	686	4258	165	527	5	4
1845	–	150	12	2	202	84	17	1	1	–	71	525	533	1599	122	254	–	10
1846	–	62	2	3	267	96	36	–	–	–	54	1108	374	2172	81	210	3	1
1847	–	109	8	2	195	118	39	1	3	–	44	785	559	3658	107	762	1	3
1848	–	97	4	1	150	100	28	1	4	1	59	1054	433	2944	89	300	1	3
1849	–	235	5	1	67	45	23	2	4	2	163	524	354	1745	56	649	2	4
1850	–	75	9	1	36	24	5	–	1	–	204	361	170	1004	41	168	–	2
1851	–	132	10	2	42	11	30	–	2	–	185	551	225	1057	69	145	2	1
1852	–	93	18	2	69	54	25	1	3	–	103	432	138	2100	72	120	4	1
1853	–	178	11	2	189	100	25	1	5	1	41	468	228	5357	55	158	10	–

		Bear			Beaver			Fox										
Year	Badger	Black	Brown	Grizzly	Large	Small	Fisher	Cross	Red	Silver	Lynx	Marten	Mink	Muskrat	Land Otter	Raccoon	Wolverine	Wolf
1854	–	182	11	14	294	129	38	4	4	5	79	1017	251	2702	78	270	5	12
1855	–	277	24	13	801	99	36	6	9	4	84	1608	517	2401	102	192	14	4
1856	–	261	47	9	842	246	74	22	12	6	164	1160	660	4750	127	408	8	32
1857	1	462	38	30	699	186	66	17	13	10	127	1462	963	5227	141	611	14	81

Table A-3. Fort Nez Percés.

		Bear			Beaver			Fox										
Year	Badger	Black	Brown	Grizzly	Large	Small	Fisher	Cross	Red	Silver	Lynx	Marten	Mink	Muskrat	Land Otter	Raccoon	Wolverine	Wolf
1826	–	–	–	–	1116	561	3	2	6	–	–	2	–	904	81	–	–	–
1827	–	–	–	–	791	520	8	3	49	–	–	1	–	704	77	–	–	–
1828	–	1	–	–	1118	383	20	8	72	3	2	2	3	707	116	–	–	–
1829	–	2	14	–	531	243	24	6	28	–	–	7	–	203	73	–	–	–
1830	–	4	26	1	561	227	35	4	44	–	68	5	–	717	85	8	1	18
1831	39	15	40	7	761	432	32	8	28	–	75	–	–	808	80	80	3	229
1832	98	38	44	7	862	412	19	4	19	–	24	2	–	1367	98	52	5	326
1833	255	95	106	19	1306	539	24	8	23	3	23	3	3	1446	139	102	3	480
1834	185	69	120	12	1162	655	7	15	80	3	39	3	3	1730	171	90	–	660
1835	128	109	181	9	787	222	16	12	90	2	29	5	2	1007	127	122	1	664
1836	85	22	42	3	506	357	23	12	94	1	16	1	1	1407	182	92	2	522
1837	40	26	27	3	492	252	32	21	61	5	9	7	5	1162	185	30	–	179
1838	71	27	44	3	406	173	16	6	21	4	7	5	4	1327	132	28	1	162
1839	67	30	44	4	289	184	16	25	43	3	113	4	3	1682	174	39	1	419
1840	38	35	37	–	296	141	9	14	26	5	143	2	5	1105	92	30	4	248
1841	–	52	73	2	251	137	10	4	10	1	55	4	43	1383	136	82	–	141
1842	82	69	95	5	317	150	27	27	8	1	50	2	36	1503	145	108	1	845
1843	85	57	71	21	330	148	30	12	54	4	60	5	90	2043	187	97	6	1014
1844	29	102	87	22	194	77	24	18	40	4	19	7	33	1323	158	45	6	459
1845	17	77	127	33	248	143	30	4	33	2	11	19	41	1121	130	46	5	306
1846	41	91	124	27	158	139	38	5	42	1	31	87	87	1283	204	100	–	284
1847	84	37	34	3	369	107	31	35	222	1	132	92	42	1041	158	147	1	1099
1848	1	8	18	2	144	92	7	11	69	1	2	59	35	228	44	11	4	121
1849	4	11	10	2	73	43	4	7	32	1	14	8	10	157	53	39	1	216
1850	–	23	8	–	97	–	3	3	17	1	5	21	6	169	28	16	–	38
1851	–	2	1	–	38	19	2	1	1	1	–	5	4	143	7	4	–	7
1852	2	9	17	1	191	66	14	4	8	2	15	12	20	332	43	14	–	55
1853	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–

Year	Badger	Bear			Beaver		Fisher	Fox			Lynx	Marten	Mink	Muskrat	Land Otter	Raccoon	Wolverine	Wolf
		Black	Brown	Grizzly	Large	Small		Cross	Red	Silver								
1854	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
1855	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
1856	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
1857	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–

Table A-4. Fort Nisqually.

		Bear			Beaver			Fox										
Year	Badger	Black	Brown	Grizzly	Large	Small	Fisher	Cross	Red	Silver	Lynx	Marten	Mink	Muskrat	Land Otter	Raccoon	Wolverine	Wolf
1826	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
1827	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
1828	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
1829	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
1830	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
1831	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
1832	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
1833	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
1834	–	56	–	–	1038	412	23	–	–	–	5	–	80	700	340	190	–	–
1835	–	33	4	–	1111	343	28	–	–	–	8	7	54	801	377	515	–	10
1836	–	58	–	–	802	259	29	2	2	–	24	2	73	525	402	700	2	12
1837	–	53	2	–	580	170	21	1	–	–	21	-	31	356	371	417	2	11
1838	–	40	4	–	568	127	20	–	1	–	36	1	47	1132	312	407	–	19
1839	2	52	4	–	675	164	44	–	5	–	42	14	175	729	316	517	1	41
1840	1	52	1	–	233	132	35	–	1	–	27	11	51	336	36	320	–	23
1841	1	56	2	1	299	139	28	–	–	–	12	1	32	162	153	226	–	18
1842	1	44	2	–	189	44	14	1	–	–	12	-	52	142	136	188	–	23
1843	1	54	5	–	442	172	19	–	1	–	17	3	72	405	219	293	–	11
1844	1	94	11	–	305	125	10	1	1	–	17	6	79	489	201	349	–	19
1845	–	99	10	–	192	73	21	–	3	–	36	9	82	500	124	217	1	26
1846	–	77	6	–	195	82	10	3	1	–	39	7	51	363	119	162	1	21
1847	–	89	13	–	78	44	9	–	–	–	17	3	36	180	96	204	–	7
1848	–	83	10	–	243	85	17	1	–	–	38	9	47	668	154	192	–	11
1849	–	61	–	–	112	37	6	–	1	–	15	–	10	394	107	219	–	2
1850	–	43	–	1	61	19	17	–	8	–	30	–	27	156	111	174	–	–
1851	–	37	3	–	60	37	23	–	–	–	23	2	22	247	109	208	1	–
1852	–	126	2	–	251	59	12	–	–	–	44	4	23	207	196	269	2	1

Year	Badger	Bear			Beaver		Fisher	Fox			Lynx	Marten	Mink	Muskrat	Land Otter	Raccoon	Wolverine	Wolf
		Black	Brown	Grizzly	Large	Small		Cross	Red	Silver								
1853	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
1854	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
1855	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
1856	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
1857	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–

Table A-5. Kamloops/Fort Thompson.

		Bear			Beaver			Fox										
Year	Badger	Black	Brown	Grizzly	Large	Small	Fisher	Cross	Red	Silver	Lynx	Marten	Mink	Muskrat	Land Otter	Raccoon	Wolverine	Wolf
1826	–	–	–	–	692	350	11	–	11	2	–	441	26	436	97	–	–	–
1827	–	–	–	–	859	431	15	8	10	–	3	380	75	775	113	–	–	–
1828	–	1	4	2	818	287	25	14	28	10	1	606	123	1796	128	–	2	–
1829	–	13	4	10	521	218	66	43	55	15	73	576	137	1684	106	–	4	1
1830	–	36	18	3	462	229	29	29	21	21	604	407	68	4207	70	–	2	1
1831	21	33	30	12	769	382	75	41	32	11	150	711	95	3137	99	1	4	91
1832	15	44	28	3	659	318	81	31	64	8	147	610	80	6155	131	1	14	38
1833	44	36	17	8	667	358	90	39	70	10	64	1009	143	6155	130	2	10	50
1834	10	28	27	8	775	422	101	28	81	3	34	964	206	6610	129	–	5	65
1835	32	44	24	7	672	299	84	34	102	4	63	1456	183	4661	123	9	7	117
1836	74	38	26	15	520	225	88	40	126	5	67	969	165	3120	92	2	5	76
1837	7	14	11	2	402	197	84	38	103	14	71	2341	119	3463	90	2	5	39
1838	27	31	13	4	346	165	126	24	84	12	227	2177	154	4533	83	2	6	36
1839	23	36	15	5	507	181	179	60	117	20	513	806	195	5779	124	2	10	64
1840	16	45	23	7	301	125	133	25	48	12	514	155	50	2021	95	–	5	49
1841	10	7	2	2	251	168	73	32	81	13	149	359	36	1798	94	–	5	27
1842	143	37	20	3	223	78	109	57	164	13	65	878	80	993	81	–	14	89
1843	8	24	15	3	222	78	49	20	62	5	23	784	73	1348	69	–	8	35
1844	30	70	30	7	136	58	75	42	108	17	28	1182	178	855	66	1	17	123
1845	50	66	30	6	174	76	60	26	99	4	42	1610	77	1054	73	1	8	92
1846	5	42	19	4	85	55	57	40	95	14	54	2446	230	2143	66	–	9	79
1847	–	43	13	5	79	77	34	71	102	20	63	1773	87	1055	48	–	10	70
1848	4	16	8	3	5	1	19	43	17	14	75	637	48	195	16	–	4	46
1849	–	96	22	11	70	20	54	74	48	30	283	1294	23	770	48	–	7	54
1850	1	52	18	11	27	2	76	32	59	19	137	1813	26	914	42	–	14	19
1851	1	97	49	6	228	124	76	29	7	10	62	1398	93	1326	63	–	23	38

Year	Badger	Bear			Beaver		Fisher	Fox			Lynx	Marten	Mink	Muskrat	Land Otter	Raccoon	Wolverine	Wolf
		Black	Brown	Grizzly	Large	Small		Cross	Red	Silver								
1852	9	57	7	7	431	208	78	43	22	18	37	1538	121	1304	57	–	59	64
1853	6	76	35	9	531	215	110	41	34	14	25	2554	154	1480	77	–	24	36
1854	22	160	68	11	421	171	147	31	34	22	46	4546	265	2058	44	–	34	86
1855	3	60	24	7	288	192	65	47	27	18	34	2378	176	342	64	–	12	80
1856	–	65	18	2	204	164	52	51	28	20	56	1694	202	182	58	–	9	95
1857	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–

Appendix B. Grizzly bear observations in the North Cascades ecosystem.

Table B-1. Class 1 observations (n = 41).

Sources	Year	Approx. Location	Observation type	Location Description
Almack et al. 1993, IGBC	1859	596500E 5425400N	1 adult, killed	Tomyhoi Lake, MBSNF
Sullivan 1983	1900-1910	698235E 5360928N	1 unaged, killed	Canyon Creek, Twisp River, ONF
Sullivan 1983, Bjorklund 1980, Majors 1975	1913	660017E 5326264N	1 unaged, killed	Phelps Creek CG, Chiwawa River, WNF
Sullivan 1983	1920's	701806E 5425175N	1 unaged, killed	Spanish Creek, ONF
Sullivan 1983, Bjorklund 1980, Majors 1975	1920	630367E 5349692N	1 unaged, killed	Lime/Green Mt, Suiattle River, MBSNF
Sullivan 1983	1922	673503E 5332727N	1 unaged, killed	Borealis Ridge, WNF
Sullivan 1983	1923	667241E 5411987N	1 unaged, photo, killed	Holman Ck, WF Pasayten River, ONF
Sullivan 1983	1943	723910E 5429447N	1 unaged, killed	Horseshoe basin, ONF
Sullivan 1983	1943-44	632660E 5334609N	1 unaged, killed	Fire Mt, Fire Creek, MBSNF
Sullivan 1983	1952	794277E 5427594N	1 unaged, killed, photo	Near Molson, Tonasket, Okanogan Co
Sullivan 1983	1952	655444E 5442815N	3 unaged, killed	Around Canyon Creek valley, Manning, BC
Almack et al. 1993, IGBC	1964	656475E 5402127N	1 unaged, killed	North of Canyon Creek, MBSNF
Sullivan 1983	1967	648876E 5382493N	1 adult, killed	Fisher Basin, NCNP
Sullivan 1983	1973-76	615550E 5467089N	1 unaged, killed	Hope Mt, BC
Almack et al. 1993, IGBC	1979	956107E 5517149N	Tracks	Upper Pitt, BC
Almack et al. 1993, IGBC	1980	607000E 5497000N	1 unaged	Inkawathia, BC
Almack et al. 1993, IGBC	1982	592300E 5474500N	1 unaged, killed	Slollicum Creek, BC
Almack et al. 1993, IGBC	1982	906941E 5553421N	1 adult, killed	Squamish Valley, BC
Almack et al. 1993, IGBC	1983	620200E 5409200N	3 adults	Picket Creek, Baker River, NCNP
Almack et al. 1993, IGBC	1984	692500E 5385500N	1 adult	Upper Methow River, ONF
Almack et al. 1993, IGBC	1986	709300E 5397700N	1 adult	Lower Chewuch River, ONF
Almack et al. 1993, IGBC	1987	642300E 5392500N	Tracks	Lower Thunder Creek, RLNRA
Almack et al. 1993	1988	638700E 5253300N	2 adults, video	Cooper Lake, WNF
Almack et al. 1993, IGBC	1989	605600E 5389500N	Tracks	Diobsud Creek, MBSNF

Sources	Year	Approx. Location	Observation type	Location Description
Almack et al. 1993, IGBC	1989	656500E 5242400N	1 adult, tracks	Teanaway Butte, WNF
Almack et al. 1993, IGBC	1989	641700E 5428500N	Food cache	Hozomeen, RLNRA
Almack et al. 1993, IGBC	1990	641000E 5426900N	Tracks, scat	Hozomeen, RLNRA
Almack et al. 1993, IGBC	1990	729218E 5412010N	Tracks	SF Toats Coulee Creek, Okanogan Co
Almack et al. 1993, IGBC	1990	644800E 5483400N	1 unaged	Jim Kelly Creek, BC
Almack et al. 1993, IGBC	1991	647500E 5463200N	1 unaged	Paradise Valley, Manning Park, BC
Almack et al. 1993, IGBC	1991	677000E 5266000N	Tracks	Mill Creek, WNF
Almack et al. 1993, IGBC	1991	678000E 5345300N	1 adult, 1 cub	Moore Point, WNF
Almack et al. 1993, IGBC	1991	631900E 5259800N	Tracks	East of Chickamin Ridge, WNF
Almack et al. 1993, IGBC	1994	673465E 5420901N	1 adult	Pasayten River near airport, ONF
IGBC	1996	635775E 5332145N	1 unaged	Glacier Ridge, MBSNF
BC Ministry of Environment	2002	661760E 5452870N	1 adult, video	NE edge of Manning Park, BC
Fitkin/Heinlen	2003	786281E 5427532N	1 unaged	East of Buckhorn Mt, Chesaw, ONF
IGBC	2010	647183E 5452365N	1 adult, photo*	Skagit River, Manning Park, BC
IGBC	2012	647183E 5452365N	1 adult, photo, DNA*	Skagit River, Manning Park, BC
BC MoE	2013	636260E 5468060N	1 adult, video*	Sowaqua Valley, BC
IGBC	2015	Undisclosed	1 adult, photo	Near East Gate, Manning Park, BC

*IGBC evaluation indicates that these may be observations of the same individual bear over time.

Table B-2. Class 2 observations (n = 139).

Sources	Year	Approx. Location	Observation type	Location Description
Sullivan 1983	mid-late 1800s	608614E 5357487N	Multiple unaged	Sauk Prairie
Almack et al. 1993	1859	596500E 5425400N	1 adult, 3 cubs	Tomyhoi Lake, MBSNF
Sullivan 1983	1895	664109E 5297334N	1 unaged, killed	Lake Wenatchee, MBSNF
Sullivan 1983	1909	668588E 5340044N	1 unaged, tracks	Head of Entiat River, WNF
Sullivan 1983, Bjorklund 1980, Majors 1975	1910	685213E 5310719N	1 unaged	Upper Entiat River, WNF
Sullivan 1983	1912-16	677086E 5300970N	Tracks	Entiat Ridge, WNF
Sullivan 1983	1914-15	677352E 5312368N	Tracks	East of Mad Lake, WNF
Sullivan 1983	1920's	657122E 5316537N	Multiple unaged, killed	Napeequa River, WNF
Sullivan 1983	1924	669418E 5308400N	1 unaged	Mouth of Chikamin Creek, WNF
Sullivan 1983	1926	700517E 5382307N	Tracks	Windy Pass, Renezvous Camp, ONF
Sullivan 1983	1933-35	673022E 5420303N	1 unaged	Pasayten River near airport, ONF
Sullivan 1983	1934	654388E 5331912N	1 unaged	Buck Creek, WNF
Sullivan 1983	mid-1930's	671505E 5392107N	1 unaged, killed	Arralde Basin, Ephrata, ONF
Sullivan 1983	1935-36	678775E 5391671N	1 unaged	Deadhorse Point, ONF
Sullivan 1983	1939	654764E 5374542N	1 unaged, tracks	NF Bridge Creek, NCNP
Sullivan 1983	1940	667539E 5418654N	Skull	Near Soda Peak, ONF
Sullivan 1983	1942	630827E 5337151N	1 adult, 2 cubs	Trail from Meadow Mt to Fire Mt, MBSNF
Sullivan 1983	1946	635593E 5332429N	1 unaged	Glacier Ridge, MBSNF
Sullivan 1983	1946	636253E 5335292N	1 adult, 2 cubs	Below Fire Creek Pass, MBSNF
Sullivan 1983	1946	630157E 5337423N	1 unaged	Meadow Mt to Fire Pass trail, MBSNF
Sullivan 1983	1948	635916E 5317415N	1 unaged	Johnson Mt, MBSNF
Sullivan 1983	1948-49	777197E 5382222N	1 unaged	Tunk Mt, ONF
Sullivan 1983	mid 1950s	658685E 5381498N	1 unaged	Fisher Creek Basin, NCNP
Sullivan 1983	mid-1950's	701840E 5425271N	1 unaged	Near Spanish Camp, ONF
Sullivan 1983	1950	671373E 5400884N	1 unaged, killed	MF Pasayten River, ONF

Sources	Year	Approx. Location	Observation type	Location Description
Sullivan 1983	1950	654146E 5340885N	1 unaged	Trail from Holden over Cloudy Pass, WNF
Sullivan 1983	1950	684057E 5427982N	1 unaged, tracks	Bunker Hill, ONF
Sullivan 1983	1951	741760E 5414536N	1 unaged	Toats-Coulee, Okanogan Co
Sullivan 1983	1954	791964E 5440953N	1 unaged, killed	Rock Creek east of Osoyoos River, BC
Sullivan 1983	1957-58	730579E 5427010N	1 unaged	NF Toats-Coulee, ONF
Sullivan 1983	1958	631613E 5351181N	1 unaged	Downy Creek, MBSNF
Sullivan 1983	late 1950's	665850E 5398297N	1 unaged, killed	SF Slate Creek, MBSNF
Sullivan 1983	late 1950's	723960E 5429311N	1 unaged, killed	Horseshoe Basin, ONF
Sullivan 1983	1960s	743748E 5400374N	1 unaged	Sinlahekin River, Sinlahekin NRA
Almack et al. 1993	1964	713213E 5379908N	1 adult	Lower Chewuch River, ONF
Sullivan 1983	1967	622167E 5422103N	1 unaged	Bear Mt, Bear Creek, NCNP
Sullivan 1983	1968	668971E 5394533N	1 unaged, killed	SF Trout Creek, ONF
Sullivan 1983	1968	722821E 5432149N	1 unaged	North of Horseshoe Basin, BC
Sullivan 1983	1970	673537E 5330956N	Tracks	Snow Brushy Creek, WNF
Sullivan 1983	1971-73	612908E 5386026N	1 unaged	Diobsud Butte, NCNP
Sullivan 1983	1971	649649E 5375086N	1 unaged	Thunder Basin, NCNP
Sullivan 1983	1972	738999E 5415888N	1 unaged	Toats Coulee Creek, Okanogan Co
Sullivan 1983	1972	668413E 5403833N	Tracks	South of Windy Pass, MBSNF
Sullivan 1983	1972	691358E 5401391N	1 unaged	West slope of Sunrise Peak, ONF
Sullivan 1983	1973	656780E 5281785N	1 unaged, tracks	Flora Lake, WNF
Almack et al. 1993	1974	637900E 5248000N	1 adult	Thorp Creek, WNF
Sullivan 1983	1974	637631E 5316427N	1 unaged	Wenatchee Ridge toward Johnson Mt, MBSNF
Sullivan 1983	1974	660543E 5283257N	1 unaged	Timothy Meadows, WNF
Almack et al. 1993	1975	641900E 5372100N	1 adult	Near Cascade Pass, MBSNF
Sullivan 1983	1977-79	671192E 5280006N	1 unaged	Tumwater Canyon, WNF
Sullivan 1983	1977	645777E 5287583N	1 unaged	Josephine Lake, Mill Creek, WNF
Sullivan 1983	1977	656511E 5455213N	1 unaged	Nicomen Ridge, BC
Sullivan 1983	1978	633662E 5461917N	1 adult, 1 cub	Mt Outram, Manning, BC

Sources	Year	Approx. Location	Observation type	Location Description
Sullivan 1983	1979	684803E 5397485N	1 unaged, tracks	Lost River, ONF
Almack et al. 1993	1980	590000E 5410000N	1 adult, 2 cubs	Lasiocarpa Ridge, MBSNF
Almack et al. 1993	1980	650000E 5250000N	1 adult, 2 cubs	Jolly Mt, WF Teanaway River, WNF
Sullivan 1983	1980	671990E 5414155N	1 unaged	Pasayten Ridge, ONF
Sullivan 1983	1981-82	664099E 5335412N	1 unaged, tracks	Below Entiat Glacier, WNF
Almack et al. 1993	1981	696000E 5442000N	1 unaged	Ashnola River, BC
Almack et al. 1993	1981	693200E 5420400N	1 unaged	Larch Pass, ONF
Almack et al. 1993	1982	813618E 5389204N	2 adults	Sanpoil River, Colville NF
Sullivan 1983	1982	769623E 5409746N	Tracks	Cougar Canyon Rd, Tonasket, Okanogan Co
Almack et al. 1993	1983	639000E 5399000N	1 adult	Sourdough Mt, RLNRA
Almack et al. 1993	1983	648000E 5477000N	1 unaged	Deer Mountain, BC
Almack et al. 1993	1983	681721E 5423768N	Tracks	Lower EF Pasayten River below Hidden Lake, ONF
Almack et al. 1993	1983	635000E 5339800N	1 unaged	Lime Ridge, MBSNF
Sullivan 1983	1983	669984E 5377099N	1 unaged	Whistler Mt, NCNP, WNF
Sullivan 1983	1983	665540E 5331111N	1 unaged	Head of Entiat valley, WNF
Almack et al. 1993	1984	642900E 5299100N	1 adult	Rapid River Basin, MBSNF
Almack et al. 1993	1985	612500E 5398000N	Tracks	Hagan Mt, NCNP
Almack et al. 1993	1985	678300E 5383000N	1 adult	Early Winters Creek, ONF
Almack et al. 1993	1985	629300E 5306900N	1 adult, 2 cubs	West Cady Creek, MBSNF
Almack et al. 1993	1985	635700E 5322600N	1 adult	Red Pass, MBSNF
Almack et al. 1993	1985	640200E 5442300N	1 unaged	Shawatus Creek, BC
Almack et al. 1993	1985	696000E 5442000N	1 unaged	Ashnola River, BC
Almack et al. 1993	1986	643900E 5361700N	1 adult	Flat Creek, WNF
Almack et al. 1993	1986	652900E 5409900N	1 adult	Dry Creek Pass, MBSNF
Almack et al. 1993	1986	660000E 5230000N	1 adult	Cle Elum Ridge, WNF
Almack et al. 1993	1986	662400E 5383800N	3 adult	Easy Pass, MBSNF
Almack et al. 1993	1986	707100E 5430000N	1 adult	Amphitheater Mt, ONF
Almack et al. 1993	1986	666100E 5417600N	2 adult	Rock Creek, ONF

Sources	Year	Approx. Location	Observation type	Location Description
Almack et al. 1993	1986	677700E 5393400N	1 adult	Deadhorse Point, ONF
Almack et al. 1993	1986	607500E 5403200N	1 adult, 2 cubs	Baker River, NCNP
Almack et al. 1993	1986	611700E 5324800N	1 adult	SF Stillaguamish River, MBSNF
Almack et al. 1993	1987	587602E 5422028N	1 adult	Excelsior Pass, MBSNF
Almack et al. 1993	1987	645000E 5418000N	2 unaged	Desolation Peak, RLNRA
Almack et al. 1993	1987	658200E 5399000N	1 adult	Canyon Creek, MBSNF
Almack et al. 1993	1987	632400E 5369400N	1 adult	Cascade River below Hidden Lake, MBSNF
Almack et al. 1993	1987	657800E 5408500N	1 adult	Devils Pass, MBSNF
Almack et al. 1993	1987	658500E 5237100N	1 adult	NF Tenaway River, Kittitas Co
Almack et al. 1993	1987	670000E 5376600N	1 adult	Whistler Mt, WNF
Almack et al. 1993	1988	626500E 5380000N	1 adult	Monogram Lake, NCNP
Almack et al. 1993	1988	676100E 5321000N	1 cub	Upper Entiat River, WNF
Almack et al. 1993	1988	689400E 5367300N	Digs	Little Slate Creek, Twisp River, ONF
Almack et al. 1993	1988	646000E 5293200N	Tracks	Nason Creek, WNF
Almack et al. 1993	1988	670015E 5376600N	1 adult	Whistler Mt, WNF
Almack et al. 1993	1989	627900E 5260300N	1 adult	Chickamin Lake, WNF
Almack et al. 1993	1989	641000E 5422400N	Tracks	Little Beaver Creek, RLNRA
Almack et al. 1993	1989	643000E 5403300N	2 adults	Pierce Mt, RLNRA
Almack et al. 1993	1989	685800E 5311400N	1 unaged	Upper Entiat River, WNF
Almack et al. 1993	1989	691000E 5368100N	Digs	WF Little Bridge Creek, ONF
Almack et al. 1993	1989	700000E 5370000N	2 unaged	West of Patterson Lake, ONF
Almack et al. 1993	1989	640000E 5288400N	1 adult	West of Stevens Pass, MBSNF
Almack et al. 1993	1989	653300E 5341300N	1 adult	West of Cloudy Pass, SF Agnes Creek, WNF
Almack et al. 1993	1989	677900E 5385200N	1 adult	Early Winters Creek, ONF
Almack et al. 1993	1989	693900E 5386500N	1 unaged	Goat Creek, Methow River, ONF
Almack et al. 1993	1989	702400E 5426200N	1 adult	Spanish Creek, ONF
Almack et al. 1993	1990	647300E 5305000N	1 adult	Little Wenatchee River, WNF
Almack et al. 1993	1990	650000E 5397000N	1 adult	Ruby Creek, RLNRA

Sources	Year	Approx. Location	Observation type	Location Description
Almack et al. 1993	1990	660500E 5345200N	1 adult	Holden Lake, WNF
Almack et al. 1993	1990	668900E 5256900N	1 adult	Ingalls Creek, WNF
Almack et al. 1993	1990	673300E 5397100N	1 adult	Rattlesnake Creek, ONF
Almack et al. 1993	1990	696200E 5416500N	1 unaged	Diamond Creek, ONF
Almack et al. 1993	1990	820583E 5340103N	1 adult	Lower Sanpoil River, CIR
Almack et al. 1993	1990	560000E 5380000N	1 adult	Lyman Hill, Whatcom Co
Almack et al. 1993	1990	630800E 5256900N	1 adult, 3 cubs	West of Chickamin Ridge, WNF
Almack et al. 1993	1990	634300E 5254500N	1 adult	Cooper Lake, WNF
Almack et al. 1993	1990	635100E 5255100N	1 adult	Cooper Lake, WNF
Almack et al. 1993	1990	648200E 5427800N	1 adult	Lightning Creek, MBSNF
Almack et al. 1993	1990	655900E 5327400N	1 adult	Buck Mt, WNF
Almack et al. 1993	1990	658000E 5382000N	1 adult	Easy Pass, NCNP
Almack et al. 1993	1990	683600E 5409800N	1 adult	Butte Pass, ONF
Almack et al. 1993	1990	687300E 5319000N	1 adult	Shady Pass, WNF
Almack et al. 1993	1990	697300E 5319000N	1 adult	Lower Lake Chelan, WNF
Almack et al. 1993	1990	735252E 5372850N	1 adult	SF Beaver Creek, ONF
Almack et al. 1993	1991	639400E 5466900N	1 unaged	Davis Mountain, BC
Almack et al. 1993	1991	642800E 5446000N	1 adult	Silverdaisy Mt, Manning Park, BC
Almack et al. 1993	1991	649200E 5400400N	1 adult	Jerry Lakes north of Ruby Creek, MBSNF
Almack et al. 1993	1991	667900E 5376900N	1 adult	Rainy Pass, WNF
Almack et al. 1993	1991	668800E 5336000N	1 adult	Entiat Meadows, WNF
Almack et al. 1993	1991	671300E 5376300N	1 adult	Blue Lake, WNF
Almack et al. 1993	1991	687100E 5241300N	1 adult	West of Blewett Pass, WNF
Almack et al. 1993	1991	694500E 5412800N	1 adult	Three Fools Pass, ONF
Almack et al. 1993	1991	703300E 5393000N	1 unaged	Eightmile Creek, ONF
Almack et al. 1993	1991	668500E 5336100N	1 adult	Entiat Meadows, WNF
Undisclosed	1994	621474E 5386441N	1 unaged	Skagit River, RLNRA
Undisclosed	1996	648117E 5400297N	1 adult	Jack Mt Trail, RLNRA

Sources	Year	Approx. Location	Observation type	Location Description
Undisclosed	1999	644300E 5412690N	1 subadult	Skymo Creek, RLNRA
Undisclosed	2006	659726E 5387262N	1 adult	Granite Creek, MBSNF

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