"A Part of the People": Human-Dog Relationships Among the Northern Coast Salish of SW British Columbia

Authors: Anza-Burgess, Kasia, Lepofsky, Dana, and Yang, Dongya

Source: Journal of Ethnobiology, 40(4) : 434-450

Published By: Society of Ethnobiology

URL: https://doi.org/10.2993/0278-0771-40.4.434

Journal of Ethnobiology

2020 40(4): 434–450

"A Part of the People": Human-Dog Relationships Among the Northern Coast Salish of SW British Columbia

Kasia Anza-Burgess[1], Dana Lepofsky[2*], and Dongya Yang[2]

Abstract. Many Indigenous People value dogs as hunting aides, draft animals, sources of fiber and food, protectors, and as companions. To better understand the close human-dog relationship among the Northern Coast Salish Tla'amin, we bring together several lines of evidence, including ethnographic information, interviews, and ancient DNA of archaeological dog burials. All indicate that dogs were an important part of ancestral Tla'amin culture and society. Local knowledge, including oral traditions, reflects the long-term social importance of dogs in mundane and ritual spheres. Tla'amin-dog relationships were focused on special breeding and training practices that enhanced the hunting skill of dogs and reinforced the bond between dog and owner. Ancient DNA analysis of 17 skeletal dog remains (3500–430 BP) from six archaeological sites confirmed that domestic dogs have a long and continuous history in Tla'amin territory, culture, and identity. DNA analysis of the D-loop region of mitochondrial DNA revealed haplotypes that were shared across broad regions and others that were unique to more localized culture areas, reflecting gene flow between dog populations via ancient social networks. Our study highlights the value of integrating archaeological data, genetic studies, and local knowledge to achieve a fuller understanding of the close relationship between dogs and humans.

Keywords: dogs, Northern Coast Salish, Tla'amin, ancient DNA, local knowledge

> "[Dogs] were so specialized in what they could do, they were actually a part of the people, the village, or the family." (Tlex-tan Murray Mitchell, 2012)

Introduction

Whether primarily for human consumption, service, or companionship, it is not an exaggeration to say that the histories of dogs throughout the world are intertwined with those of humans (Pierotti and Fogg 2017; Shipman 2015; Snyder and Moore 2006). Such histories are not static, of course, and shifted as cultural, ecological, and biological parameters changed through time. Some aspects of these sometimes complex and intimate relationships can be tracked with the tangible evidence provided by archaeology and ancient genetics (e.g., Ameen et al. 2019; Brown et al. 2013; Cannon et al. 1999; Crockford 1997). However, understanding the more elusive aspects of human-dog relationships, such as the potentially profound bonds that can develop between master and canine, can be more difficult to tease out from only the material record alone. Thus, integrating diverse lines of evidence can be a powerful way to augment our understanding of ancient human-dog relationships (e.g., Barsh et al. 2006).

The lives of humans and dogs on the Northwest Coast of North America have been intertwined for millennia (Witt et al. 2015). Dog remains have been found in early mid-Holocene sites in the region (Cannon et al. 1999) and dogs feature prominently in ancient and widespread oral traditions. In the nineteenth and early twentieth centuries, explorers, naturalists,

[1]Department of Physical Therapy, University of British Columbia, Vancouver, BC. V6T 1Z3 Canada.
[2]Department of Archaeology, Simon Fraser University, Burnaby, BC, Canada.
[*]Corresponding author (dlepofsk@sfu.ca)

and ethnographers to the region remarked on the ubiquity and variety of the native dogs. These dogs were bred and trained for a multitude of purposes, including hunting aides (e.g., Barnett 1939), as protectors (Lord 1866), draft animals (Teit 1909), and sources of food (Teit 1906) and fiber (Barsh et al. 2006).

Data from morphometrics of archaeological dog specimens and the ethnographic record suggest that, prior to European contact, there were two main classes of dogs on the Northwest Coast. These were the hunting (or "village") dog and, in some Coast Salish areas, the woolly dog, whose long, thick fur was used as fiber and incorporated into woven textiles (Schulting 1994). Although it has been proposed that woolly dogs could be differentiated from hunting dogs archaeologically based on their smaller size and build (Crockford and Pye 1997), body shape may not actually be reliable criteria for distinguishing the two types of dogs (Barsh et al. 2006). Additionally, researchers have not been able to determine a unique genetic lineage that distinguishes woolly dogs from other Coast Salish dogs (Barsh et al. 2006; Koop et al. 2000).

As in many parts of the world, there is a lack of detail regarding the long-term relationships among people and dogs on the Northwest Coast. Since the arrival of European goods and lifeways, most of the ancient dog lineages have become extinct (Ní Leathlobhair et al. 2018) and the traditional roles of dogs and their relationship with humans has begun to disappear. Despite these genetic and cultural shifts, dogs continue to hold importance among many local Indigenous communities.

In this study, we use genetic and ethnographic data to explore the history of human-dog relationships among the Tla'amin (Sliammon)-Coast Salish of British Columbia (Figure 1). Our research is nested within a long-term, collaborative heritage project co-run by Tla'amin First Nation and the Archaeology Department at Simon Fraser University (SFU Archaeology and Tla'amin First Nation 2012). The overarching goals of the project are broad and diverse, but are grounded in the Tla'amin community's desires to document their heritage and to situate that knowledge in current issues, such as Aboriginal rights and title, education, and health. The particular interest in dogs arose from community members' memories of their families' close relations with hunting dogs. We enrich these memories by combining them with oral traditions, ethnographic and archaeological data, and ancient DNA analysis of archaeological specimens. Collectively, these different kinds of knowledge allow glimpses into the long-term and intimate relationships between the Tla'amin, their ancestors, and their dogs.

Archaeological and Ethnographic Evidence of Human-Dog Relations in the Pacific Northwest

Dogs are ubiquitous in the archaeological record of the Pacific Northwest (McKechnie et al. 2020) and can be among the most common terrestrial vertebrate remains recovered in middens. While some suggest that dogs were not eaten for subsistence (Crockford 1997), detailed zooarchaeological analyses of dog remains in middens are usually not conducted. This means potentially informative data, such as morphometrics, breakage patterns, and detailed contextual background, are usually not available in faunal reports. There is a need for a better understanding of how and why dog bones are commonly found in the archaeological record with other zooarchaeological midden remains.

Despite the gaps in knowledge about dogs of the Pacific Northwest, archaeological and ethnographic data from the Pacific Northwest indicate strongly that human-dog relationships are age-old, complex, and deeply meaningful. While the earliest archaeological evidence of dogs only dates to ~6000 years ago (Cannon et al. 1999), dogs almost certainly had been in the region

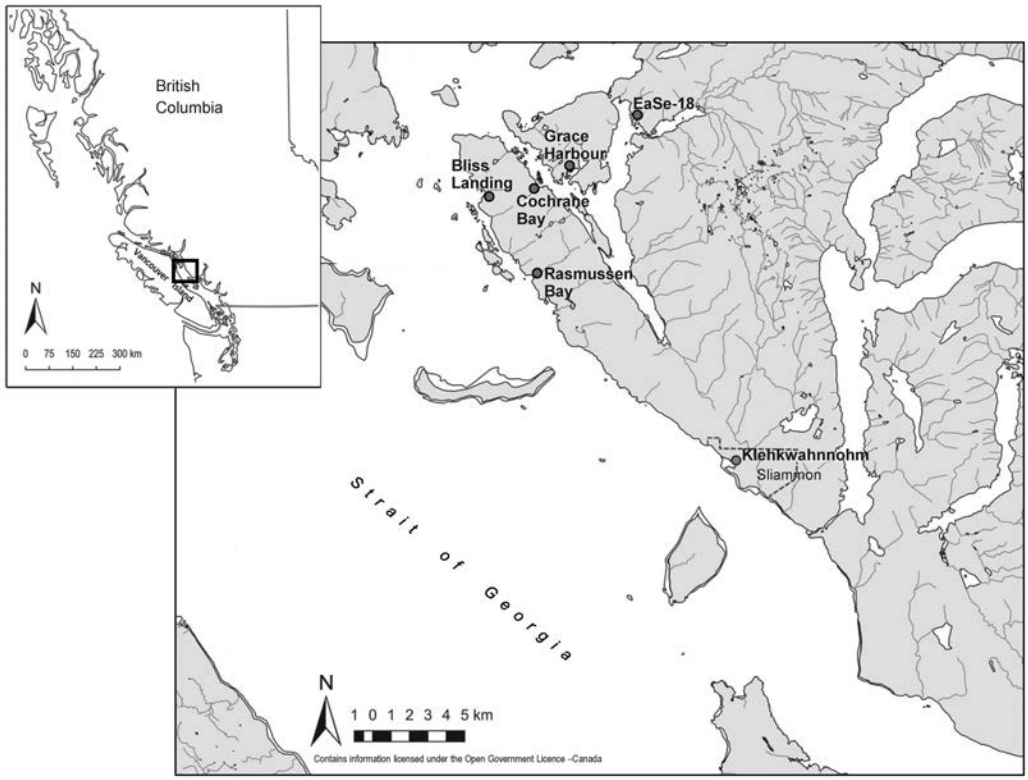

Figure 1. Locations mentioned in the text.

several millennia earlier (see Perri et al. 2019). After 4000 BP, there is evidence of human-dog co-burials and dog-only burials in the archaeological records of both the coast (e.g., Arcas Consulting Archeologists 1999:54; Cybulski 1992:63) and Interior Plateau (Crellin and Heffner 2000:162). In addition, dog remains are recovered from ritual contexts in archaeological houses, such as those associated with house preparation and feasting (Hayden and Spafford 1993). Collectively, this evidence reflects the intertwined lives of dogs and people in both the everyday and spiritual realms, and the absolute importance of and respect given to dogs in the archaeological past.

Ethnographic and ethnohistoric sources indicate the ongoing importance of dogs into the eighteenth and nineteenth centuries. For instance, dogs were sacrificed and buried with their deceased owner (e.g., Lamb 1960:85) or buried by themselves (Barnett 1955:97). In many Pacific Northwest cultures, dogs occupy a nebulous space because they are categorized as animal and/or as human, depending on the context (Amoss 1984:292). As such, dogs were sometimes granted privileges that would be normally reserved only for people, including being named.

Despite the continuity in the importance of dogs, colonization also led to shifts in human-dog relations. In the case of the woolly dog, their decline is associated with the introduction of sheep wool and wool blankets. Woolly-dog fur stopped being used by the Coast Salish by the mid-1800s (Crockford 1997; Schulting 1994); however, some remnants of the breed that was once used for wool may have persisted into the mid-1900s (Mackie 2019). In the case of hunting dogs, their decline in importance is likely associated with a range of factors, including restricted access to areas that

were once traditional hunting grounds and increased engagement with the settler economy that resulted in shifts in patterns of seasonal resource harvesting. In addition, as we discuss further below, a prohibition of hunting with unleashed dogs would have also reduced the use and importance of hunting dogs.

Methods

Community Interviews and Ethnographic Documents

The Tla'amin-Northern Coast Salish, along with the Klahoose and Homalco, are speakers of the Ahayajuthem (Mainland Comox) dialect of the Comox language (Kennedy and Bouchard 1990). The Tla'amin know that they have always lived in this area (Kennedy and Bouchard 1983:17); archaeological remains in their traditional territory date to the early Holocene (Springer et al. 2014). The Tla'amin interact with and rely on the rich and diverse land and sea resources of their territory, gathering and tending a variety of plants and shellfish, fishing for herring, salmon, and other finfish, and hunting both marine and terrestrial animals (Kennedy and Bouchard 1983:25–41). Terrestrial mammal hunting focused on black-tailed deer (*Odocoileus hemionus*), mountain goat (*Oreamnos americanus*), and black bears (*Ursus americanus*). Hunting of deer was aided by highly trained dogs who assisted by chasing prey back to hunters (Barnett 1939:232; Kennedy and Bouchard 1983:37). Our interviews with the Tla'amin focused on their use of dogs for this purpose.

The first author conducted semi-structured interviews focused on dogs in 2012 and 2013. Questions revolved around understanding the following themes: subsistence, spiritual beliefs, husbandry, companionship, trade, protection, and social organization. Participants were recruited using snowball sampling starting with participants suggested by two community members who were part of the larger Tla'amin-SFU project. Many of the interviews were with the grandchildren of historian Chithlethukt Rose Mitchell (1904–1988; Welch et al. 2011). All interview recordings and typed field notes were given to participants for approval. Interview protocols were approved by the Sliammon Cultural Committee and Simon Fraser University's Office of Research Ethics and followed the practice of free and prior informed consent. A total of seven interviews were conducted with six members of the Tla'amin community (Supplementary Table 1). In the results, these are identified by the person's initials and the year the interview was conducted (2012, 2013).

We also reviewed the ethnographic sources about the northern Coast Salish, and the Tla'amin particularly, searching for information about dogs. The ethnographic information for the Tla'amin specifically was collected in the 1930s and 1970s (Barnett 1935-1936, 1939, 1955; Kennedy and Bouchard 1983). Kennedy and Bouchard (1983) lived with the Tla'amin community for an extended period and recorded several aspects of Tla'amin traditional culture, including their relationship with dogs in the twentieth century.

In addition, our summary is based on interviews conducted between 1995 and 2000 by and with the Tla'amin for their treaty process (identified in the text by the person's initials and the year [1995–2000]). These interviews were not focused on dogs specifically, but details about the use of dogs in the twentieth century are incorporated into them. Refer to Supplementary Table 1 for additional information regarding all interviews (1995–2000 and 2012, 2013).

Archaeological Dog Specimens

The archaeological samples were from both midden contexts and intentional dog burials from settlement sites (Table 1). From the midden and burial contexts, 45 animal bone specimens from various sites were

identified as potential canid (Caldwell 2015) and sampled for ancient DNA analysis. It was not possible based on context to determine if the dog remains from the middens represented food waste, a disturbed burial, or some other deposit type. Of the original 45 specimens, 21 samples were confirmed with ancient DNA analysis to be a species of *Canis* (see below). Two samples, one from Bliss Landing (CFA 33) and one from Klehkwahnnohm (CFA 16), were randomly selected for radiocarbon dating by W. M. Keck Carbon Cycle AMS laboratory to estimate the antiquity of the samples.

Ancient DNA

We used mtDNA to determine which haplotypes were present among Tla'amin archaeological dogs. We recognize the limitations of mtDNA data for determining a unique genetic signature and focus our analysis on situating the Tla'amin data within broader distributions of dog mtDNA haplotypes. These data allow us to make inferences about the movement of dogs across the region, which in turn reflects broader social relations (e.g., trade, kin relations, migrations, etc.).

DNA extraction and analysis were carried out in the dedicated Ancient DNA Laboratory at Simon Fraser University, Canada, following vigorous contamination control measures and procedures (Yang et al. 2004). All ancient DNA extractions from bone samples were undertaken following a modified silica-based spin column method (Yang et al. 1998). Blank extractions and PCR negatives were also included in all lab processes, respectively, to monitor potential contaminations. All samples were decontaminated using a previously established, multi-step approach (Yang et al. 2004, 2008).

Ancient DNA samples were amplified using a two-step approach. First, to identify the taxon of origin, DNA was amplified using previously published universal mammalian primers H1346 and L1269 to target a very short 12S mtDNA fragment (117bp) (Rollo et al. 2002). Following this, any samples identified as canids were amplified using three overlapping, canid-specific primer pairs, adapted from Leonard et al. (2002) (Supplementary Table 2). Together, these three primer pairs were used to assemble a 425bp sequence of the mitochondrial D-loop from three smaller fragments (150bp, 220bp, and 235bp). This sequence was cut down to 198bp to allow for comparison with reference sequences from previous studies (Ames et al. 2015; Barta 2006; Boyko et al. 2009; Castroviejo-Fisher et al. 2011; Klütsch et al. 2011; Koop et al. 2000; Leonard et al. 2002; Losey et al. 2013; Savolainen et al. 2002; Thalmann et al. 2013; van Asch et al. 2013; Vilà et al. 1997).

To ensure the authenticity of ancient DNA data, we performed repeat DNA extractions from the same bone sample, and/or performed repeat PCR amplifications and subsequent DNA sequencing to most of the samples in the study (Supplementary Table 3). Only those bone samples whose DNA sequences could be successfully repeated were taken as authentic DNA data and were used for subsequent ancient DNA analyses. Haplotypes not previously documented in archaeological dog specimens in British Columbia have been submitted to GenBank (accession numbers MT876383–MT876387). For further specifications on ancient DNA methods, see Supplementary Methods 1.

Results

Community Interviews and Ethnographic Documents

Dogs and Worldview

Both the ethnographic record and community interviews speak to the long-term importance of dogs (*čɛnoʔ*) to the Tla'amin. The Dog Children origin story, common to the broader Coast Salish and other coastal peoples, reflects this founda-

tional bond. In this narrative, a woman gives birth to pups who later shed their dog skins and become specialized hunters (Kennedy and Bouchard 1983:12). The special place of hunting dogs is also evident in the fact that trained Tla'amin hunting dogs were given dog-specific ancestral names and were buried at death (Barnett 1955:97; Kennedy and Bouchard 1983:37; Suttles 1974:104; TMM 2012). Furthermore, hunting dogs were not to be yelled at, hit, or killed, because they were believed to have a spirit (HGM 2012). Finally, that dogs were notable among the Tla'amin is reflected in place names such as, *čɛn,* so named because "[a] long time ago the people that used to stay here had many dogs" (Tla'amin First Nation 2002:47).

Types of Dogs

Ethnographic sources indicate that Tla'amin used dogs for both hunting and wool (Barnett 1935-1936, 1939:242). However, unlike their Coast Salish neighbors on Vancouver Island (Barnett 1939:232; Olsen 2010:61) and further south (Allen 1920:469; Gunther 1927:225), the Northern Coast Salish did not maintain wool dogs as a breed distinct from dogs used for hunting (Barnett 1939:232). Instead, it seems that the Tla'amin and other northern Coast Salish used any dog with suitable hair for blanket fiber (Barnett 1939:232, 242) and additional fiber was obtained as needed by trading with other Salish peoples who did keep woolly dogs (Olsen 2010:61). The abundance of highly valued wool from mountain goats in the nearby mountain may account for the lack of emphasis on woolly-dog breeding among the Northern Coast Salish (Barnett 1955:120).

Although not reported to have bred dogs solely for their fiber, the Tla'amin made use of both goat wool and dog wool for their blankets (Barnett 1939:242). One community member's grandmother described woolly dogs this way:

> They were always white. They were about the same size [as hunting dogs], but they were broader dimensions across the base. So they're more stocky and bigger legs, but they were short legs and they just ruled the roost sort of thing in the house. They were more of a lap dog that provided what they needed just by combing him. (TTM 2012)

Barnett (1955:120) noted that both white and brown dog fur was used to make blankets, the latter being used for a border, decoration, or the entire blanket, but white wool, particularly that of mountain goats, was preferred.

While there are no hunting dogs in the Tla'amin community today, they were common and valued up until the recent past by the Northern Coast Salish of northern Vancouver Island and the mainland (Barnett 1939:232; VP 2012/2013). In addition to being used for hunting, these dogs were used to scare off bears and other intruders (VP 2012/2013). Hunting dogs could be of various shapes and sizes, and any dog could be trained to be a hunting dog (ANON 2012). In Chithlethukt Rose Mitchell's family, hunting dogs were medium-sized with short fur, similar in appearance to dingoes, and had pointy ears.

> From her description they were pretty lean and they were probably about 18 inches tall by probably about two feet long and kind of a whippy tail. Just all different colors. They weren't a single breed with the same pattern all the time. They were spotted, they were black, they were white or brown, but not really mixed colors like black, white, and brown. They were either brown, white, or black, or spotted white with black spots. And they were very lean and tight fur, not really long but long enough that it lays down. (TMM 2012)

The wide range of shapes and sizes suggests that breeding and training, not

physical form per se, determined a dog's prowess as a hunter's assistant.

Breeding, Training, and Treatment of Hunting Dogs

The ethnographic evidence suggests that there was some deliberate interbreeding of hunting dogs with wolves to improve a dog's hunting ability. One interviewee remembered that their grandmother had two hunting dogs that were half-wolf and half-dog and offered that most hunting dogs had to be part wolf to make them good hunters (ANON 2012). This is consistent with the broader Coast Salish belief that, "the wolf was the hunter par excellence of all land mammals" (Barnett 1955:93). In general, offspring of any good hunting dog were valued since those puppies would also likely be good hunters (VP 2012/2013).

The association with wolves and dogs not only increased a dog's hunting prowess, but it also strengthened the bond between hunter and dog. Breeding dogs with wolves reinforced the supernatural association between wolves and hunters. According to the Tla'amin belief, "[w]olves were people. They should never be killed... land hunters were reincarnated as wolves" (Barnett 1955:93). One Tla'amin elder further expressed this connection between humans, wolves, and hunting.

> The killer whales, they're man eh? Like when the guy dies here in Sliammon they come [back] as a killer whale. You can talk to 'em, they'll listen to you. You can talk to a timber wolf, they'll listen too. Timber wolf is the same as the killer whale. When there's no fish [black fish will?] hit the beach like a timber wolf running up in the bush, howling away, go and find some deer. Three or four hours after come back hittin' the water. My Grandfather's there watchin', and he goes "shwoo, shwoo" like that.... I don't think we can talk to wolf now, eh? They say they can talk to 'em about, oh, a hundred years ago. But now, I don't think they understand. (BC 2013)

Training was instrumental in developing an efficient hunting dog and in strengthening the bond between the hunter and dog. Hunting dogs were chosen for their ability to run, and what made a good hunting dog was speed, good sight, and a sensitive sense of smell (VP 2012/2013). A new dog was trained by sending it out with an already trained hunting dog (VP 2012/2013). Interviewees recounted that dogs were owned by the man or woman who cared for, trained, and hunted with the dog and, furthermore, that the dog was taught to hunt only for their master (ANON 2012/2013).

To be effective hunting partners for their human counterparts, Tla'amin hunting dogs were trained from the time they were very young. They were trained to know the scent of their prey by attaching a deer hoof to the nose of the young dog (Barnett 1935-1936) or by cutting the dogs' noses and rubbing in a "concoction" (Barnett 1939:232). As Kennedy and Bouchard (1983:37) note, "[a]s soon as it started to walk, the puppy was placed inside a bloody deer's stomach and swung around in the air, while the hunter spoke to it, telling it to run quickly after the deer and always to bring him back bucks that were fat."

The Tla'amin used false hellebore (*Veratrum viride*) root, an important, powerful medicine, on hunting dogs. The effect of false hellebore was the same on dogs and humans: it would increase speed and stamina, allowing them to run all day. Tla'amin soccer players used hellebore root for this reason until the 1970s. For dogs, hellebore would also improve sense of smell, sight, and hearing (VP 2012/2013). Hellebore could be administered to dogs in a variety of ways. According to Kennedy and Bouchard (1983:37), this was done by either pouring a solution of hellebore root and water down a dog's throat (to increase stamina and sense of smell), or by placing a small amount of hellebore in the dog's eyes to improve their vision. Multiple community members also said that hellebore would be placed in a dog's eyes (PLH

1996, JM 1998). Hellebore root could also be filed off and mixed with the dog's food, rubbed into small cuts made in the dog's legs (VP 2012/2013), or put up the dog's nose (JM 1998).

In some families, their hunting dog lived inside the house, while others kept them tied in a shelter, with boughs or a hide on the floor (Kennedy and Bouchard 1983:37; VP 2012/2013; JM 1998). Still others "kennelled" their dogs (Barnett 1939:232), possibly in a hole in a bank, as was the practice elsewhere on the coast (Barnett 1955:96; Suttles 1974:103). In general, dogs were fed the same foods their owners ate (e.g., deer, seal, and fish; VP 2012/2013). However, Chithlethukt Rose Mitchell's grandchildren remember that she would chew food and feed it to her pregnant dog to ensure an easy delivery.

Hunting with Dogs

While most of the interviewees said that Tla'amin dogs were trained only to hunt deer, Barnett (1939:231–232) also mentions that they were used to hunt mountain goat. The most commonly described method for hunting deer involved letting one to three dogs off of the boat at the hunting spot, which was often a small island. After the dogs chased a deer back to the shore, people would kill the deer and then slide the deer onto the boat using a skid made of two logs fastened together. If the dogs chased the deer for more than five minutes, people would let the deer go and call the dog back because the meat would get soft; however, it was reportedly rare that the dogs were unsuccessful in the hunt (JM 1998; Kennedy and Bouchard 1983:37).

Alternatively, dogs were also used to herd deer toward a net stretched between two trees (Kennedy and Bouchard 1983:87), or to drive deer off of a cliff.

> The object was not to catch them [the deer], but just to out-flank them and be able to keep them within a boundary where you could run, you know, just guide them toward this place [where there] was water.... So the people could wait there with their canoes. It was rocky on the bottom, so when they [the deer] come off of there it was sure that they would get killed, and if not you're in your canoe, you can take them out yourself. But they were trained to just be able to help you out-flank, and then told when to start barking and frighten them. (TMM 2012)

By the early to mid-twentieth century, Tla'amin use and training of hunting dogs had declined. One reason for this may be that hunting with unleashed dogs became illegal (AM 1998; BC Wildlife Act [British Columbia 1996] Sections 78, 79). Another was a gradual move away from traditional subsistence strategies as people became successful in local fishery and logging industries (VP 2012/2013). Similarly, while deer was an important staple food in the past, its value as a food has declined in recent years.

Archaeological Dog Specimens

Of the 21 bone fragments identified as belonging to the *Canis* genus based on ancient DNA analysis, two specimens (CFA 10 and CFA 11) were from an intentional burial context (Springer et al. 2014; Table 1). These two fragments represent two different dogs that were placed in an excavated pit and covered with fire-altered rock. They were found in association with the burial of an approximately 35- to 45-year-old woman, whose remains were dated to approximately 1900 years ago (Springer et al. 2014:308). Two of the 21 specimens (CFA 16 and CFA 33) were subjected to AMS dating at W. M. Keck Carbon Cycle AMS laboratory. These samples were dated at 380–486 and 3486–3561 cal yrs BP (1 sigma).

Ancient DNA

Forty-five archaeological samples were collected initially. Of these, 27 were amplified successfully using the previ-

ously described 12S mammalian universal primers (60% success rate). Only 21 of 27 samples were positively identified as domestic dog (*Canis lupus familiaris*), using GenBank BLAST searches and phylogenetic analyses. The remaining six samples do not belong to the *Canis* genus. Their misidentification reflects the difficulty of using morphology to identify heavily fragmentary bones to species level (Yang et al. 2004).

A 425bp D-loop sequence was used to further confirm the species identity of *C. lupus familiaris* and to determine the minimum number of individuals (MNI) present. This 425bp sequence was successfully assembled for 17 of the 21 canid samples. The remaining four samples failed to generate any D-loop sequences, likely due to poor DNA preservation. When the 425bp sequences were compared, 17 Tla'amin canid samples displayed a total of ten different DNA haplotypes (Figure 2). By assessing the number of different 425bp haplotypes in the discrete archaeological contexts, we determined that the 17 archaeological samples represent a MNI of 12 (Table 1). When 425bp sequences were cut down to 198bp to compare with reference DNA sequences from previous studies, eight different haplotypes were identified (Table 1). When this 198bp sequence was aligned with reference sequences and analyzed in phylogenetic trees (Supplementary Methods 1), Tla'amin archaeological dogs were found to be dispersed throughout the highly diverse modern dog/wolf clade A but grouped most closely with domestic dogs (see Barta 2006:89).

Given that mtDNA reflects the female lineage, it is unsurprising that we did not find support for the ethnographic information that wolves were bred with dogs. That is, the broader dog literature suggests that the practice was to let female dogs out over night to mate with wild canids (wolves or coyotes; Allen 1920:450; MacNeish and Teit 1956:88). The successful mating of a wild female with a tame male is generally

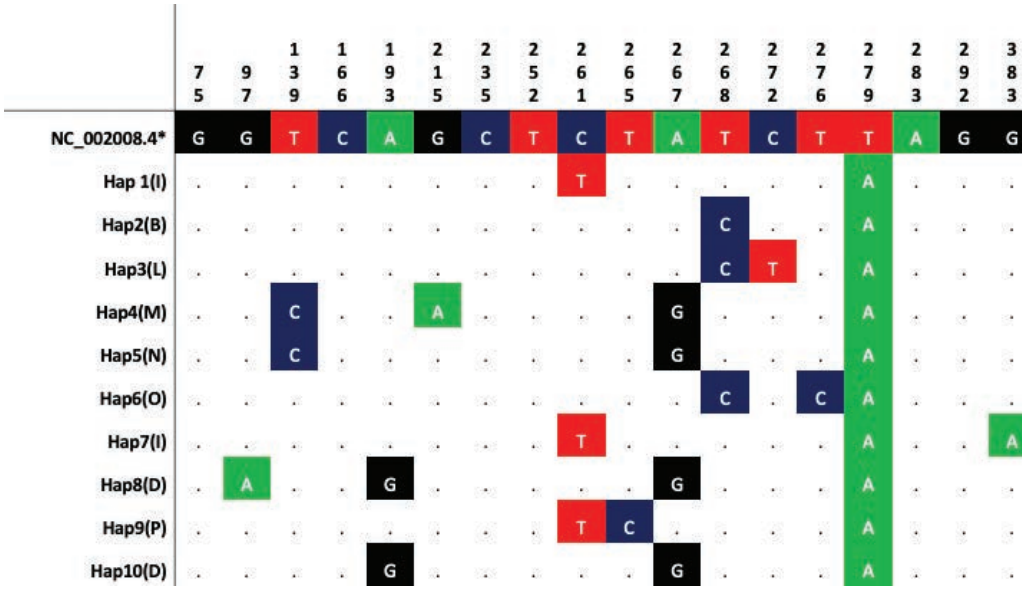

Figure 2. Substitutions documented in 425bp fragment of mtDNA from Tla'amin canids (198bp haplotype shown in brackets) compared to standard *Canis lupus familiaris* GenBank reference sequence beginning at position 15361 (top row; Kim et al. 1998). Numbers across the top refer to positions within the fragment sequenced; haplotypes listed to the left. Note that at position 279 the Tla'amin haplotypes are the same, but differ from the standard reference sequence due to the fact the reference sequence is derived from a modern dog.

thought to be exceedingly rare (Crockford 2006:101). Thus, mating with a male wild canid would only show up in the ancient DNA analysis of dog's Y-chromosome, not in mtDNA. Additionally, in the rare event that a wild female and tame male did mate, the pups would likely remain with the wild female and not in the care of humans. However, wild canid mtDNA has been previously documented in archaeological dogs. Barta (2006) documented a coyote mtDNA signature in three Northwest Coast archaeological dogs, suggesting that back-crossing between female coyotes and male dogs could occur. Similarly, Leonard et al. (2002) propose that the introgression of wolf mtDNA into a domestic dog population is responsible for the genetic uniqueness of the Tahltan dogs' mtDNA haplotypes.

Situating the Phylogeny of Tla'amin Archaeological Dogs Within a Regional Context

Aligning the 198bp Tla'amin canid sequences with reference canid sequences from previous studies allows us to contextualize Tla'amin dogs in relation to canine lineages in British Columbia, North America, and worldwide (Figure 3; Supplementary Table 4). Within British Columbia, Tla'amin dogs share the common Hap D found in all British Columbia sites (with n > 1 *Canis* specimens). This haplotype crosses multiple language and cultural boundaries (Barta 2006), indicating that the lineage has a long history in British Columbia. One of our Hap D samples (CFA 33) was dated to 3486–3561 cal yrs BP, which is the earliest documented occurrence of this haplotype in the southern part of coastal British Columbia.

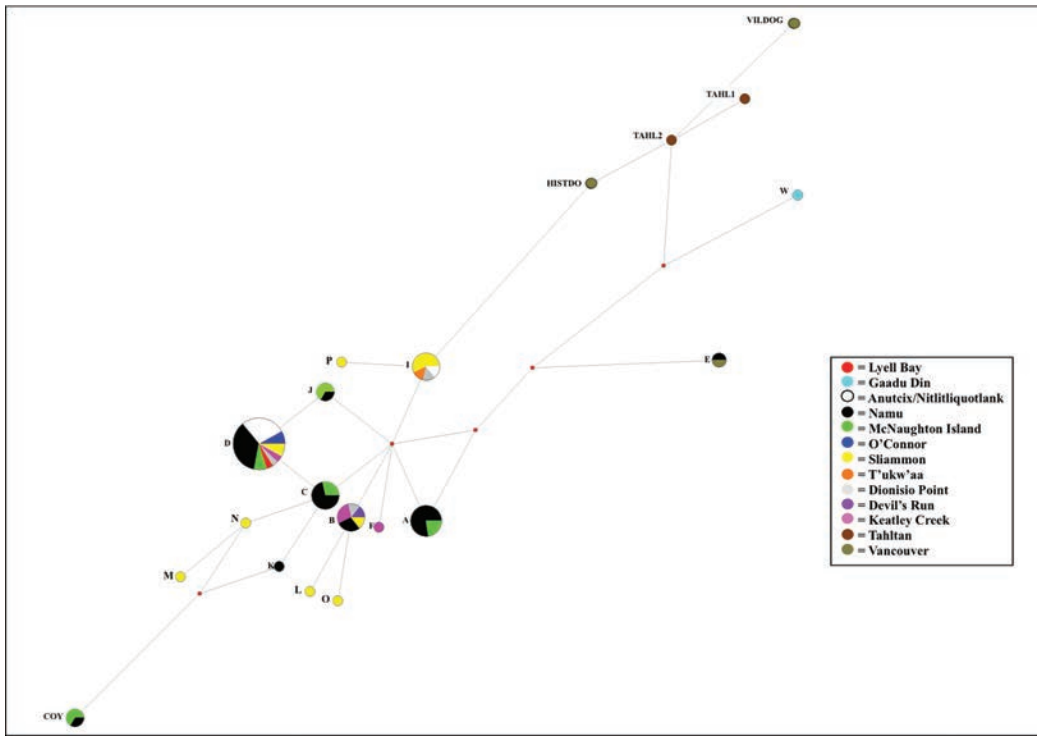

Figure 3. Median joining network showing distribution and genetic relationship of BC archaeological dog haplotypes. Each branch indicates one mutational step (small red dots are hypothetical mutations). Note that Sliammon specific haplotypes (L, M, N, O, and P) are closely related to haplotypes documented across BC (I, B, and C). See online for color version.

Unlike Hap D, Hap I and B have restricted temporal and spatial ranges within British Columbia, possibly reflecting more regionally focused social connections among First Nations of the central coast of British Columbia and the Coast and Interior Salish people. Hap I, common in our samples, is only found in sites younger than 2000 BP and only within the traditional territories of the Coast Salish, Nuxalk, and Nuu-chah-nulth (Barta 2006)—despite it being widespread in the rest of North America by 1300 BP (Ames et al. 2015; Leonard et al. 2002). Hap B is documented at a Northern Wakashan site (Namu) dating to ~4000 years ago and then becomes widely distributed throughout Coast and Interior Salish territory approximately 2000 years ago (Barta 2006; Cail 2011). The single occurrence of Hap B in our sample (Table 1) falls within this same late Holocene time range.

Our results revealed five haplotypes not previously documented in archaeological dog specimens in British Columbia (Hap L, Hap M, Hap N, Hap O, and Hap P; Figure 3). The absence of these haplotypes in British Columbia indicates that these lineages are either rare and/or are found in regions of British Columbia that are, as yet, unsampled. The limited distribution of these haplotypes may suggest a unique breeding history of some of the ancestral Tla'amin dogs.

Not surprisingly, our results ultimately link Tla'amin dogs to ancestry in Eurasia. Hap D has been documented in an archaeological canid from South Baikal, Russia, dated to 6000–7000 years ago (Losey et al. 2013), and in a modern non-breed dog from China (Pang et al. 2009), reflecting their shared Eurasian origin with modern clade A dogs. Furthermore, a GenBank BLAST search of the five dog haplotypes found in this study, but not previously found elsewhere in British Columbia, showed identical matches for Hap N and P, and similarity (with a one base pair difference) for Hap L, M, and O from modern dogs in East Asia.

Discussion

Taken together, the oral traditions, memory accounts, archaeological remains, and ancient DNA complement each other to reveal a several-millennia-old, multidimensional, and intimate relationship among people and dogs. Among the ancestral Tla'amin and other Pacific Northwest Indigenous Peoples, dogs were well-integrated community members whose relationships with people moved fluidly between mundane, ritual, and gendered spheres. The bond between humans and dogs was re-enforced through a myriad of interactions, such as daily tending, intensive training, and hunting excursions, as well as a larger worldview about the importance of both dogs and wolves.

Our combined results reflect the interconnectedness, but also regional distinctiveness, of human-dog relationships across social-spatial scales. Ethnographic evidence suggests that, at least in the twentieth century, the Tla'amin were unique among the Coast Salish in that they did not breed woolly dogs and focused their attentions on hunting dogs. Unfortunately, it may not be possible to evaluate genetically or morphometrically whether this was true in the more distant past, since Tla'amin memories suggest hunting dogs were not restricted to specific sizes or lineages. At a more general level, the five Tla'amin dog haplotypes not found elsewhere in the extant British Columbia record may indeed reflect the long-term distinctiveness of Tla'amin-dog relationships. Similarly, the Tla'amin word for dog (*čɛnɔ*), which differs from other Coast Salish terms, may also indicate a unique relationship, at least in colonial times (Pache et al. 2016).

However unique, Tla'amin-specific relations with dogs were nested within larger interaction spheres that span vast spatial and temporal distances. Within British Columbia, the ancient genetics suggest the possibility the Tla'amin and their dogs participated in social networks with the Nuu-chah-nulth and the Nuxalk; surpris-

Table 1. Attributes of archaeological samples analyzed for ancient DNA.

Site (unit/level/layer)	Lab code	Context	Age	Element (MNI)[1]		425bp Hap	198bp Hap
Klehkwahnnohm DlSd-6 (EU4/2/II)	CFA 16	Midden layer containing partially articulated dog remains	CFA 16: 312–499 cal. BP[2] (uncalibrated ^{14}C age: 1125 +/− 15 BP)	Rib shaft frag.	(MNI 1)	Hap1	Hap I
	CFA 4			3 cranial frags.		Hap1	Hap I
	CFA 5			R. upper canine		Hap1	Hap I
Rasmussen Bay DlSe-26 (EU4/3/I)	CFA 2	Midden	Oldest assoc. arch. deposits: 489–363 cal. BP[3]	R. metatarsal III or IV	(MNI 1)	*Failed*	*Failed*
	CFA 3			R. metatarsal		*Failed*	*Failed*
	CFA 18			Distal R. tibia shaft		Hap7	Hap I
	CFA 19			R. metatarsal II		*Failed*	*Failed*
Grace Harbour EaSe-11 (CS1/2/I)	CFA 1	Midden	Oldest assoc. arch. deposits 950–790 cal. BP[3]	Deciduous R. incisor	(MNI 1)	Hap1	Hap I
EaSe 18 (WF2/Slump)	CFA 6	Midden	730–2834 cal. BP[3]	Juvenile proximal end R. femur	(MNI 2)	Hap2	Hap B
	CFA 7			Partial R. innominate		Hap3	Hap L
Bliss Landing EaSe-2	CFA 38	Midden	CFA 33: 2918–3214 cal. BP[2] (Uncalibrated ^{14}C age: 3595 +/− 20 BP)	Juvenile vertebra frag.	(MNI 3)	Hap1	Hap I
(TP3/20–30cm)	CFA 32			Juvenile vertebra frag.		Hap9	Hap P
(TP3/30–40cm)	CFA 42			Juvenile metapodial frag.		Hap1	Hap I
(TP3/40–50cm)	CFA 41			Juvenile R. scapula, lateral end		Hap1	Hap I
(TP3/130–140cm)	CFA 33			Juvenile L. rib		Hap10	Hap D
Cochrane Bay EaSe-76 (EU17/4/III)	CFA 10	Burial: partially excavated pit with two dogs	Assoc. w/ burial of 35- to 45-year-old woman dating to ~1900 BP[3]	L mandible	(MNI 4)	Hap4	Hap M
	CFA 11			Canine tooth		Hap5	Hap N
(EU17/3/II)	CFA 13	Midden	740–4120 cal. BP[3]	Incisor		Hap5	Hap N
	CFA 45			Canine tooth		*Failed*	*Failed*
(EU2/14)	CFA 15			First lower molar		Hap6	Hap O
(EU14/Wall)	CFA 20			Mandible fragment with molar		Hap8	Hap D

[1] R = Right, L = Left; MNI determined by number of haplotypes and non-repeating elements at each site.
[2] Assuming 90% marine carbon, Delta R 422 +/− 50 (Marine/INTCAL13 calibration curve). Calibrated at 2-sigma using Calib v. 8.2.
[3] Springer et al. 2014

ingly, the extant data do not indicate a similarly close relationship between dogs, the Tla'amin, and the other Coast Salish groups. At even broader temporal and spatial scales, shared worldviews surrounding dogs are indicated by the pan-regional treatment of dogs in ritual and for other uses (e.g., Crellin 1994; Crellin and Heffner 2000; Diaz 2019; Tifental 2016) and the ancient and widespread importance of the Dog Children tradition. Similarly, the haplotypes shared among dogs from throughout British Columbia, North America, and Eurasia also reflect a myriad of complex inter-regional social relations that are age-old and cross-cultural.

Our study highlights the value of combining multiple methods of inquiry to understand the long-term and complex relationships among people and other-than-human beings. In the case of Tla'amin dogs, ancient DNA provided insights into ancient social networks and migration. Adding the archaeological data, our insights become a bit more nuanced by providing information on time depth and how dogs were treated in life and in death. With community knowledge, we go beyond "data" and begin to understand how dogs integrated into the daily lives and belief systems of the Tla'amin. Noticeably missing from our multifaceted approach, however, is a full incorporation of linguistic data. Robust future analyses of dog-people interactions across regions would combine the kinds of data and knowledge presented here with historical linguistics. Another area of study that holds promise for further elucidating past human-dog relationships is stable isotope analysis (e.g., Hillis et al. 2020). Future directions for research should also build on our genetic data by incorporating whole genome sequencing and calculating population diversity indexes.

Today, European dog lineages have replaced most of the ancient North American dog lineages (Ní Leathlobhair et al. 2018). Similarly, among the Tla'amin, hunting dogs are no longer maintained as a distinct type of dog with a specific purpose. Dogs, however, still play a central role in Tla'amin identity and connection to their heritage and the memory of hunting dogs is strong among some community members. Although their role has changed, dogs continue to be a strong presence in the Tla'amin village today, often greeting you as you walk through the community.

Acknowledgments

First and foremost, we are grateful to the Tla'amin community, for hosting, teaching, and befriending us, and for graciously sharing knowledge of their heritage. We are particularly grateful to the six interview respondents for recounting their knowledge about Tla'amin hunting dogs. Michelle Washington, formerly of the Sliammon Treaty Society and one of the co-directors of the SFU-Tla'amin research project, conceptualized this study of Tla'amin dogs. In this study and in all aspects of the larger research project, Michelle guided our exploration of Tla'amin heritage. Thanks also to Sosan Blaney, who served as a community mentor for the 2012 Tla'amin-SFU-USASK field school; Nyra Chalmer, who was the teaching assistant for the 2011 Tla'amin-SFU field school; Antonia Rodrigues for her guidance and training in the aDNA lab at SFU; and to Liz Hammond-Kaarremaa, Gene Hunn, and Cecil Brown for their discussions about dog names. The Tla'amin-SFU-USask archaeology and ethnohistory field school was financially and logistically supported by the Department of Archaeology at Simon Fraser University and the History Department at University of Saskatchewan. This research was supported by various Social Sciences and Humanities Research Council grants awarded to Dana Lepofsky, Dongya Yang, and Kasia Anza-Burgess.

References Cited

Allen, G. M. 1920. Dogs of the American Aborigines: With Twelve Plates. *Harvard University Museum of Comparative Zoology Bulletin* 63:431–517.

Ameen, C., T. R. Feuerborn, S. K. Brown, A. Linderholm, A. Hulme-Beaman, O. Lebrasseur, M. H. S. Sinding, Z. T. Lounsberry, A. T. Lin, M. Appelt, et al. 2019. Specialized Sledge Dogs Accompanied Inuit Dispersal across the North American Arctic. *Proceedings of the Royal Society B: Biological Sciences* 286. DOI:10.1098/rspb.2019.1929.

Ames, K., M. Richards, C. Speller, D. Yang, R. Lyman, and V. Butler. 2015. Stable Isotope and Ancient DNA Analysis of Dog Remains from Cathlapotle (45CL1), A Contact-Era Site on the Lower Columbia River. *Journal of Archaeological Science* 57:268–282. DOI:10.1016/j.jas.2015.02.038.

Amoss, P. 1984. A Little More than Kin, and Less than Kind: The Ambiguous Northwest Coast Dog. In *The Tsimshian and Their Neighbors of the North Pacific Coast*, edited by J. Miller and C. M. Eastman, pp. 292–305. University of Washington Press, Seattle and London.

Arcas Consulting Archeologists. 1999. Archaeological Investigations at Tsawwassen, BC, Volume IV. Interpretation. Report on File (Permit 1989-41), British Columbia Archaeology Branch, Victoria.

Barnett, H. 1935-1936. Original unpublished notebooks from research on the Sliammon Coast Salish. Manuscript on file, Library Special Collections Division, University of British Columbia, Vancouver.

Barnett. H. 1939. Culture Element Distributions: IX Gulf of Georgia Salish. *Anthropological Records* 1:221–295.

Barnett, H. 1955. *The Coast Salish of British Columbia*. University of Oregon, Eugene, OR.

Barsh, R., J. M. Jones, and W. Suttles. 2006. History, Ethnography, and Archaeology of the Coast Salish Woolly-Dog. In *Dogs and People in Social, Working, Economic, or Symbolic Interaction, 9th ICAZ Conference*, edited by L. Snyder and E. Moore, pp. 1–11. Oxbow Books, Oxford.

Barta, J. 2006. Addressing Issues of Domestication and Cultural Continuity on the Northwest Coast Using Ancient DNA and Dogs. Unpublished Doctoral Dissertation, Department of Anthropology, McMaster University, Hamilton, ON.

Boyko, A., R. Boyko, C. Boyko, H. Parker, M. Castelhano, L. Corey, J. Degenhardt, A. Auton, M. Hedimbi, R. Kityo, E. Ostrander, J. Schoenebeck, R. Todhunter, P. Jones, and C. Bustamante. 2009. Complex Population Structure in African Village Dogs and its Implications for Inferring Dog Domestication History. *Proceedings of the National Academy of Sciences of the United States of America* 106:13903–13908.

British Columbia. 1996. Wildlife Act. In *Revised Statutes of British Columbia,* Chapter 488. Queen's Printer, Victoria, BC.

Brown, S., C. Darwent, and B. Sacks. 2013. Ancient DNA Evidence for Genetic Continuity in Arctic Dogs. *Journal of Archaeological Science* 40:1279–1288.

Cail, H. 2011. Feasting on Fido: Cultural Implications of Eating Dogs at Bridge River. Unpublished Master's Thesis, Department of Anthropology, University of Montana, Missoula.

Caldwell, M. E. 2015. Northern Coast Salish Marine Resource Management. Unpublished Doctoral Dissertation, Department of Anthropology, University of Alberta, Edmonton, AB.

Cannon, A., H. Schwarcz, and M. Knyf. 1999. Marine-based Subsistence Trends and the Stable Isotope Analysis of Dog Bones from Namu, British Columbia. *Journal of Archaeological Science* 26:399–407.

Castroviejo-Fisher, S., P. Skoglund, R. Valadez, C. Vilà, and J. Leonard. 2011. Vanishing Native American Dog Lineages. *BMC Evolutionary Biology* 11:73.

Crellin, D. 1994. Is There a Dog in the House: The Cultural Significance of Prehistoric Domesticated Dogs in the Mid Fraser River Region of British Columbia. Unpublished Master's Thesis, Department of Archaeology, Simon Fraser University, Burnaby, BC.

Crellin, D., and T. Heffner. 2000. The Cultural Importance of Domestic Dogs in Prehistoric Keatley Creek Society. In *The Ancient Past of Keatley Creek, Volume II: Socioeconomy*, edited by B. Hayden, pp.151–164. Archaeology Press of Simon Fraser University, Burnaby, BC.

Crockford. S. 1997. *Osteometry of Makah and Coast Salish Dogs*. Archaeology Press of Simon Fraser University, Burnaby, BC.

Crockford, S. 2006. *Rhythms of Life: Thyroid Hormone and the Origin of Species*. Trafford Publishing, Victoria, BC.

Crockford, S., and C. Pye. 1997. Forensic Reconstruction of Prehistoric Dogs from the Northwest Coast. *Canadian Journal of Archaeology* 21:149–153.

Cybulski, J. 1992. *A Greenville Burial Ground: Human Remains and Mortuary Elements in British Columbia Coast Prehistory*. Archaeological Survey of Canada Mercury Series Paper No. 146. Canadian Museum of Civilization, Hull, QC.

Diaz, A. L. 2019. Resource Relationships Along the Fraser River: A Stable Isotope Analysis of Archaeological Foodways and Paleoecological Interactions. Unpublished Doctoral Dissertation, Department of Anthropology, University of British Columbia, Vancouver, BC.

Hayden, B., and J. Spafford. 1993. The Keatley Creek Site and Corporate Group Archaeology. *BC Studies* 99:106–139.

Hillis, D., I. McKechnie, E. Guiry, D. E. St. Claire, and C. T. Darimont. 2020. Ancient Dog Diets on the Pacific Northwest Coast: Zooarchaeological and Stable Isotope Modelling Evidence from Tseshaht Territory and Beyond. *Scientific Reports* 10:15630. DOI:10.1038/s41598-020-71574-x.

Gunther, E. 1927. *Klallam Ethnography*. University of Washington Publications in Anthropology 1:173–313. University of Washington Press, Seattle.

Kennedy, D., and R. Bouchard. 1983. *Sliammon Life, Sliammon Lands*. Talonbooks, Vancouver, BC.

Kennedy, D., and R. Bouchard. 1990. Northern Coast Salish. In *Handbook of North American Indians, Vol. 7: Northwest Coast*, edited by W. Suttles, pp. 441–452. Smithsonian Institution Press, Washington.

Kim, K. S., S. E. Lee, H. W. Jeong, and J. H. Ha. 1998. The Complete Nucleotide Sequence of the Domestic Dog (*Canis Familiaris*) Mitochondrial Genome. *Molecular Phylogenetics and Evolution* 10:210–220. https://doi.org/10.1006/mpev.1998.0513.

Klütsch, C., E. Seppälä, T. Fall, M. Uhlén, A. Hedhammar, H. Lohi, and P. Savolainen. 2011. Regional Occurrence, High Frequency but Low Diversity of Mitochondrial DNA Haplogroup d1 Suggests a Recent Dog-Wolf Hybridization in Scandinavia. *Animal Genetics* 42:100–103.

Koop B., M. Burbidge, A. Byun, U. Rink, and S. Crockford. 2000. Ancient DNA Evidence of a Separate Origin for North American Indigenous Dogs. In *Dogs Through Time: An Archaeological Perspective, BAR International Series 889*, edited by S. Crockford, pp. 271–286. Archaeopress, Oxford.

Lamb, W. K. 1960. *The Letters and Journals of Simon Fraser 1806-1808*. Macmillan Company of Canada, Toronto, ON.

Leonard, J., R. Wayne, J. Wheeler, R. Valadez, S. Guillén, and C. Vilà. 2002. Ancient DNA Evidence for Old World Origin of New World Dogs. *Science* 298:1613–1616.

Lord, J. K. 1866. *The Naturalist in Vancouver Island and British Columbia*. R. Bentley, London.

Losey, R., S. Garvie-Lok, J. Leonard, M. Katzenberg, M. Germonpré, T. Nomokonova, M. Sablin, O. Goriunova, N. Berdnikova, and N. Savel'ev. 2013. Burying Dogs in Ancient Cis-Baikal, Siberia: Temporal Trends and Relationships with Human Diet and Subsistence Practices. *PLoS ONE* 8:e63740. DOI: 10.1371/journal.pone.0063740.

Mackie, Q. 2019. Coast Salish "Woolly Dogs," ca. 1946 [web page]. URL: https://qmackie.com/2019/01/03/coast-salish-woolly-dogs-ca-1946/. Accessed on November 18, 2020.

MacNeish, J., and J. Teit. 1956. Canadian Anthropology Society Field Notes on the Tahltan and Kaska Indians: 1912-1915. *Anthropologica* 3:39–171.

McKechnie, I., M. L. Moss, and S. J. Crockford. 2020. Domestic Dogs and Wild Canids on the Northwest Coast of North America: Animal Husbandry in a Region without Agriculture? *Journal of Anthropological Archaeology* 60:101209. DOI:https://doi.org/10.1016/j.jaa.2020.101209.

Ní Leathlobhair, M., A. Perri, E. Irving-Pease, K. Witt, A. Linderholm, J. Haile, O. Lebrasseur, C. Ameen, J. Blick, A. Boyko, et al.

2018. The Evolutionary History of Dogs in the Americas. *Science* 361:81–85. DOI:10.1126/science.aao4776.

Olsen, S. 2010. *Working With Wool: A Coast Salish Legacy and the Cowichan Sweater*. Sono Nis Press, Winlaw, BC.

Pache, M., S. Wichmann, and M. Zhivlov. 2016. Words for 'Dog' as a Diagnostic of Language Contact in the Americas. In *Language Contact and Change in the Americas: Studies in Honour of Marianne Mithun*, edited by A. Berez-Kroeker, D. Hintz, and C. Jany. pp. 385–410. John Benjamins Publishing Company, Amsterdam/Philadelphia.

Pang, J.-F., C. Kluetsch, X.-J. Zou, A.-B. Zhang, L.-Y. Luo, H. Angleby, A. Ardalan, C. Ekström, A. Sköllermo, J. Lundeberg, S. Matsumura, T. Leitner, Y.-P. Zhang, and P. Savolainen. 2009. mtDNA Data Indicate a Single Origin for Dogs South of Yangtze River, Less Than 16,300 Years Ago, from Numerous Wolves. *Molecular Biology and Evolution* 26:2849–2864.

Perri, A., C. Widga, D. Lawler, T. Martin, T. Loebel, K. Farnsworth, L. Kohn, and B. Buenger. 2019. New Evidence of the Earliest Domestic Dogs in the Americas. *American Antiquity* 84:68–87. DOI:10.1101/343574.

Pierotti, R., and B. R. Fogg. 2017. *The First Domestication*. Yale University Press. DOI: 10.2307/j.ctt1wc7rbm.

Rollo, F., M. Ubaldi, L. Ermini, and I. Marota. 2002. Ötzi's Last Meals: DNA Analysis of the Intestinal Content of the Neolithic Glacier Mummy from the Alps. *PNAS* 99(20):12594–12599.

Savolainen, P., Y.-P. Zhang, J. Luo, J. Lundeberg, and T. Leitner. 2002. Genetic Evidence for an East Asian Origin of Domestic Dogs. *Science* 298:1610–1613.

Schulting, R. 1994. The Hair of the Dog: The Identification of a Coast Salish Dog-hair Blanket from Yale, British Columbia. *Canadian Journal of Archaeology* 18:57–76.

SFU Archaeology and Tla'amin First Nation. 2012. Tla'amin Archaeology [web page]. URL:https://www.sliammonfirstnation.com/archaeology/. Accessed on November 18, 2020.

Shipman, P. 2015. *The Invaders: How Humans and Their Dogs Drove Neanderthals to Extinction*. Harvard University Press, Cambridge.

Snyder, L. M., and E. A. Moore, eds. 2006. *Dogs and People in Social, Working, Economic or Symbolic Interaction*. Oxbow Books, Oxford.

Springer, C., M. Caldwell, N. Chalmer, J. Jackley, and D. Lepofsky. 2014. Final Report on Archaeological Investigations (2009-0132) by the Simon Fraser University–Tla'amin First Nation Archaeology and Heritage Stewardship Project, Powell River Regional District, British Columbia. Report on File (Permit 2009-0132), British Columbia Archaeology Branch, Victoria.

Suttles, W. 1974. *The Economic Life of the Coast Salish of Haro and Rosario Straits*. Garland Publishing, New York, NY.

Teit, J. 1906. *The Jesup North Pacific Expedition: Memoir of the American Museum of Natural History, Volume II, Part V, The Lillooet Indians*. E.J. Brill, Leiden.

Teit, J. 1909. *The Jesup North Pacific Expedition: Memoirs of the American Museum of Natural History: Volume II, Part VII, The Shuswap*. E.J. Brill, Leiden.

Thalmann, O., B. Shapiro, P. Cui, V. Schuenemann, S. Sawyer, D. Greenfield, M. Germonpré, M. Sablin, F. López-Giráldez, X. Domingo-Roura, et al. 2013. Complete Mitochondrial Genomes of Ancient Canids Suggest a European Origin of Domestic Dogs. *Science* 342:871–874. DOI:10.1126/science.1243650.

Tifental, E. 2016. The Bridge River Dogs: Interpreting aDNA and Stable Isotope Analysis Collected from Dog Remains. Unpublished Master's Thesis. Department of Anthropology, University of Montana, Missoula.

Tla'amin First Nation. 2002. Place Name Number 47. In *Sliammon Place Name Index*, pp. 47.

van Asch, B., A.-B. Zhang, M. Oskarsson, C. Klütsch, A. Amorim, and P. Savolainen. 2013. Pre-Columbian Origins of Native American Dog Breeds, with Only Limited Replacement by European Dogs, Confirmed by mtDNA Analysis. *Proceedings of the Royal Society B*. 280:21031142.

Vilà, C., P. Savolainen, J. Maldonado, I. Amorim, J. Rice, R. Honeycutt, K. Crandall, J. Lundeburg, and R. Wayne. 1997. Multiple and Ancient Origins of the Domestic Dog. *Science* 276:1687–1689.

Welch, J., D. Lepofsky, M. Caldwell, G. Combes, and C. Rust. 2011. Treasure Bearers: Personal Foundations for Effective Leadership in Northern Coast Salish Heritage Stewardship. *Heritage and Society* 4:83–114.

Witt, K., K. Judd, A. Kitchen, C. Grier, T. Kohler, S. Ortman, B. Kemp, and R. Malhi. 2015. DNA Analysis of Ancient Dogs of the Americas: Identifying Possible Founding Haplotypes and Reconstructing Population Histories. *Journal of Human Evolution* 79:105–118. DOI:10.1016/j.jhevol.2014.10.012.

Yang, D., A. Cannon, and S. Saunders. 2004. DNA Species Identification of Archaeological Salmon Bone from the Pacific Northwest Coast of North America. *Journal of Archaeological Science* 31:619–631.

Yang, D., B. Eng, J. Waye, J. Dudar, and S. Saunders. 1998. Improved DNA Extraction from Ancient Bones Using Silica-Based Spin Columns. *American Journal of Physical Anthropology* 105:539–543. DOI:10.1002/(SICI)1096-8644(199804)105:4<539::AID-AJPA10>3.0.CO;2-1.

Yang, D., L. Liu, X. Chen, and C. Speller. 2008. Wild or Domesticated: DNA Analysis of Ancient Water Buffalo Remains from North China. *Journal of Archaeological Science* 35:2778–2785.