

Indigenous knowledge and species assessment for the Alexander Archipelago wolf: successes, challenges, and lessons learned

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Abstract

The United States Fish and Wildlife Service in Alaska, USA, conducted a species status assessment for a petition to list the Alexander Archipelago wolf (*Canis lupus ligoni*) under the Endangered Species Act in 2020-2022. This federal undertaking could not be adequately prepared without including the knowledge of Indigenous People who have a deep cultural connection with the subspecies. Our objective is to communicate the authoritative expertise and voice of the Indigenous People who partnered on the project by demonstrating how their knowledge contributed to the species status assessment. The Indigenous knowledge applied in the assessment is the cultural and intellectual property of those who have shared it. We employed rapid appraisal research to expeditiously develop a preliminary and qualitative understanding of Indigenous People's cultural and ecological knowledge of Alexander Archipelago wolves. We used semi-directed interviewing and inductive coding

Italics highlight names, words, and phrases presented in Indigenous languages.

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from grounded theory for text analysis. Indigenous knowledge contributed to the agency's understanding of the Alexander Archipelago wolf in Southeast Alaska and helped the agency with their classification decision. Indigenous research partners explained the rich cultural significance and position of wolves in Tlingit society and described human–wolf relationships and ecological interactions. The agency used a single-species assessment approach based in species ecology and conservation biology, whereas the Indigenous wolf experts applied a multi-species, community ecology approach based in a sociocultural context of balance and respect. The Indigenous wolf experts successfully addressed knowledge gaps identified by the agency. The partners were challenged by a short regulatory timeframe that did not allow for comprehensive study of Indigenous knowledge and constrained review and feedback by Indigenous experts. The United States Fish and Wildlife Service learned that its assessment framework was not designed to account for an Indigenous worldview. To level the playing field, the agency and Indigenous experts should discuss how to co-develop an assessment framework that equitably applies both perspectives.

KEYWORDS

applied social science, cultural context, Endangered Species Act, existencescape, human–wolf relations, Southeast Alaska, Tlingit, traditional ecological knowledge

“Our knowledge is ancient and continuous. Wolves are cherished just like a person. Our relations with wolves are local and intimate. Acknowledgement and respect for our knowledge is a key part of the regulatory process. The incorporation of our knowledge in the determination is a significant step. A concern of ours is that the law separates and alienates us from our surroundings and relationships with all of our natural resources which include the Wolves.”

—Mr. Michael *Kauish* Jackson, *Kaach.ádi* Clan Kake, Alaska, USA

The United States Fish and Wildlife Service (USFWS) in Alaska, USA, has prepared a species status assessment (SSA) in response to a petition to list the Alexander Archipelago wolf (*Canis lupus ligoni*) under the Endangered Species Act (Wolf et al. 2020, Federal Register 2023, USFWS 2023). During the initial stages of the SSA, the USFWS noted that Indigenous knowledge was not represented in the previous 2 assessments for the subspecies. The regional decision makers and their advisors understood the value that Indigenous knowledge could contribute to the SSA and invested time and funds to conduct a study to document Indigenous knowledge. According to executive directive and guidance, “Indigenous knowledge is a valid form of evidence for inclusion in federal policy, research, and decision making” (Prabhakar and Mallory 2022:4), and federal agencies should recognize and apply Indigenous knowledge along with scientific inquiry in natural resources management (Lander and Mallory 2021). These federal directives guided the agency's decision to

recognize and apply Indigenous knowledge in this assessment of the subspecies. The agency included results of the Indigenous knowledge study in the draft and final SSA reports via extensive citations and an appendix containing the full study report (Brooks et al. 2022, USFWS 2023).

This article draws from Brooks et al. (2022) and includes publicly available information documented therein. Although there is overlap, this paper includes new objectives and content that differ from Brooks et al. (2022). The purpose of this article is to communicate the authoritative expertise and voice of the Indigenous Peoples who partnered on the project by demonstrating how their cultural and ecological knowledges were approached and applied. Our objectives are to illustrate the cultural and ecological context of Indigenous knowledge; describe how Indigenous knowledge experts contributed facts included in the SSA; and share successes, challenges, lessons learned, and recommendations moving forward. The Indigenous knowledge presented herein is the cultural heritage and intellectual property of the Indigenous knowledge holders, their ancestors, and descendants. They have made a generous and valuable contribution to this work that clearly demonstrates their deep connections to the Alexander Archipelago wolf. From hereto forward, we capitalize Wolf (*Gooch*) when referring to the nonhuman being Wolf and the Wolf People to acknowledge and highlight Tlingit–Wolf relations.

JUSTIFICATION AND PRECEDENT

The Indigenous Peoples of Southeast Alaska have ancient, and continuously evolving, sociocultural and socioecological relationships with wolves, extending at least back to the time of the mammoths. These relationships are not frozen in time, and the Indigenous Peoples living in the region continue to apply their own cultural and ecological models of coexistence with wolves and other species in their homelands (Langdon 2019, Brooks et al. 2022). The listing petition and the SSA have a direct and important connection to the Indigenous cultures and subsistence ways of life in Southeast Alaska. Indigenous Peoples and wolves living there depend on the same lands and waters and many of the same food sources, and they have ancient and close relationships embedded in Tlingit society through the Wolf moiety, clan, and house social structure (Monteith 1998, Hope 2009, Langdon 2020a, Brooks et al. 2022, Smythe 2022). These multigenerational relationships and experiences with Wolf qualify local Indigenous cultural experts, hunters, and trappers as expert observers and contributors to the SSA (Reo 2011, Peacock et al. 2020).

There is extensive precedent for the application of Indigenous knowledge in natural resources and wildlife and fisheries science and management. Examples from the literature include a synthesis of collaborative research using Indigenous ecological knowledge and Western science in marine environments (Thornton and Maciejewski Scheer 2012). Indigenous knowledge has been studied and applied in a number of cases, including to reestablish traditional Tlingit harvest of glaucous-winged gull (*Larus glaucescens*) eggs in Glacier Bay National Park, Alaska (Hunn et al. 2005, National Park Service 2021); understand annual variability in the abundance of Arctic cisco (*Coregonus autumnalis*) in the Colville River, Alaska (Murphy et al. 2007); and accurately estimate stock abundance and document seasonal movement patterns and behaviors for bowhead whales (*Balaena mysticetus*) in the Beaufort and Chukchi seas (Albert 2001, Quakenbush and Huntington 2010, Huntington et al. 2021). In Hawaii, USA, Indigenous knowledge has been applied to conservation plans for endangered monk seals (*Monachus schauinslandi*), focusing on Native Hawaiians' sociocultural values (Kittinger et al. 2012). In Canada, Indigenous knowledge has been applied to understand and compare habitat suitability models for endangered woodland caribou (*Rangifer tarandus*; Polfus et al. 2014), extend historical baselines of size and abundance for yelloweye rockfish (*Sebastes ruberrimus*; Ekert et al. 2018), and predict the abundance of culturally significant western redcedar trees (*Thuja plicata*; Benner et al. 2021). Federal resource management agencies published guidance for applying Indigenous knowledge in decision making processes (Rinkevich 2011, Kendall et al. 2017, National Oceanic and Atmospheric Administration 2019, Advisory Council on Historic Preservation 2021). In a small number of cases, wildlife professionals have included Indigenous knowledge in frameworks used to develop wildlife status assessments (MacCracken et al. 2017, Peacock et al. 2020, Singer et al. 2023, USFWS 2023).

The USFWS is required to incorporate the best available information about a species in the SSA (USFWS 2016). In this case, appropriate information included, among others, wolf health and abundance, wolf territories and

distribution within its ecological setting, reproductive behaviors, social organization, and current and future habitat conditions and prey needs (USFWS 2016, Brooks et al. 2022). But Alexander Archipelago wolves are cryptic, and Western scientific knowledge about them is incomplete. Western science has illuminated certain aspects of the subspecies' biology and status, but there is still much to learn, especially in remote regions of the subspecies' range. Local Indigenous stewards of wildlife "hold knowledge that contributes to understanding local ecology that scientists who only travel to communities periodically and for short periods may lack" (Peacock et al. 2020:250). The Tlingit and other Indigenous groups in Southeast Alaska, who live every day with wolves on the land and hunt, trap, and gather the same foods in the same places as wolves, know much about the ecological and biophysical information needed for the SSA. Every analyst, project manager, scientist, and decision maker involved with this listing process has something to learn from those who have coexisted with Wolf in this place for millennia.

INDIGENOUS KNOWLEDGE AND CULTURE

It is not correct to decontextualize or compartmentalize Indigenous knowledge in Western science and wildlife management. Extracting Indigenous knowledge from its cultural background to integrate it with Western scientific frameworks and criteria dismisses its meaning and shifts the authority and power of the knowledge from Indigenous Peoples to Western science and wildlife management regimes (Nadasdy 1999, Mazzocchi 2008). To mitigate the risk of decontextualization, we informed decision makers at the outset about the rich sociocultural context and historical origins of Indigenous knowledge of Wolf for Tlingit society, way of life, and cultural practice (Brooks et al. 2022). The interim report appended to the SSA was purposely designed to demonstrate the rich cultural context that exists as an interconnected part of the Indigenous ecological knowledge applied by the federal agency to the SSA (Brooks et al. 2022). When the Indigenous partners shared their knowledge of Wolf, they were sharing the importance of their cultural and historical connections to Wolf at the same time because the 2 are inextricably linked.

Culture is the general term covering all aspects of the way of life practiced by a human society in which members share understandings that enable the group to live collectively. Because Indigenous cultures have been ontologically and epistemologically separated from Western science and natural resources management (Nadasdy 1999, Mazzocchi 2008, Muller et al. 2019, Hickey 2020), we provide 3 definitions from Indigenous scholars. "Culture is a system of ideas, [values, relationships], and beliefs displayed in peoples' creations and activities, which over time, comes to characterize the people who share in the system;" "cultural context is the cultural setting, [place], or situation in which an idea, custom, or skill was created and performed;" and Indigenous knowledge is "the unified knowledge system that originates from and is characteristic of a particular society and its culture" (Alaska Native Knowledge Network 2000:25-27).

Indigenous knowledge, also called traditional ecological knowledge (TEK), corresponds to Indigenous ways of knowing, or Indigenous science, which is a sophisticated and place-based knowledge system used by an Indigenous People to interpret how the natural world works in their homelands (Cajete 2020). "Traditional environmental knowledge is no less sophisticated in its empirical foundations than 'Western' science, and it is dynamic, open to innovations, borrowed from neighbors, or co-opted from colonial practice. However, this knowledge is owned by local peoples, expressed in their Native languages, and applied in the practices of their daily lives, which makes such traditional knowledge Indigenous" (Hunn and Meilleur 2010:351). We use the term traditional ecological knowledge while acknowledging there are Western cultural biases and political dimensions tied to the English words, traditional, ecological, and knowledge (Nadasdy 1999). For many Indigenous communities, TEK is more than a knowledge system; it is a way of life that embodies the entirety of this knowledge, and it can provide valuable insights into the depth of relationships human beings can establish with their environments (Nadasdy 1999, Mazzocchi 2008, Ramos 2021). For example, Ramos (2021) contextualized Yurok TEK to demonstrate the value of Indigenous science and research methodologies in wildlife management and conservation. Yurok research partners

in northern California, USA, defined their TEK as a system in which the Yurok strive to create balance through physical and spiritual management in tandem (Ramos 2021). To properly understand the value and utility of TEK, non-Indigenous researchers and managers must accept the existential relationships and exchanges, both personal and spiritual, between Indigenous Peoples and wildlife to be real and valid for contributing to Western science and guiding sustainable wildlife management (Hammond and Judy 1996, Redmond 1996, Lewis and Sheppard 2005, Nadasdy 2007, Hickey 2020).

Wildlife professionals must recognize the nature and importance of Indigenous belief systems and languages in understanding and applying TEK to Western science and wildlife management (Booth and Jacobs 1990, Reo 2011, Ferguson and Weaselboy 2020, Ramos 2021). For example, in the Yurok language, the concept of TEK is encompassed in the English statement, "to take care of the Earth" (Ramos 2021:18). Indigenous stewards of wildlife hold to the central tenets of caring (i.e., an ethos of care); reciprocal responsibilities; and an interconnected network of sacred relationships based on respect, balance, and kinship (Booth and Jacobs 1990, Salmón 2000, Thornton and Kitka 2010, Langdon 2019, Muller et al. 2019). There exists a need to understand Indigenous knowledge and wildlife management as parts of culture, life, and relationships (Brooks et al. 2015). We therefore included sociocultural information about Wolf and Tlingit society throughout the article to place Indigenous knowledge in the proper context.

STUDY AREA

Biophysical

We conducted this study February through August 2022 in Southeast Alaska, which is an officially named region of the state also known as the Alaska Panhandle. Southeast Alaska consists of the mainland from Cape Yakataga in the north to Dixon Entrance in the south, including the islands of the Alexander Archipelago (Audubon Alaska 2016; Figure 1). It has a land area of 91,010 km² (U.S. Census Bureau 2020). The Tongass National Forest covers about 80% of the land base (Kruger 2005). The region is physically diverse with >29,000 km of coastline (about 20% of the coastline of the United States; Audubon Alaska 2016), temperate rainforests of Western hemlock (*Tsuga heterophyll*) and Sitka spruce (*Picea sitchensis*), mountains, glacial fjords, rivers, estuaries, and thousands of islands. The Alexander Archipelago has about 5,000 islands, over 1,000 of which are named on maps. Thornton (2012) documented over 145 islands in Southeast Alaska named by Indigenous Peoples in their languages.

The Coast Mountains form the eastern border of Southeast Alaska and have peaks that rise to 1,524–2,743 m; British Columbia, Canada is to the east (Figure 1). On the mainland west of Glacier Bay, is the Fairweather Range, the tallest coastal mountains in the world; Mount Fairweather rises from sea level to 4,572 m in the span of 19 km; the topography of Southeast Alaska includes several categories: mountain summits (43%), mountain slopes, (32%), lowlands (10%), valleys (8%), hills (5%), and coasts (2%; Audubon Alaska 2016:9-10). Air and sea temperatures in Southeast Alaska are influenced by the Alaska Current, a marine eddy off the North Pacific Drift that maintains moderate temperatures during the year. The climate is relatively warm in the winter and cool in the summer compared to northern regions of the state. Temperatures can be below freezing for extended periods, particularly in the northern mainland region; average annual precipitation is highly variable and ranges from 70 cm to 1,200 cm; and annual snowfall averaged 1.3 m during the past 30 years but varied considerably between high and low elevations (Audubon Alaska 2016:14-22).

The Alexander Archipelago is a center of endemism with a high diversity of mammals, birds, and fishes (Audubon 2016). Alexander Archipelago wolves, a subspecies of the gray wolf, occur in much of this forested coastal region except on the islands of Admiralty, Baranof, and Chichagof (Audubon 2016; Figure 1). The wolves occupy many land cover types, including beaches, mudflats, forests, muskegs, and mountains, and consume many prey species, including salmon (*Oncorhynchus* spp.), beavers (*Castor canadensis*), ungulates, and marine mammals; competitors include bears and humans (Audubon 2016, Brooks et al. 2022).

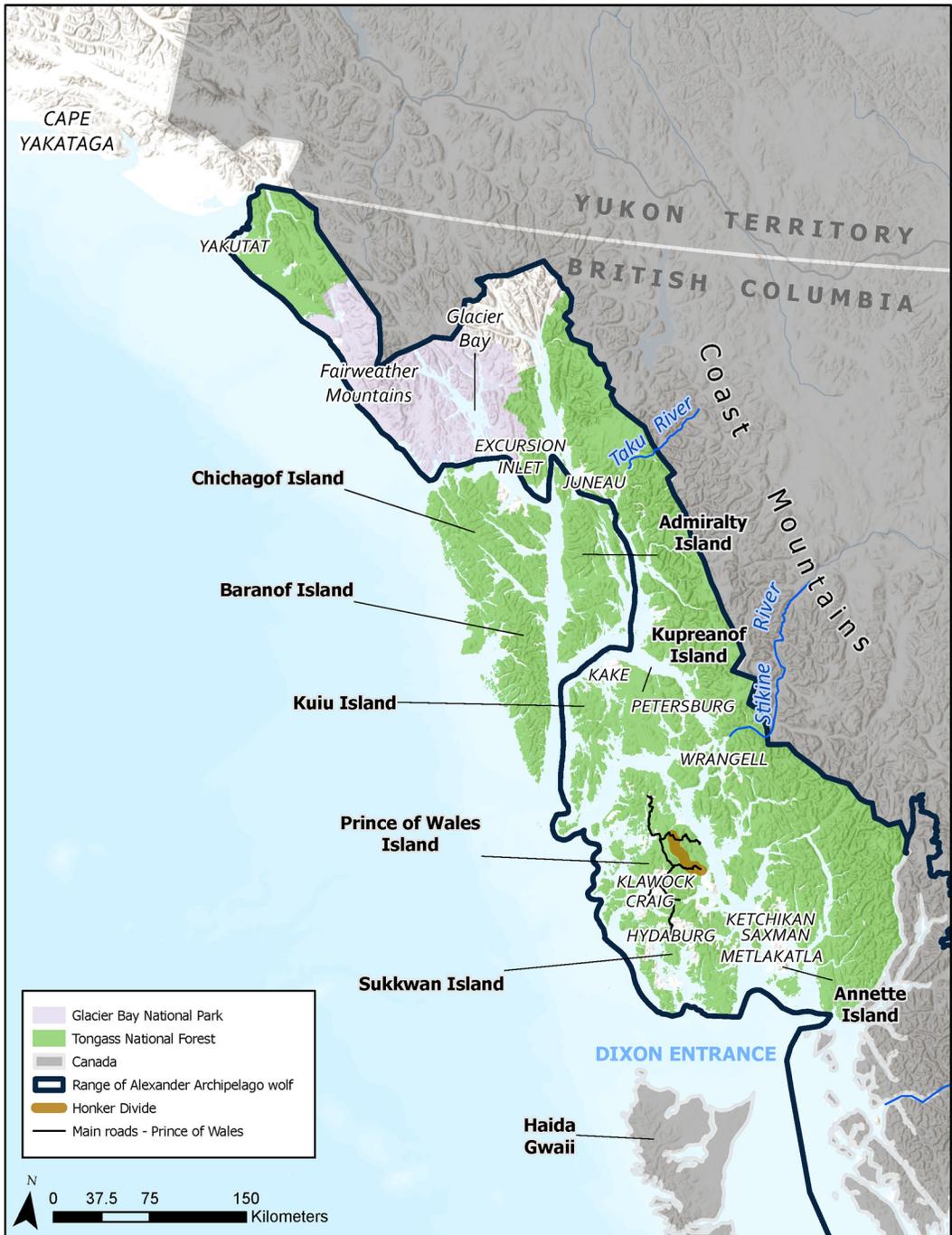


FIGURE 1 Southeast Alaska, USA, showing the range of the Alexander Archipelago wolf, human communities, islands, and other places and features referenced in the text for the Indigenous knowledge study, 2022–2023. Source: United States Fish and Wildlife Service on 2 June 2023.

Sociocultural

A diversity of people, estimated at >71,000, live in about 33 communities in Southeast Alaska; only 3 communities are connected by roads to other parts of the mainland, and most people travel in and out of the region by airplane and boat (Kruger 2005, U.S. Census Bureau 2023). Primary land uses include subsistence hunting, fishing, and gathering; tourism, visitor, and recreation services; commercial fishing; and forestry (Kruger 2005).

Archeological evidence of stone tools indicates humans arrived in the region 11,000 years ago at a time of deglaciation and substantial coastal changes (Moss et al. 2016). Human remains from Prince of Wales Island have been dated to 9,800 before present (Dixon 1999:118). There are 3 Indigenous groups in Southeast Alaska: Tlingit, Haida, and Tsimshian. The Tlingit and Haida were the Indigenous occupants in the region when European explorers arrived in the late eighteenth century. Archeological and linguistic evidence suggest that groups of Tlingit have been in the region for $\geq 6,000$ years (Langdon 2020a). The Haida emigrated to the southern part of the Prince of Wales Archipelago from Haida Gwaii in several waves approximately 100–150 years prior to European appearance (Blackman 1990). Tsimshian Peoples lived on the mainland of northern British Columbia before European contact. In the nineteenth century, Tsimshian groups moved to an island near the mouth of the Skeena River before relocating to Alaska in 1887 (Brock 2004, American Museum of Natural History 2021). Tsimshian Peoples in Alaska today live on Annette Island near Dixon Entrance on the Metlakatla Indian Reserve, established by the United States Government in 1915.

Although they are not linguistically related and display distinct cultural identities, the 3 Indigenous groups in Southeast Alaska share matrilineal descent, corporate kin groups, key ontological assumptions about human existence, and central ceremonial forms and rituals (Langdon 2020a). This brief synopsis is based on Tlingit society as they have been the predominant Indigenous group in Southeast Alaska since prior to European contact. We introduce the interrelated concepts of existencescape, social organization, and ceremony to wildlife professionals to demonstrate the significance of Wolf in Tlingit culture and society. Complete descriptions are beyond our purpose; for details see Brooks et al. (2022).

Existencescape

An existencescape comprises the realm of possible understandings, behaviors, and creative responses given a set of cosmological and ontological principles (Langdon 2019). These are expressed in the values, beliefs, and thoughts of a cultural group, allowing the group to share orientations to their existence in the world, including the deeply ingrained habits, skills, and dispositions people have due to their life experiences and positions in society (Bourdieu 1977). In the temperate rainforest of their homeland, the Tlingit create an existencescape premised on shared similarities of being with and relating to other living entities such as Wolf (Langdon 2019, 2020b). To the Tlingit, Wolf is a being, a form equivalent in essence to a person, including an invisible spirit that is found in all beings. A key element of all persons, both human and nonhuman, is the spirit that has the capacity to live, die, and be reborn, a process termed cosmological cycling (Fienup-Riordan 1983). Tlingit recognize all entities in their world are interdependent, which demands appropriate relations and behaviors by all and for each other to sustain existence through cosmological cycling (Langdon 2019, 2020b).

Tlingit existencescape is based on core beliefs expressed in oral traditions, ancient charters, and covenants about their origins and early history. These narratives explain natural and social phenomena and may involve supernatural beings or events. Through the Raven cycle of narratives passed down through the generations, Tlingit acquire understandings of the nature of existence: processes, interactions, time, and space. Similar to Yup'ik oral instruction practices (Fienup-Riordan 2017) and Klwane First Nation hunters' accounts (Nadasdy 2007), Tlingit learn the living forms in the world around them are persons essentially like themselves in that they are perceptive, sentient, attentive, volitional, and desirous of respect (Thornton and Kitka 2010, Langdon 2019). Tlingit are taught that people must be observant, attentive, open to new knowledge, and respectful. Tlingit learn that through respectful relations with other beings and ritual actions, they can fulfill moral obligations in the charters and covenants to sustain their existence. This orientation to life gives meaning and purpose to all action (Langdon 2020b).

Social organization

Social organization comprises the kinship structure that establishes identity and relationships among people, patterns of marriage, leadership principles, and ceremonial practices necessary to reproduce society. Everyday social life is organized by membership and engagement at multiple levels. The first principle is matrilineal descent. Every person born in Tlingit society takes on a primary identity from their mother. That identity operates at multiple levels. The first level is the dual division known as moiety; there are 2 sides or opposites, Ravens on one side and Wolves or Eagles on the other. The Wolf moiety is referred to as the Eagle moiety in northern Southeast Alaska. In each moiety, there are numerous clans that are named, corporate transgenerational entities whose members share an identity. Tlingit houses were named and recognized residential and economic units of Tlingit clans. A person is then at birth a member of moiety, clan, and house and would normally marry someone from the opposite moiety to create relationships between clans characterized by ceremonial reciprocity (Langdon 2020a; Table 1).

Ceremony and sacred objects displaying Wolf

The *ku.éex'* (i.e., potlatch) is a pivotal ritual in the cosmological cycling of the human life, as it frees the spirit of the person honored on the occasion to be reborn and return to the realm of the living to be reunited with kin. The hosts invite their opposite relatives to give recognition, thanks, and gifts to reinforce bonds and establish new leaders. At the beginning of the *ku.éex'*, is the period of grieving at which time clan leaders of the opposite moiety approach the host clan who are positioned facing members of the opposite moiety wearing their appropriate regalia (Figure 2). Members of the opposite clan walk up and approach the hosts carrying their *at.óow*, typically crest blankets. *At.óow* are sacred and revered property belonging to a clan (White and White 2000, Smythe 2022). The opposites may provide a short account, or oratory, of the *at.óow* tradition and speak of how the crest, in this case Wolf, will protect, aid, comfort, and support the opposites in their difficult time of grief (Dauenhauer and Dauenhauer 1984).

Gooch (Wolf) serves as a fundamental symbol and emblem of group history and identity for clans that have Wolf as a crest and for members of the Wolf moiety (Smythe 2022). Wolves appear many times in the foundational *at.óow* accounts of these clans (Brooks et al. 2022). *At.óow* is a Tlingit compound word that translates to owned thing and refers to an original acquisition, purchase, or sacrifice by a clan ancestor at some point in the clan's history. *At.óow* is a significant cultural concept in Tlingit religious practice and exemplifies 2 main features of Tlingit oral tradition: ownership and reciprocity (Dauenhauer and Dauenhauer 1984, 1990). Clan crests, such as Wolf, embody the supernatural entities depicted on *at.óow*, and crests are living beings whose spirits reside in *at.óow* (Smythe 2022). Hats, tunics, and blankets typically have symbols or images of Wolf (Figure 2) associated with the events, locations, and spirits that were collectively owned by the matrilineal Wolf clan or house and that memorialized specific *at.óow* (Dauenhauer and Dauenhauer 1990). The associated objects, songs, and dances created to memorialize the event of acquisition are handed down and placed on display or performed by subsequent generations (Thornton et al. 2019).

METHODS

Planning

The impetus for examining Indigenous knowledge was a petition to list the Alexander Archipelago wolf as threatened or endangered under the Endangered Species Act (Wolf et al. 2020). The USFWS has conducted 2 previous status reviews in response to listing petitions for the subspecies; the agency determined the Alexander Archipelago wolf was not warranted for listing in both instances (Federal Register 1997, 2016). Neither review

TABLE 1 Indigenous research partners and knowledge holders interviewed for the species status assessment for the Alexander Archipelago wolf, Southeast Alaska, USA, 2022-2023, including information on demographics, family, and wolf hunting or trapping experience.

Name	Community or area	Age	Moiety	Clan	House	Wolf trapper	Wolf hunter	Biography
Judith Daxootsú Ramos	Yakutat	64	Raven	<i>K̄waashk'i Kwáan</i>	Owl	No	No	Ms. Judith Ramos was born and raised in Yakutat where she spent most of her life. She is a respected cultural expert and like her mother, Mrs. Elaine Abraham, is Raven. She is the granddaughter of Mr. Olaf Abraham of the <i>Teikweidi</i> clan.
Devlin Shaagaw Éesh Anderstrom	Yakutat	26	Raven	<i>K̄waashk'i Kwáan</i>	Moon	No	No	Mr. Anderstrom has lived in Yakutat during his life and continuously since 2013. He has extensive hunting experience for moose with his father but not for wolves. He carries the name and spirit of his great-great grandfather as foretold in a dream to a clan member prior to his birth.
Thomas <i>K̄aachkutí</i> Mills	Excursion Inlet	78	Raven	<i>T'ákdaintaan</i>	Head	Yes	Yes	Mr. Mills is a Tlingit elder and longtime resident of Excursion Inlet/Icy Strait on the mainland. He has lived a Native way of life and attended boarding school in Hoonah starting at age nine. Mr. Mills is a veteran, serving 6 years in the Vietnam War. He trapped wolves with his father when he was young. He has been inside wolf and bear dens, and he once raised a wolf pup as a family pet and pack animal.
Michael Kauish Jackson	Kake	72	Raven	<i>K̄aach.dáí</i>	Not identified	Yes	Yes	Mr. Michael Jackson grew up in Kake. He trapped wolves with his father in his youth. The traditional ecological knowledge and cultural knowledge he shared about Wolf pertains to the Kupreanof and Kuiu islands. He is a Tlingit elder and cultural expert.
Scott Gus'tú Jackson	Kake	45	Wolf	<i>Was'eeneidí</i>	Not identified	Yes	Yes	Mr. Scott Jackson is an expert wolf trapper who has lived in Kake for most of his life except when he went to college. He communicates closely with local wolf biologists and works with other local experts to enhance deer abundance.

(Continues)

TABLE 1 (Continued)

Name	Community or area	Age	Moiety	Clan	House	Wolf trapper	Wolf hunter	Biography
Jon Yaanasgit Rowan	Klawock	59	Wolf	<i>Shangukeidi</i>	Wolf Gooch	Yes	Yes	Mr. Rowan is a retired cultural education teacher at the Klawock School District. He has lived in Klawock for most of his life except during military service. He is a respected cultural expert, experienced wood carver, and has hunted and trapped wolves. He started trapping later in life and was mentored by Mr. Thomas George.
Thomas George	Klawock	68	Raven	<i>L'eneidi</i>	Dog Salmon	Yes	Yes	Mr. George is a Tlingit elder who has lived in Klawock his entire life. His Tlingit name means "Before the Raven Rises." He is an expert wolf hunter and trapper, requiring different methods and skills. He began trapping at age 9. His Father is Mr. Robert William George, Sr. from the Wolf Clan.
Michael Gitwaayne Douville	Craig	74	Raven (Crow)	<i>Deisheetaan</i>	Not identified	Yes	No	Mr. Douville is a Tlingit elder and resident of Craig in the central part of the archipelago. He is an expert on wolves and has been hunting deer and trapping wolves on the land since age 15. He started hunting deer with his mentor, Mr. Bud Thomas, and he was taught how to trap by Mr. Claude Hanson and Mr. Lester Nelson. When he started to trap, there was a federal bounty on wolves.
Tony Sanderson	Hydaburg	61	Eagle	<i>Sgajuuuga.ahl</i>	Not identified	Yes	No	Mr. Sanderson participated as a traditional knowledge holder in Hydaburg. He is Eagle and has spent his life in Hydaburg. He grew up trapping and works with state biologists and the Hydaburg Cooperative Association on wolf population estimates using mark-recapture.



FIGURE 2 *Kaagwaantaan* clan members present Wolf crest regalia to Raven hosts at *ku.éex'* while providing condolences and support; referenced in the Indigenous knowledge study for the Alexander Archipelago wolf in Southeast Alaska, USA, 2022–2023. Source: Brooks et al. (2022).

included a formal assessment of TEK, and the agency does not currently provide explicit direction for the application of TEK in its SSA framework (USFWS 2016). The USFWS has been directed to recognize and include Indigenous knowledge in decision making (Lander and Mallory 2021), and it has access to national and regional guidance documents published by federal agencies (Rinkevich et al. 2011, Ball et al. 2015, Ramos et al. 2016, Prabhakar and Mallory 2022).

To determine whether the subspecies was warranted for listing, the USFWS assessed its current and future viability based on the best available Indigenous and Western scientific understandings (USFWS 2023). The USFWS Ecological Services Program determined early on that including Indigenous knowledge in the SSA for the Alexander Archipelago wolf was imperative for making a well-supported decision (Markegard et al. 2023). The White House directive to elevate TEK in federal decisions helped ensure this was a priority (Lander and Mallory 2021, Prabhakar and Mallory 2022). The USFWS team concurrently considered how to identify the important gaps in the agency's knowledge for the Alexander Archipelago wolf and build relationships with the Indigenous communities that live and interact with wolves. The first part was relatively straightforward, but the second was more daunting given the time constraints and limited relationships between the Ecological Services Program and Tribes in Southeast Alaska. The agency team identified several primary gaps in its knowledge, including 1) movements of wolves and connectivity, 2) habitat use by wolves, 3) population dynamics of wolves and their prey (i.e., abundance, trends, age, sex ratios), 4) human effects on wolves and prey (e.g., timber harvest, road development, wolf harvest, climate change), and 5) gaps in geographic coverage of existing data (i.e., there are data for Prince of Wales Island but substantially less information for other parts of Southeast Alaska).

The USFWS is subjected to deadlines imposed by the Endangered Species Act that are beyond its control and had <1 year to finalize the SSA, which was not adequate for developing trust and building relationships, let alone completing a comprehensive TEK study. The team initiated formal government-to-government consultation with

Tribes to hear their counsel and open a dialogue, approaching the work as the beginning of a long-term relationship that it could continue to develop and maintain in perpetuity. To achieve the immediate objectives of the SSA to consider all available information and meet the legal timeline under the Endangered Species Act, the agency needed to locate partners who were trusted by Indigenous communities and who had experience designing and conducting ethnographic studies on TEK in rural Alaska.

Fortuitously, members of the agency's assessment team had been invited by the Prince of Wales Tribal Conservation District to join its quarterly meeting to discuss the listing petition and the potential for a wolf TEK study. The District's environmental planner was critical for identifying appropriate people with whom to partner. He recommended the agency reach out to S. J. Langdon, a well-known and respected anthropologist in Southeast Alaska. The Alaska Native affairs specialist for the USFWS recommended they contact J. J. Brooks, a federal social scientist also trained in conservation biology to assist with the TEK research and reporting. Then, USFWS contacted Sealaska Heritage Institute in Juneau, Alaska to identify C. Smythe, senior ethnologist, to administer the research. The Institute is an Alaska Native nonprofit founded in 1980 to perpetuate and enhance Indigenous cultures in Southeast Alaska. It promotes cultural diversity and cross-cultural understanding through public services, events, and scientific and policy research (Sealaska Heritage Institute 2016).

After an initial briefing, the USFWS, Ecological Services Program procured a cooperative agreement to fund Sealaska Heritage Institute to design and conduct a TEK study to communicate and contribute Indigenous knowledge, information, and facts for use in the SSA. The primary goals for the TEK study were to understand Tlingit culture and TEK related to the Alexander Archipelago wolf and address gaps in the agency's knowledge. Early in the process, S. J. Langdon consulted with 4 local Indigenous experts for guidance about the study. The co-principle investigators (S. J. Langdon and J. J. Brooks) worked closely with the USFWS team to understand the knowledge gaps listed above and design interview questions to learn about the gaps, including Indigenous experiences with Wolf, cultural connections to Wolf, ecological and biological characteristics and behaviors of wolves, and practices and motivations for wolf harvest (Brooks et al. 2022:134-138).

Tribal consultation

The USFWS initially sent Dear Interested Party letters to all local Tribes in January 2022 to announce the initiation of the SSA before they requested and arranged for a government-to-government consultation on 2 March 2022. We applied insights shared by Tribal leaders during this consultation to support the design of the TEK study. Tribal consultation is a policy mandate and essential first step in the SSA process (Brooks 2022, Brooks et al. 2022:133). Seven Tribal leaders, representatives, and staff were in attendance. A Tribal leader in the region opened the dialogue: "Thank you for including Tribal leaders, because nobody usually comes to us about what we know about our areas. We do see healthy wolf populations on the ground. We hear them. The only thing we see adversely affected is when we try to use science to explain what's going on, but I believe in science. I've seen the cycle of these wolves over 65 years, and I believe they have the right to live, but we know for a fact they are healthy around us. Thank you for including us Tribal leaders. We do have local knowledge, and it's time the agency starts listening to us. This has been on my mind for a long time, and I'm trying to be respectful. I just want to share my experience" (Brooks et al. 2022:128).

The Tribes raised a concern that there was not enough time allowed for the TEK study to be properly accomplished, which caused frustration. They asked for several more consultations during the process. A second Tribal leader spoke: "I want to remind the USFWS it's March, and the assessment is roughly half over at the end of the month, and there has been little consultation with Tribes at this point... Government-to-government consultations are very important and should be at the forefront before the draft status assessment is put out in July 2022" (Brooks et al. 2022:129).

Most of the discussion focused on the need to provide adequate subsistence harvest of black-tailed deer (*Odocoileus hemionus sitkensis*; the Alexander Archipelago wolf's primary prey) and other ungulates (e.g., moose [*Alces alces*]) for communities in the region. A chairman for a Tribal council said, "It's important to echo our reliance

on deer and moose populations” (Brooks et al. 2022:129). Experienced hunters and trappers explained when wolf numbers are too high on the islands, deer numbers decrease dramatically, and there is inadequate subsistence harvest to fill freezers. Tribal participants implicated the harvest of old growth forest in a decrease in deer abundance and recounted a story about traveling to Juneau to buy meat during the COVID-19 pandemic when local stores were empty and there were no deer to harvest.

Tribal leaders expressed the need for government wildlife managers to obtain better wolf population estimates so biologists in Alaska could set proper quotas for wolf hunting and trapping. Residents practice a subsistence way of life and harvest deer for cultural reasons and food security. The local trappers said they need to remove enough wolves to ensure adequate subsistence harvest of deer. It was unanimous that the wolves in Southeast Alaska are healthy and abundant. There was frustration with outsiders, who had never been to their homelands, trying to make decisions for them. An expert on wolves in the region later interviewed for this study explained, “Outsiders do not know what is going on in our place, they are trying to make local decisions, and that is not right. Wolves adversely affect deer harvest success. Deer are in decline in past years; Alaska Department of Fish and Game reports also indicate that. The geography we have will support a lot of deer, but we need to keep predators in check, so it's devastating to deer, it's from high predation. You also need to stop harvest of old growth forest to have a place for deer to overwinter” (Brooks et al. 2022:130).

The agency arranged for a second government-to-government consultation on 1 August 2022 focused on the draft TEK report. Participation was low, however, most likely because of timing conflicts with summer fishing activities. Two community leaders from Alaska Native corporations participated in the consultation. The regional director for USFWS in Alaska was on the call with 11 staff members. The co-principle investigators presented a summary of the TEK study findings for the Alexander Archipelago wolf. Afterwards, the Alaska Native leaders and the agency engaged in an open discussion about the potential for co-stewardship and collaborative research to obtain improved estimates of wolf abundance (Brooks et al. 2022:115, 120-121).

Indigenous research partners

Nine Indigenous experts on wolves and Tlingit culture partnered with us in this study (Table 1). We selected Indigenous experts using a combination of purposive and peer referral sampling (Bernard 2006, Jacobs and Brooks 2011). We contacted people who were highly knowledgeable about wolves based on their years of experience trapping and hunting wolves or because they knew about the position and significance of Wolf in Tlingit society. Initial contacts referred the team to other experts to be considered for the study. They sought local experts who could speak about places in the subspecies' range, including the areas of Yakutat ($n = 2$), Excursion Inlet ($n = 1$), Kake (Kupreanof and Kuiu islands; $n = 2$), Klawock and Craig (Prince of Wales Archipelago; $n = 3$), and Hydaburg ($n = 1$; Figure 1; Table 1).

One co-author (S. J. Langdon) interviewed 1 woman and 8 men ages 25 to 77 during spring 2022. Four of these individuals are elders, but they were not specifically asked about this particular status. Seven of the interviewees had trapped wolves during their lives, and 5 of these trappers had hunted wolves (Table 1). All interviewees identified as Indigenous and have long family histories in Southeast Alaska. Several individuals are cultural experts and are recognized by the rest of the society as highly knowledgeable about their culture, and they are qualified to share their culture with others (Alaska Native Knowledge Network 2000, Rhapsody Project 2023). The interviewees are co-authors of the TEK report and this article, which would not have been possible to produce without their intellectual contributions.

Social scientific methods

To meet the 12-month timeline for the SSA phase, we developed a hybrid research approach that combined principles and methods from 3 well-established and compatible techniques in social science. These included rapid

appraisal, qualitative interviewing, and grounded theory (Glaser 1992, Beebe 1995, Huntington 1998, Bernard 2006, Jacobs and Brooks 2011). Rapid appraisal is used to expeditiously develop an initial, preliminary, and qualitative understanding of a situation such as Indigenous People's knowledge of wolves and how it may contribute factual information for a wildlife status assessment (Carruthers and Chambers 1981, Beebe 1995). Semi-directed interviewing works well for documenting Indigenous knowledge because it is flexible, allowing for questions to be directed toward topics of interest while capturing important contextual knowledge not directly targeted. This approach to interviewing creates opportunities for conversational dialogue in the form of qualitative texts that contain Indigenous knowledge and reflect the Indigenous traditions of oral history, storytelling, and oral transmission (Dauenhauer and Dauenhauer 1984, Huntington 1998). "Grounded theory is an approach to social science that is used to uncover concepts and categories, not to test hypotheses or replicate theory (Glaser 1992). Analysts who use grounded theory describe and conceptually organize textual data based on their properties and dimensions to discover patterns and generate an understanding of a current situation" (Jacobs and Brooks 2011:94-95).

We combined these approaches to construct personal history narratives with recognized cultural experts and longtime wolf trappers and hunters (Table 1; Brooks et al. 2015, 2022). While asking questions, the interviewer encouraged open-ended conversations about interviewees' experiences with wolves on the land and in the context of their culture to learn about wolf biology and ecology, including hunting behaviors and prey, characteristics and movements, and interactions with humans to address gaps in Western knowledge. The interviewer asked cultural experts about sociocultural connections to wolves and how Wolf is used and displayed in names, clan crests, ceremonies, sacred *at.óow*, and *ku.éex'* (Brooks et al. 2022:134). Some personal narratives about Wolf contained cultural and ecological information, and others contained 1 type or the other. Some partners provided extensive geographic information about wolf distribution, range, and locations of specific wolf packs. We mapped these locations when adequate geographical and place name data were shared (Brooks et al. 2022:65).

The interviewer made audio recordings transcribed verbatim, resulting in 10 hours of dialog. We proofed the transcripts, corrected them for English and Tlingit languages, and minimally edited proofed transcripts for clarity, spelling, and grammar. We provided each Indigenous knowledge holder an informed consent form to read and sign beforehand, which the interviewer also signed (Brooks et al. 2022:140). We compensated each Indigenous research partner with an honorarium, and all interviewees agreed to be identified by name. We provided each knowledge holder an opportunity to review their transcripts, the SSA report, and the TEK report appended to the SSA. Where time and preference allowed, we asked a smaller subgroup of the 9 interviewees to provide feedback on the manuscript, which we mailed to each co-author. To avoid additional burden on the interviewees, we did not require thorough reviews with written comments as a criterion for co-authorship.

We applied inductive coding from grounded theory to organize the interview texts, identify Indigenous knowledge that addressed gaps in the agency's knowledge, and categorize emergent knowledge that illustrated relationships between Tlingit and Wolf (Bernard 2006, Jacobs and Brooks 2011). The co-principle investigators carefully listened to the recordings while reading through the transcripts. During a second read, we used the comment function in Microsoft Word® (Microsoft, Redmond, WA, USA) to apply coding labels to selected sections of text. During the process, we frequently discussed the contents of each transcript, considering how we were applying labels until we reached consensus agreement. There was little to no variability between coders that was not resolved through discussion. The coding labels were short descriptive words and phrases that summarized selected text and reflected gaps in the agency's knowledge. Many of the labels corresponded to the interview questions, as these were designed to learn information about wolves that the agency did not have. Examples of labels included two types of wolves used to indicate knowledge about the occurrence, differences, and interactions between coastal wolves and larger interior wolves; wolf health used to identify Indigenous observations of body condition or maladies; and hunting behaviors, diet, and movement patterns used to identify predatory and travel behaviors. Beneath the labeled codes, we used the comment function in Microsoft Word® to write memos containing summary observations and assessments of how Indigenous knowledge could contribute to the SSA and

wolf management. We conducted within-interview and within-area analyses because TEK is closely tied to specific ecosystems, relationships, and places in the landscape where individual Indigenous knowledge holders have lived and gained extensive experience through being on the land and engaging in their cultures (Hickey 2020, Brooks et al. 2022).

RESULTS AND DISCUSSION

The Indigenous partners shared the importance and position of Wolf in Tlingit culture and substantial information about wolf behaviors, traits, and habitats documented in Brooks et al. (2022). The wolf experts contributed knowledge that addressed questions about gaps in Western knowledge and some emergent and unsolicited narratives about their experiences with Wolf. Several interviewees reported over 50 years of active engagement with wolves (Table 1). Brooks et al. (2022) presented comprehensive syntheses of the knowledge holders' insights with analysts' commentary where appropriate, including analytical categories, narrative characterization, and extensive direct quotations to support categories. For this article, we discuss findings and insights about the cultural significance of Wolf; the Tlingit concept of time in relation to ancestors and ceremony; the Tlingit concept of balance, which merges culture, ecology, and ceremony (Figure 3); and where and how TEK was applied in the SSA report.

Tlingit relations with *Gooch Kwáani*: the Wolf People

For the Tlingit of Southeast Alaska, the meaning of Wolf goes beyond a subspecies of interest for biological conservation. They have an actively vibrant relationship with Wolf. Mr. Devlin Anderstrom from Yakutat shared an ancient and deep cultural connection to Wolf. He articulated that Tlingit and Wolf are similar beings with profound connections. "We have a lot of respect for them, because we think about them as another type of people. I was just having this conversation with somebody the other day about what the difference is between a real Tlingit worldview and then the modern worldview, and one of the things is that in school, we go there, and we learned that humans are animals, we're part of the animal kingdom and for us, when we talk about things in Tlingit, like every type of species, we call it the people, so the wolf species, that's *Gooch Kwáani*, the Wolf People. So, to us, it's the other way around. We see everything else as being people too, especially the wolves because they're so similar to us. The Wolf People have this symbiotic relationship with Ravens like we do. I think that's actually where that moiety comes from."

Mr. Mike Douville from Craig shared an Indigenous view of wolves based in a deep respect for the hunting prowess and skills of Wolf that contrasts with the majority Western European ethos of wolves, which is based in hatred, fear, violence, and cruelty (St. Germain 1999). The interviewer asked, "In terms of the wolf kills that are not consumed, leading to hatred of wolves in the Western ethos—wolves labelled cruel or unrestrained, do you have any thoughts on that?" Mr. Douville: "I don't have any hatred for them. They're really probably the best at what they do. I mean they're really good at it. I think the hate comes from competing for food, tempts the Wolf, and they're so much better at hunting than any human. They are absolutely the peak deer predator. So they can get deer where you can't, and it frustrates a lot of people, and they've developed this hatred for them. But they're just good at what they do. They have a good nose; they have good ears; they can move fast; if they get after a deer, it doesn't stand a chance; they will get it. You can hunt in a place where you can hardly even get a deer, and Wolf will be fat, seriously, fat as Deer! I can show you pictures of a St. John wolf from a year before that is fat as Deer, and no one's hunting there because they can't get any deer, but there's enough deer to keep Wolf fat." Wolf is a nonhuman person with perhaps the same temptations that people may have to misuse his ability as a great hunter. Wolf is not cruel but may take more deer than he apparently needs because he has this ability. That is a profound understanding based in

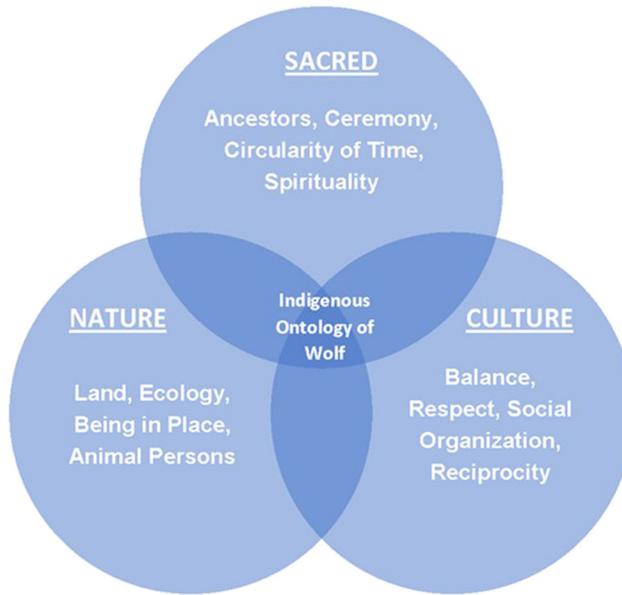


FIGURE 3 Tlingit existencescape demonstrated in the overlap of sacred, natural, and cultural dimensions, revealing an Indigenous ontology and model of Wolf, adapted from Mazzocchi (2008), Thornton and Kitka (2010), Csaki (2016), Hatfield et al. (2018), Cooper (2019), Langdon (2019, 2020b), Brooks et al. (2022), and referenced in the Indigenous knowledge study for the Alexander Archipelago wolf in Southeast Alaska, USA, 2022–2023.

an Indigenous worldview, Tlingit existencescape, and extensive observations and experiences on the land with wolves in their ecological setting.

Mr. Michael Jackson from Kake further demonstrates Tlingit existencescape in a description of how hunters engage with the animals they harvest. The Tlingit do not simply kill animals. There is a deep and respectful relationship ritualized in specific actions directed towards animals by the hunter. Mr. Jackson shared, “They didn’t just go out to kill Wolf. If they saw a wolf, they just didn’t kill it. They had to get ready, and they had a ritual to do, and when they killed it, there was a ritual to put it to rest. It wasn’t just going out to get the wolves to say, ‘ha, I’m a sports hunter,’ and put it on the wall. No, even today, when my son goes hunting, I told him right from the beginning, and he was wondering why I put water in the mouth or go down and drink water out of the stream and come back and share it with Deer or Wolf, Mink, Otter, same as Seal. You can put saltwater in your mouth and not swallow it and go over and share it with the animal for its last drink. That’s part of the ritual, laying to rest and closing the eyes.”

The Tlingit relationship with Wolf and other animal persons has elements of sacredness, respect, and thankfulness. Mr. Jackson explains what hunters do before and after killing an animal as a ritualized demonstration of respect. Mr. Devlin Anderstrom from Yakutat explained why he is never fearful about being approached or threatened by wolves when he has made a moose kill. He practices what his Grandmother taught him when he is out on the land. The interviewer asked, “Now, have you ever heard a story or had the experience of wolves closing in on you after you’ve made a moose kill?” Mr. Anderstrom responded, “I’ve never had them really come up to me like that. I’ve heard some interesting stories about that. I’ve never had that happen or really even had that as a worry or a fear. I talk to them when we’re out there. We call it *x’alaka’áns’*. My Gram taught me that the animals will hear you and understand you if you talk to them and explain what you’re doing there. So, I’ll talk to the wolves and the bears and explain to them what I’m doing out there. I’ll ask them to not let any harm come to me and even to protect me because that pack out there, those are the same wolves that protected my *Gaawhittaán* (Drum House Clan) ancestor when he got hurt. So, they’re kind of like relatives; that’s the way we see them.”

Mr. Anderstrom talks to the animals, asks them for help and protection, and remembers the story of his injured ancestor being protected by Wolf. He is related to Wolf, so he is not afraid. Ms. Judith Ramos also speaks of talking to Wolf as if speaking to one's relatives; she describes a sense of kinship. The interviewer asked, "Can you tell me as a child what you were taught about wolves?" Ms. Ramos explained, "Most of the stories I learned about were through my mother. She would accompany her father Olaf and whenever they would encounter a wolf, they would talk to Wolf because his people, the *Teikweidí* clan, have a relationship with Wolf. I grew up hearing stories about the Wolf, they would come down mostly in the winter down from the mountains down to the Yakutat area nearer to the community." The interviewer followed up with, "Do you remember what your grandfather might have said to the wolves?" Ms. Ramos responded, "He would just talk to them like they were his brothers. Greet them, and mom would talk to them; she loved the wolves, she would tell stories about talking to the wolves, when they would accompany her and her father as they were doing things out on the land. She would talk about how the Wolf would just be there. She always loved talking about her Wolf... She had a real love for the wolves. I think there was a sense the Wolf had a kind of relationship with them through Olaf's family; they were like his brothers."

The Tlingit People in Southeast Alaska relate to wolves by living closely with them in their homelands, practicing their culture through ceremony and ritual, reaffirming their Indigenous identity, and continuing to practice their way of life on the land and sea. Stories and experiences of Tlingit–Wolf relations are passed down through the generations. This relational sustainability is part of the Tlingit existencescape, which merges time, ecology, place, and respect (Thornton and Kitka 2010; Cooper 2019; Langdon 2019, 2020b; Figure 3).

Time and ancestors: Haa Shuká, Haa Shagóon, and Haa Kusteeyí

Tlingit clans have relationships with their ancestors. The discussion of Indigenous knowledge of wolves would not be complete without acknowledging ceremony, the circular nature of time, and clan ancestors (Csaki 2016, Hatfield et al 2018; Figure 3). The concept *Haa Shuká* refers to our ancestors. The ancestors have a continuing presence that is most manifest when their names are called out at the beginning of the *ku.éex'*. When displaying official regalia (i.e., *at.óow*) on the occasion of a *ku.éex'*, living clan members experience the presence of their ancestors. Regalia play an important role, as wearing and presenting them at a *ku.éex'* invokes the presence of the deceased clan elders. The act of bringing out *at.óow* and wearing it is a highly formal display of clan history and identity because it is clan property inherited and passed down through generations.

A more encompassing concept is *Haa Shagóon*. Dauenhauer and Dauenhauer (1990:19) characterize this as "those born ahead of us who are now behind us and those unborn who await ahead of us." Thus the term references the past and the future and the total clan membership in those temporal domains. It is a primary Tlingit concept that sits at the core of the existencescape and defines how Tlingit think of the social interactions among the generations that are essential for the continuity of the human spirits of the clan. *Haa Shagóon* is the embodied Tlingit construct that culturally defines cosmological cycling through direct connection of one's ancestral relatives with one's descendants. The concept is invoked at critical moments in Tlingit ceremonial and ritual events such as the mortuary *ku.éex'*. While primarily intended to recognize and honor recently deceased persons, this ceremony is a pivotal social ritual for the clan and larger society because it is formally structured to honor and recognize all the ancestors, those who have gone before, and to celebrate and embrace the positioning of young people in their social stations, envisioning their active roles to ensure continuity of the clan in the future.

Haa Kusteeyí refers to the totality of Tlingit culture and historical existence. It is used when discussing our way of life as what is valued and practiced from time immemorial. We learned about Tlingit concepts of time, ancestors, and *at.óow*. The Tlingit concept of time is demonstrated when they display sacred objects at *ku.éex'*. Mr. Jon Rowan from Klawock explains when the *at.óow* come out for the people to see during a ceremony, the clan's ancestors are present with them. The interviewer asked, "When you are in an occasion where those garments are worn, what sort of impact does wearing them have on you?" Mr. Rowan explained, "Well, like when our *at.óow* come out, we believe

that's all our ancestors being represented. They're with us. That's our uncles, they're standing with us when they're brought out. They're with us. It's like say you went to Ireland, and you guys had a special ceremony that said your ancestors are here now. How would you feel? I would feel pretty darn good that they're here with me, and that's represented in this sacred item. That's that kind of power. It's like we're with our ancestors because they did the same things. Where we practice it is almost darn near within a quarter mile of where they practiced it. You know, living it."

All the generations are together when *at.óow* come out, invoking *Haa Shuká* and *Haa Shagóon*. When clan members enact *ku.éex'* and the same or very similar rituals their ancestors had enacted, the entire clan is united across time. This is a powerful experience tied to sacred objects, place, and an ancient way of life (Figure 3). The power of the sacred objects displaying Wolf lies in their capacity to invoke the ancestors and bring the past and future into the present.

Wooch Yax (Balance)

Wooch Yax refers to maintaining spiritual and social harmony, or balance, and includes respect for others and for all things (Dauenhauer and Dauenhauer 1984, Thornton and Kitka 2010, C. Smythe, Sealaska Heritage Institute, personal communication). Across several knowledge holders and during tribal consultations, we learned the primary motive for trapping and hunting wolves is to ensure adequate deer and moose abundance for subsistence harvest. The preferred means of keeping predation in balance is subsistence hunting and trapping of wolves near communities where hunters normally access deer and other ungulates for food security and continuity of Tlingit identity and way of life. These motives, desires, and practices are based in the Tlingit cultural value of *Wooch Yax* (i.e., balance), including spiritual, ecological, and cultural balance (Figure 3). The practice ensures healthy wolves and plenty of venison. Mr. George explained, "Wolf has to eat, and we have to eat."

The Kake area: Kupreanof and Kuiu islands

The people in the Kupreanof and Kuiu islands know by experience and from their elders that controlling Wolf's use of critical ungulates allows for enough deer to sustain both human and wolf populations; this is a key principle of Tlingit conservation (Thornton and Kitka 2010). From a subsistence perspective, there are 2 dimensions to the wolf–deer dynamic. Mr. Michael Jackson indicated when wolves are present in the community's deer hunting areas, the deer become spooked and skittish or scared, making them difficult to hunt, and after the wolves eat a large number of deer in an area, deer become too scarce for adequate subsistence harvest. Mr. Jackson stated, "The people noticed the impact of the wolf because the wolves would eat the deer, and the deer would get scared. They knew it because there were some villages that didn't trap the wolves. They didn't have trappers who went out of their way to go get wolves, and here they had been almost starving. I remember my father telling me those different places he'd go where that was happening. When he'd tell stories, the meaning of the story was that you had to control wolves."

Mr. Scott Jackson explained that trappers' motivations are to ensure the people's subsistence way of life in perpetuity. Good subsistence equates with wealth and good health for the community and the Tlingit People (i.e., long-term viability). Mr. Scott Jackson said, "That's the bottom line; we're subsistence trappers not trying to overstep our boundaries and trying to show respect. We're trying to respectfully get something back that pays dividends into our family. This is how a lot of us are rich. If we can keep our subsistence rich, our community remains rich, and it keeps us from having to go to the store so often. I keep reiterating why we do this; we're trying to enhance our subsistence way of life. If we're going to allow outsiders to come in and throw a wedge in there, they have to at least realize a place like Kake really needs deer [and other wild foods]. We don't always have store bought foods and other commodities."

Mr. Scott Jackson explained how to maintain a balance among subsistence needs, wolf numbers, and deer numbers, which if achieved allows for the health of all. Subsistence harvest is dangerous the farther from home one

must travel to find deer. He reminds the reader there is a subsistence priority in Alaskan law, so there is a need to trap wolves in places where people subsistence hunt for deer near their communities. "I became involved in wolf trapping a long time ago. We lost my uncle, my cousin, and a family friend on the north side of the island. By then, we had already started trapping. What we started realizing is every area where we did trap, the abundance of deer and moose in that certain area went up. At one point after we lost our family members and friend, we came to the realization that we shouldn't have to travel a dangerous waterway to go across that strait to harvest our deer. Our subsistence gatherers shouldn't have had to do that. This is one of the reasons why I set out to catch as many wolves as I can in certain areas; I only trap the areas where I hunt."

When there are too many wolves, they are not healthy. Mr. Scott Jackson trapped an area for a decade before he could save a hide that had market value. He advised the most correct way to manage wolves in his place is through subsistence trapping and hunting. "For the first 10 years we couldn't even save a [wolf] hide, and to me it seemed like they were eating themselves out of [prey]. We'd catch wolf after wolf after wolf, and they'd be mangy and have bugs on them, and their fur would be coming off; their tails wouldn't have any fur. There's such a separation of opinion on what the right way is to go about managing, and I think the right way to manage them is to allow subsistence trappers to keep trapping because they're not out there to decimate the wolves. We're out there to help increase the subsistence way of life. We're not all just killers who are up to no good. That has been the perception."

Trappers in the Kake area cooperate in an organized fashion and on a set timeline for wolf harvest. The interviewer asked, "After you had trapped, how quickly did you begin to see deer replenishing?" Mr. Jackson replied, "It took about three to five years because you'll start seeing fawns; it's not going to happen right away. You're looking at three to five years, maybe. I have friends I asked to come and help me trap because this place is overrun. They go down on the south end, and we work together. I work the north side, and then we'll meet together because you can't do it by yourself. It's too much area. We're realizing a majority of the Kuiu Island wolves are the ones that are flooding onto our island and wiping our game clean. It took about five years, and you can look at the reports for the moose and the deer. I got a call earlier saying, we were the highest moose-take area again in Southeast Alaska. It's been going in a steady uphill ever since those guys started helping me trap, but they don't come up every year; they'll come up every third year. That's our own rotation. I respect everything and out of respect you need a balance. Our balance is every third year, we have those guys come up."

Experts stated that in areas where wolves have been trapped, wolf health improves, as there is higher prey abundance. Mr. Jackson explains if there are too many wolves at one time, the younger ones are not allowed to eat because the older dominant wolves consume all the food. When the wolves become healthier, they start to form new packs in different areas; as they become trap shy and warier of people, they relocate. The interviewer asked, "How long did it take for you to begin to see the improvement in their health and the quality of the wolf pelts?" Mr. Jackson responded, "Once the other trappers started coming up, about three years; right away, we started seeing healthier wolves. You want to take out the old ones because they always end up taking all the food from the younger ones. I think it's a good dynamic. What I've noticed is you have packs splitting up to make new packs when they're healthiest. It's the same thing they used to notice on Prince of Wales Island when they're trapping really good. You will see the older male and female split off, and they'll start their own little pack. Yes, there's going to be balance. I think if we can keep away from outside interference, we can keep it positive for this island. I grew up out here. When I had to go to college, I was living in the grocery store eating pork chops, steaks, and chicken. I'm used to my Native diet. After this process, the [wolf] hides improve. They're very marketable once they improve."

The Klawock area: northern and central Prince of Wales Island

Mr. Thomas George represents the Klawock area but has trapped and hunted wolves near many communities in Southeast Alaska. He explained when there are too many wolves, they run out of food and become unhealthy. Mr. George showed the interviewer 2 photos, one of a healthy wolf, after substantial trapping on the island, and one of

a skinny underweight wolf in the absence of trapping (Brooks et al. 2022:91). Mr. George explained, "You see how big that wolf is? It weighed 143 pounds. That is one year after we had harvested 168 wolves on the island here. He did not have the competition to go after food. Look how skinny that wolf is. That's a shoulder blade; there's no meat on it and look at those ribs; there's nothing' on it. This is a full-grown adult female wolf; wet, she weighed 30 to 50 pounds. There was no food out there for her. She's still retaining that hunting area as her domain, but there's nothing for her to eat there."

Mr. George also traps a wolf pack on a 3-year rotation, and he leaves at least one breeding adult to reestablish the pack to ensure the deer stay healthy. He said if you stop trapping for more than 3 years, the pack may substantially increase, and a 3-year trapping cycle ensures a healthy mature wolf pack. "I targeted the packs on a 3-year rotation because after the third year, if you leave it alone for more than 3 years you're going to wind up with a wolf pack that's much larger than the original pack size when you first went in there. Anywhere I trapped, I'd really work on taking that pack down, but I always made sure to leave at least one adult of breeding age if not a breeding pair. Going with a 3-year rotation, you wind up with more mature wolves than you would catching a whole bunch of pups."

Mr. George reiterated if not trapped or hunted for 3 years, with a good food source, a pack can substantially increase their numbers. Mr. George quantified, "In 3 years, in my experience, if left alone, they can come back 200% better than the original pack size. I brought that up to the area biologist's attention, and he asked me if I was sure. I said, 'Yes, absolutely positive.' He pulled out some paperwork for me to read. It's exactly the same findings that he came across." Mr. George provided a caveat for his observations of pack-size growth, "If the food source is available, and you have low mortality." Mr. George's estimate of a potential 200% increase in pack size in 3 years was corroborated in the case of the Honker Divide pack (Figure 1). Four years after trapping ceased, the wolf pack there grew from 11 animals to 36, which is a 227% increase. Trapper access to the pack had ceased when the road was gated for the purposes of continuing research on the pack.

Mr. George said trapping a large pack that has not been trapped for more than 3 years results in catching a lot of young wolves and pups for which there is no fur market. Other wolf experts in this study agreed that when you start trapping a pack, you catch the younger wolves first that have little experience with traps, as they are not trap shy or wary. "I trapped the Hydaburg area for a couple of years and built up a deer herd on Sukkwan Island to where I couldn't hang a snare anymore. Of the wolves I initially took there, only one was worth any value because they didn't have the nourishment to put hair on. There was no fur, and the fur on the rest were all dull and kinky from being undernourished. They were skinny little runts, every one of them. I let them alone for 3 years and went back and set it all up. I caught 9, and only 2 of them were not marketable. The rest of them were big and plush with silky hides. It's amazing what a turnaround you can see. The wolves had so many deer on that island, they had plenty to eat, and they flourished because I left them alone for 3 years. If I'd left them alone for 4 years, boom, they'd kill that deer herd off overnight. It makes a healthy Wolf overnight."

Mr. George explained how he uses deer abundance and difficulty in deer harvest as indicators to determine where he is going to concentrate on wolf harvest. He understands the relationship between predator and prey abundance, and he uses this knowledge to guide his wolf trapping and hunting behaviors. "I'd always determine where I'm going to be concentrating on harvesting wolves while I'm deer hunting. How much effort do I have to put into deer hunting in this area versus that area, and why doesn't this area produce deer? It's been a better environment for deer than this one, and there's more deer over here, so you put 2 and 2 together and there's got to be a problem developing. So that determines where and when I'd concentrate on trapping wolves." Mr. George demonstrated that one experienced wolf trapper and hunter with high success can affect subsistence harvest of deer over a large geographical area, benefitting many communities. Mr. George shared, "Well, the truth of the matter is, when I was hard at it, I had every freezer on the island here full of venison, including Ketchikan, Saxman, Metlakatla, Wrangell, and Petersburg. Yes, everybody was happy; everybody was a great hunter."

The Craig area: central Prince of Wales Island

When Mr. Douville talks about wolf abundance and population health in the Craig area, it is always in the context of deer abundance, health, and availability for subsistence harvest. His discussions of predator-prey dynamics included humans harvesting both deer and wolves to achieve and maintain balance. In this case, he integrates the current condition of forests into his explanation. Mr. Douville, explained, “We do have a good population of Wolf. I mean, our population of wolves is high enough to where our deer harvest numbers are still going down, and they will continue to go down because we’re not able to keep the wolf population at 100 to 150 animals. We probably can maintain adequate deer, but we’re not going to build a deer population like we had in the 2000s because all through the 1990s and 2000s and up to 2010, we were able to trap a lot. We have 2 things: stem exclusion [in older secondary growth forests] and a high wolf population, and we’re still trending down.”

Mr. Douville’s observations indicate that secondary forest conditions as a result of historical clearcutting are negatively affecting the deer population. He explained that deer are at high risk due to stem exclusion, deep snows in winter, and wolf predation. Stem exclusion in older secondary-growth forests limits the ability of deer to use these areas in the summer because sunlight is unable to penetrate to the forest floor and facilitate production of nutritious forage species; there is no growing space available for new stems (Ingram 2021). In young secondary growth forests, there is no canopy cover in winter and the snow gets too deep for deer to easily move. The interviewer asked, “What are your thoughts about the impact of the secondary forest on the deer population?” Mr. Douville responded, “I think we’re at a high-risk time because we have so much secondary growth that doesn’t support deer. Geographically we have enough ground to have deer, a good population, but then you have predation. So we’re at high risk because of snow. It could decimate the deer population, which it probably did this winter. But in the short term, if you keep the wolves at a manageable level, then you’d have deer. For quite a few years, we were able to trap all winter, and we kept the population down.”

Mr. Douville said the most he has taken while wolf trapping is 31 animals in one year, and he averaged about 25 per year for a number of years, which did not seem to adversely affect the wolf population. The interviewer asked, “What is your sense about that number in terms of affecting the wolf population?” Mr. Douville replied, “At the time, I was doing it every year. It was okay. There seemed to be plenty of wolves.” Mr. Douville now focuses his trapping efforts on the nearby islands to keep a small area that has enough deer to support local hunters. When trapping stops or is not seriously and consistently pursued, the wolf population increases quickly. “The only thing I can do is trap on the islands here and keep a small area that’s got a decent deer population so we can get meat.” The interviewer asked, “In your experience, there’ve always been wolves on those islands even when you’re trapping?” Mr. Douville: “There are some; yes, there’s still Wolf, not as many as there were before because I’ve been working on them for several years. As soon as you let your thumb off it, they’ll regroup, and you’ll have a pretty good population. It doesn’t take too long.”

Decreasing deer abundance may be an indicator wolves are doing well, and their population is at a viable level. Mr. Douville added, “We’ve got plenty of wolves. The deer population would totally indicate that. The deer population is going down, which means you’ve got so many wolves that you can’t even keep it sort of level. There will never be a level [perfect balance], but you can hope for one—you don’t have to kill them off. It’s never been my desire to do that, maybe on a couple small islands. So long as I have a small place to hunt that can produce quite a few deer, but the local hunting population gets onto it, too, and it’s really hard because they’re as bad as the wolf.” Mr. Douville has no desire to kill all the wolves; he seeks balance. He is getting older, and it is a challenge for him to put in the effort required to remove the optimal amount of wolves, so he tries to maintain just enough effort to get deer meat. He thought local demand for deer would exceed his capacity to maintain adequate deer abundance via subsistence wolf trapping. During times of low deer abundance, competition among local deer hunters can be a problem.

Application of TEK to the SSA

The SSA report included an in-depth review of the subspecies' biology and threats, an evaluation of its ecological status, and an assessment of the current and future resources and conditions needed to maintain long-term viability (USFWS 2016, 2023; Figure 4). The USFWS considered what the Alexander Archipelago wolf needs to maintain viability by characterizing its status in terms of its resiliency, redundancy, and representation (principles known as the 3Rs in conservation biology). Resiliency is the ability of a species to withstand normal variation in environmental conditions and demographic rates; redundancy is the ability of a species to withstand catastrophes; and representation is the ability of a species to adapt to both near-term and long-term changes in its physical and biological environment (Smith et al. 2018). The agency team organized the SSA report into topics:

1. taxonomy and morphology,
2. range and distribution,
3. life history (i.e., reproduction, dispersal, social organization, and survival),
4. resource needs (i.e., prey and habitat),
5. factors influencing viability (e.g., timber harvest, wolf harvest, inbreeding),
6. current condition (in terms of the 3Rs), and
7. future condition (in terms of the 3Rs).

Interviews with Indigenous knowledge holders for the TEK study were completed shortly after the USFWS finalized the first draft of the SSA report. The first step in applying TEK to the SSA was for the USFWS assessment team to review the TEK report submitted in summer 2022 and identify relevant information for inclusion in the SSA

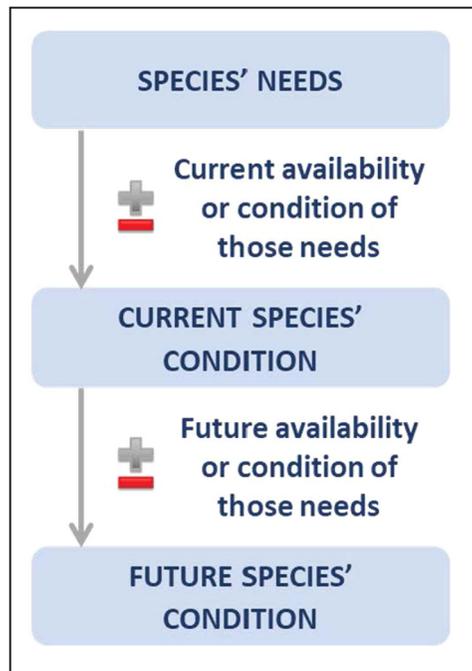


FIGURE 4 Summarized stages in the single-species framework used by the United States Fish and Wildlife Service for the species status assessment for the Alexander Archipelago wolf referenced in the Indigenous knowledge study for Southeast Alaska, USA, 2022–2023. *Source:* United States Fish and Wildlife Service (2016).

report (USFWS 2023). All TEK added to the body of the SSA report was cited in a standard scientific format, and the entire TEK report was included as an appendix to the SSA report. The introduction of the SSA report provided a summary of the TEK study design and a brief description of the Indigenous way of knowing.

The TEK study provided new information about Alexander Archipelago wolves and added to the existing body of knowledge collected using Western scientific methods. In the SSA, the agency team applied TEK in 5 of the 7 focal areas (i.e., taxonomy and morphology, life history, resource needs, factors influencing viability, and current condition). In terms of taxonomy and morphology, Indigenous knowledge holders provided comparisons of Alexander Archipelago wolves with timber or Yukon wolves (*Canis lupus pambasileus*), a separate subspecies of gray wolf. Mr. Mills stated, "We have 2 different kinds of wolves that were in Excursion Inlet. We have the Alexander Archipelago wolf, which is a smaller species... but the timber wolf is a great big thing. It weighs around 200, 250 pounds, and an Archipelago wolf is much smaller. I don't think they get over 60 pounds. They were always present, but they never ever mix" (Brooks et al. 2022:51). These observations provided important information for understanding wolf populations in northern Southeast Alaska, where Western scientific knowledge and data, including genetic data, are lacking.

The topics of wolf life history and resource needs in the SSA were particularly enhanced by TEK. Indigenous knowledge holders shared a wealth of information about reproduction (e.g., litter sizes, maternal experience and age, denning and pup-rearing behaviors), dispersal (e.g., distances traveled; use of roads, trails, and marine passages), social organization (e.g., pack sizes, territories and home ranges, inter- and intra-pack dynamics, hunting behaviors and patterns), and diet (e.g., diversity of prey, preference for ungulates, seasonal feeding behaviors). The authors of the SSA learned that wolf pack territories appear to be organized by streambeds and watersheds in some areas of Southeast Alaska (e.g., Yakutat, Excursion Inlet, Kupreanof Island, Kuiu Island) and by islands in other parts of the subspecies' range (e.g., the Prince of Wales Complex; Brooks et al. 2022). For example, Mr. Michael Jackson shared, "Here on Kupreanof Island, we were taught that the wolves are usually in each watershed and are closely related to other wolves in nearby watersheds. The large mountain ranges separate wolf packs. The wolf packs migrate along with the deer from north to south on Kupreanof Island. The mountains on the southside of Kupreanof Island provide protection for the deer from the strong, cold north winds and when it's sunny, [there is] more of the food for the deer as the snow melts." The TEK report also provided meaningful insights about wolf behaviors that could be used to develop more effective techniques for estimating their abundance (Brooks et al. 2022:115). Local wolf trappers have years of experience disguising their scent, attracting wolves, and making close contact with these animals, which are invaluable skills for designing and implementing the hair trap, mark-recapture technique.

Knowledge holders shared the importance of subsistence wolf harvest (both hunting and trapping) and how it contributes to balanced and healthy populations of deer, wolves, and humans where they coexist. Indigenous knowledge documented in the SSA indicates that to have healthy wolf packs near human settlements, wolves must be trapped and hunted on a 3-year cycle in which a substantial portion of the pack is removed, but never the entire pack, to reduce competition for food. If wolves have adequate prey and no other sources of mortality, packs left unharvested for >3 years will substantially increase in size. When regularly harvested, new packs will start to form in different locations when a breeding pair disperses from a harvest area after becoming trap-shy and warier of people. Coordinated and consistent subsistence harvest of wolves by local experts creates a balanced ecosystem optimal for healthy deer, wolves, and people (Brooks et al. 2022:115).

The TEK study addressed some anthropogenic factors that contribute to and threaten Alexander Archipelago wolf viability and the current condition of wolf populations in Southeast Alaska. The Indigenous research partners discussed the adverse effects of historical clearcutting on Alexander Archipelago wolves' primary prey, black-tailed deer, which prefer multi-aged forest canopies (Wallmo and Schoen 1980, Parker et al. 1999, Shanley et al. 2021). Indigenous knowledge about pack sizes and the number of packs in various locations, especially in the northern region and Prince of Wales Island, improved the agency's understanding of the current condition of the subspecies. For the northern region, Mr. Mills described the locations and geographies for 2 wolf packs in Excursion Inlet. He shared information on pack size, travel patterns, and the time a pack takes to travel a circuit around its territory: 1

pack ($n = 12$) takes 42 days to travel its territory, while the other pack ($n = 40$) takes about 70 days to complete a circuit. These packs have maintained this travel pattern during his lifetime (Brooks et al. 2022:52). For Prince of Wales Island, TEK about pack sizes and numbers of packs contributed to a quantitative model used in the SSA report to estimate population size and evaluate current resiliency (USFWS 2023:81-82, 97).

Once the TEK report had been reviewed and applied to the SSA by the agency team, the draft SSA, with the full TEK report included as an appendix, was distributed for peer and partner review. Peer reviewers included outside technical experts that had not been involved in the SSA. They included researchers in the fields of carnivore and wolf ecology; human dimensions of wildlife; Indigenous knowledge systems; and population, landscape, and climate modeling. Peer reviewers represented academia, non-governmental organizations, and government agencies. The partner reviewers contributed to the SSA and included experts from the State of Alaska, Tongass National Forest, and the social scientists from the TEK study team.

The Indigenous experts interviewed for the TEK study were invited to participate as partner reviewers. None of the 9 interviewees provided comments on the SSA, potentially because of difficulties with the timing of a relatively short 30-day review window, which conflicted with subsistence fishing seasons and with accessing the technology needed to view the complete SSA. To overcome technological issues, a paper copy of the draft SSA report was mailed to each Indigenous knowledge holder. One Indigenous partner returned the draft with no comments. We revisit this challenge in the next section.

SUCCESSSES, CHALLENGES, AND LESSONS LEARNED

The TEK study was successful in terms of its effect on the SSA. The TEK shared by the Indigenous wolf experts addressed all primary knowledge gaps identified by the USFWS assessment team prior to the TEK study. As a result, the SSA was more rigorous, and the decision-making process was based on more complete information. The USFWS gained insight about the Alexander Archipelago wolf and also about the relationship between people and the subspecies. The study substantially improved the agency's awareness of the scope of cultural and ecological knowledge held by Indigenous People in Southeast Alaska regarding the subspecies and its ecological settings. Bolstered by this information, the USFWS and other management agencies will be better positioned to work effectively with local partners and Tribes to study and manage the Alexander Archipelago wolf and its habitat.

This project helped facilitate long overdue conversations between the USFWS Ecological Services Program and Tribes in Southeast Alaska about a controversial topic that holds significance for both. Most importantly, this study ensured that Indigenous voices and knowledges were and will continue to be meaningfully represented and acknowledged in a space where they previously were not but should have been (Brooks 2022). The USFWS now has a foundation on which to build future dialogues and relationships with Tribes about other species and habitats in Southeast Alaska. At a broader scale, this project has increased the recognition of TEK as an important contribution to the conservation work being done by the USFWS in Alaska. It is being shared as a case study within the USFWS and the United States Department of the Interior, and governmental offices across the nation have begun reaching out for suggestions on how to adapt this strategy to their work.

There were many challenges and lessons learned throughout the process. Two of the most significant issues were related to time and funding constraints. Because the study was triggered by a listing petition, the USFWS was held to strict timelines and funding mechanisms dictated by the Endangered Species Act. This type of study normally requires 2 to 5 years for community outreach; data collection; analysis; writing; review; and discussions between coauthors, Indigenous research partners, and the agency analysts and decision makers who seek to apply TEK. The unfortunate reality is we were on a restricted timeline due to the legal requirements and deadlines mandated by the Endangered Species Act, resulting in the expedited study being inherently reactive rather than proactive. There was little opportunity to talk with Tribes beforehand about the most meaningful ways to learn and

include their knowledge in the SSA and limited time for proper follow up with Indigenous knowledge holders about their interviews and the contents of the TEK report.

As social scientists, we were unable to plan and do participant observation or other place-based, field research activities. Having discussions with local wolf experts out on the land while setting traps for wolves, for example, would have allowed opportunities to learn more information and hear different perspectives. Visiting den sites, kill sites, and wolf trails or witnessing ceremonies with knowledge holders allows for enhanced sharing and contextualization of Indigenous knowledge and cultural practices. Fieldwork also facilitates capturing pertinent photographic images and conducting in-depth mapping exercises. We note an important caveat: although these additional research activities may have strengthened this study, ethical researchers would be required to obtain adequate permissions from Tribal and community leaders beforehand as part of a research approval process to protect data sovereignty, ownership, and confidentiality of sensitive cultural practices, places, and images (Kelley et al. 2013, Rodriguez-Lonebear 2016, Carroll et al. 2019, Brooks 2022).

The interviews conducted for the TEK report were applied to a Western scientific framework that was not developed with Indigenous knowledge in mind. The agency realized the framework used to conduct the SSA is based on an iterative, but linear, species-centric, and Western scientific model that does not account for an Indigenous worldview (USFWS 2016). There is debate in the literature about the similarities and differences between Indigenous and Western sciences; scholars have identified both, and the differences are often highlighted over the similarities (Tsuiji and Ho 2002). Although equally valuable and complementary, Indigenous and Western sciences have been characterized as different knowledge systems based in different ontologies (Brooks and Bartley 2016, Kendall et al. 2017). Indigenous science tends to be holistic, spiritual, qualitative, relational, and non-linear (Tsuiji and Ho 2002; Figure 3), whereas Western biological science tends to be positivistic, reductionistic, quantitative, and linear (Tsuiji and Ho 2002; Figure 4). Notably, the SSA framework used by the USFWS left little room for the cultural and spiritual context and Tlingit existencescape that are imperative for appropriately understanding and meaningfully applying TEK (Mazzocchi 2008, Hatfield et al. 2018, Langdon 2019, Ramos 2021, Brooks et al. 2022). The agency team did not fully recognize the implications of this challenge until later in the process. The USFWS is only now starting to grapple with the challenges of including TEK and its cultural context in the Western science-based assessment process. This is important because TEK cannot be on a level playing field with Western science in the SSA process until a framework is co-developed to reflect and draw upon both perspectives in an equitable manner (Singer et al. 2023).

A similar challenge that frequently arose with agency managers during the internal review process was whether Western scientific knowledge or TEK was right or more valid. This overlapped with the concern that there would be conflicts between them, and either Western scientific data or TEK would need to be chosen to make a decision. This required an adjustment to the way agency leaders framed the decision. Rather than viewing Western and Indigenous sciences as opposing knowledge systems, agency leaders were challenged to view them as complementary, or as 2 tools used together to answer a single question (Kendall et al. 2017, Brooks et al. 2019). "When there is more than one way of knowing, all ways should be used to contribute to a more complete understanding of knowledge" (Tsuiji and Ho 2002:346). The knowledge systems may not always come to the same conclusion, just as 2 Western scientific studies may not. In these cases, if TEK is going to be treated with the same relevance as Western science, it is necessary to assess and document all uncertainty and assumptions with both ways of knowing before deciding, which would require more time for collection of additional information and analysis in an already restricted regulatory timeframe. We are not suggesting, however, that TEK requires validation by Western scientific standards because it does not. Indigenous knowledge holders should be consistently invited to review how their TEK is used and interpreted and to clarify any uncertainties and misinterpretations where these exist. This requires more time for adequate follow up with Indigenous knowledge holders.

The USFWS and Indigenous wolf experts focus their wolf assessment models on different levels of ecological organization. Because Endangered Species Act decisions are inherently species centric (Gilbert et al. 2022), the agency used parameters of single-species ecology, including wolf abundance, distribution, and diversity across

populations to assess the subspecies' ability to sustain wild populations over time (USFWS 2016:6, 2023). The Indigenous wolf experts in this study employed a multi-species model focused on a human-wolf-deer system similar to a community ecology approach. Health and viability of the system over time are achieved by maintaining balanced interactions and interdependencies among people, ungulates, and wolves (Brooks et al. 2022). Gilbert et al. (2022:11) argued, "large mammalian predators are inevitably dependent on complex social-ecological communities and must be considered within the context of a system rather than an individual species population." This is a key realization and an important lesson learned to be considered in any future discussions about modifying the agency's wildlife assessment framework.

We learned that *Wooch Yax* (Balance), as described above, is an appropriate Indigenous model for wolf health and management in Southeast Alaska (Figure 3). The objective of coordinated wolf trapping is to have and maintain an Alaska Native diet in perpetuity and the sociocultural wealth and ecological health that ensue. When there is respectful balance, Wolf, Deer, and Tlingit are healthy, and there are successful deer hunters and adequate amounts of venison in communities, indicating a healthy socioecological system (Brooks et al. 2022). Mr. Scott Jackson shared, "It's really been cool to see so many successful hunters the last couple of years with moose and deer. We grew up on deer, and it's cool to be able to see the elders at least be able to keep on doing what they're doing. In a sense, it keeps a lot of them kicking, including my father." To maintain the Indigenous way of life in Southeast Alaska, Indigenous residents seek balance among wolf and deer abundance and communities' needs for ungulates. Since all are part of Tlingit existencescape, a single being, or species is rarely if ever considered outside the context of the others.

The USFWS faced practical and logistical challenges during the peer and partner review process, primarily related to timing and technology. The rigid deadline for the SSA meant the 30-day review period would overlap with the subsistence fishing season in Southeast Alaska. The review was conducted via an online portal to ensure digital copies of the SSA could not be distributed outside the selected review group. Because many of the Indigenous knowledge holders live in remote areas with intermittent or lower quality computer access and Internet connectivity, they faced greater challenges using the portal than other reviewers. Reviewers that were unable to use the portal because of limited technology or experience were allowed to review a hard-copy version of the SSA. The hard copy had been redacted before distribution in certain places to safeguard sensitive pre-decisional information. The redactions may have presented concerns over transparency and sharing of knowledge. This could have caused confusion and frustration and may have discouraged some peer and partner reviewers from providing comments. Agencies must implement timing, technology, and logistics in ways that are culturally appropriate to be effective and successful when working with Indigenous Peoples (Jacobs and Brooks 2011, Brooks and Bartley 2016).

For Southeast Alaska, like many other rural areas of the world where wolves and humans co-exist, the relationship between state, federal, and Tribal governments is fraught with tension and distrust when it comes to wolf management. The Alexander Archipelago wolf has been petitioned for listing under the Endangered Species Act 3 separate times in 28 years, and each time there has been intense disagreement among stakeholders about whether protections are necessary. Therefore, it was contentious to initiate a TEK study under these circumstances for a third assessment. The USFWS did not want individual opinions about the listing decision to influence the TEK interviews, nor did they want interviewees to feel uncomfortable sharing their knowledge with the agency, albeit we do not know if these concerns were shared by the Indigenous partners. The agency team was able to mitigate some of these concerns by partnering with individuals and institutions that were well-known and trusted in Indigenous communities in the study area. It became clear that in the future, the USFWS will need to proactively develop better cultural awareness, communication, and relations with Indigenous communities in Southeast Alaska before they may meaningfully coproduce knowledge for decision-making (Jacobs and Brooks 2011, Wheeler et al. 2020, Brooks 2022, Brooks et al. 2022).

It is difficult to predict with any certainty what the effect to Indigenous communities would be if the subspecies had been determined to be warranted for listing under the Endangered Species Act. If federally listed, management of the subspecies in Southeast Alaska would be dictated by language in the Final Listing Rule of regulations for wolf harvest and other human activities that affect wolves and their habitats. We cannot generalize the feelings and responses of all Indigenous individuals and communities in Southeast Alaska toward these hypothetical changes

because the communities are unique in many ways. Based on key insights from the TEK study, it is likely that many of the communities represented by the Indigenous participants would find a decision to list the wolf as threatened or endangered to be unfounded. As evidenced in the record of tribal consultation and the interview transcripts, none of the Indigenous experts believe wolves in Southeast Alaska to be threatened or endangered (Brooks et al. 2022). The Indigenous research partners shared that there are abundant wolves in their places. Therefore, we expect that a decision to list the wolf under the Endangered Species Act would come as a surprise to many Indigenous communities in Southeast Alaska, and ultimately, it would result in ongoing frustration and distrust toward the USFWS. Even if language in the Final Listing Rule were to allow for subsistence wolf harvest to continue as currently managed, we expect there would be anxiety generated in Indigenous communities by exerting further federal authority over wolf management.

Finally, the agency faced challenges regarding its capacity to design and implement a TEK study. Few USFWS employees are trained to execute anthropological studies, let alone Indigenous studies involving interviews and qualitative data analyses, and those skills were important for ensuring the TEK study was done appropriately and efficiently. The agency was fortunate to find external social scientists who were able to dedicate a substantial amount of time and resources to this effort and with very little advance notice. This is unlikely to be the case for future assessments of this nature. Development of the TEK report required several hundred hours of combined labor by 9 local experts, 3 senior social scientists, 2 professional linguists, 3 transcriptionists, and 2 editors.

RECOMMENDATIONS

Build capacity to support application of TEK

The Department of the Interior and many of its bureaus are in the process of developing guidance and training to increase capacity for applying Indigenous knowledge. Natural resource managers and conservation professionals across the federal government need more expertise to properly understand and apply TEK to their work. Agencies should seriously consider hiring more social scientists with appropriate specializations and Indigenous knowledge expertise to assist with TEK projects and train agency biologists. This work requires people with appropriate professional expertise and local knowledge of the communities selected for research. Expertise is required in Indigenous science, cultural anthropology, human ecology, sociology, or human geography (Primo and Brooks 2022). In this case, it was necessary to procure this expertise through a cooperative agreement with an Alaska Native organization and subcontracted social scientists. Agency specialists and contracted researchers would ideally have familiarity and pre-existing relationships with local knowledge holders. During this writing, the USFWS in Alaska hired 2 Indigenous knowledge liaisons to help guide its work with Tribal governments and Indigenous knowledge holders.

In addition to building internal capacity to elevate Indigenous knowledge in decision-making, the USFWS should build capacity within Tribes. This will ensure lasting and mutually beneficial partnerships between communities that have extensive local knowledge of wildlife and the USFWS, who shares responsibility with Tribes for the stewardship of wildlife (Brooks 2022). Agencies should work to develop funding mechanisms through existing authorities whereby they can directly contract with Indigenous experts for tribal stewardship and co-stewardship of fish and wildlife (Department of the Interior 2022). Tribal governments and rural knowledge holders often need more staff and expertise to apply for funding opportunities and develop proposal budgets for projects. It may be necessary to contract through a third party to reach and fund the needed Indigenous experts. In addition to formal financial assistance and contracting, the agencies could investigate the possibility of funding scholarships or mentor fees for Alaska Native elders and stipends for young Indigenous professionals and students to participate in wildlife management activities in their tribal homelands and to learn from their elders. The continuity of TEK can only be accomplished by the transmission of experience and knowledge from older to younger generations. Agencies should prioritize the creation of permanent science and management jobs for which Indigenous

knowledge holders or Indigenous students are most competitive. This type of support would clearly signal that agencies recognize and value Indigenous knowledge and realize its importance in the process of agency management decisions now and in the future.

More specific guidance and training should be developed for agency employees who are directed to apply TEK in wildlife assessment work, including guidelines for specific frameworks or laws to increase efficiency and improve outcomes when dealing with time-constrained decision processes such as Endangered Species Act assessments and National Environmental Policy Act analyses (Prabhakar and Mallory 2022). Case studies of TEK application should be widely distributed internally and externally, and employees should be directed to seek out training and read current TEK literature for their job performance criteria.

Strengthen trust, communication, and collaboration

The starting point should be government-to-government consultation with Tribal nations. Existing guidance for conducting government-to-government consultations should be properly and consistently implemented well before public involvement processes are initiated and important decisions are imminent (Brooks 2022). Federal agencies must initiate formal consultations with Tribes about agency projects planned in the region and invite the participation of Tribal leaders and members in developing and conducting the projects with the agencies. Consultation should be regularly initiated in advance of projects and other planned activities in tribal homelands. Success occurs when there are pre-existing relationships between agency leaders and Tribes and between researchers and Tribes. Agencies should recognize when there is a need for a third party with linkages to Tribes to serve as a cultural broker between the agency and Tribes for specific projects.

During tribal consultations and community engagements, agency leaders and experts should invite leaders from Tribes and other Indigenous partners in Southeast Alaska to explore what they consider to be needs and priorities for wildlife research and management in their homelands. The agency should identify local experts and ask them about research questions of interest; then, invite them to co-develop agency-sponsored studies that apply Indigenous science alongside Western wildlife science, research, and decision making. The ultimate objective should be to apply a complementary Indigenous knowledge system to agency decision making processes, not perfectly integrate Indigenous science and Western science (Kendall et al. 2017).

One way to establish trust is by prioritizing relationships with Indigenous Peoples and communicating regularly with Tribes about conservation issues and opportunities of mutual interest; whenever possible, meetings should be held in person in communities where Indigenous Peoples live using their cultural protocols, timelines, and local technologies (Jacobs and Brooks 2011, Brooks et al. 2015, Brooks and Bartley 2016). Co-developing research and monitoring studies with Indigenous partners would help foster trust. Whenever agencies engage Indigenous partners to co-develop studies, they should include a component on TEK that includes the underlying sociocultural context. Collaboration should occur throughout all aspects of the work, including proposal development. If there is fieldwork in which data are collected, efforts should be made to closely work together on the land, especially when the work occurs in a Tribe's ancestral lands.

Indigenous partners should be afforded equitable and accessible opportunities to review TEK studies and products before these are finalized. Asking Indigenous knowledge holders to read lengthy draft reports and provide written comments may not be the most appropriate way to obtain their feedback, as this approach is based in a Western bureaucratic tradition. Tlingit society is rooted in a narrative, or oral tradition of communication and learning (Dauenhauer and Dauenhauer 1984). The agencies should work with Tribes in Southeast Alaska to devise and test alternative review formats. A spoken and reflective dialogue about a TEK project or product geared towards mutual understanding and consensus may prove more effective for obtaining feedback from Indigenous experts. Similar approaches have been developed to conduct qualitative analyses more meaningfully for Indigenous research participants (Andrews 2021, Bartley and Brooks 2021). Moreover, procedural logistics and regulatory

deadlines often conflict with tribal timelines and cultural practices (Jacobs and Brooks 2011). To the extent practicable, the agencies should learn local Indigenous calendars to properly schedule tribal engagements to avoid conflicts with culturally important ceremonies and harvest seasons.

Coproduction of knowledge

The USFWS and Tribes in Southeast Alaska may be able to strengthen their relationships through a coproduction of knowledge approach, especially for studies designed to estimate wolf abundance or monitor long-term viability (Brooks et al. 2022). Coproduction of knowledge involves mutual understanding, interaction, and respect, and the recognition that each party brings something valuable to the discussion (Isaac 2015). Coproduction acknowledges and accounts for Indigenous expertise, values, and ways of knowing through interactions that are mutually beneficial and can result in common understandings, new knowledge, and wildlife assessment frameworks that either independently include or blend multiple perspectives. A coproduction approach sets the stage for equitable treatment of Indigenous knowledge, shared intellectual authority, and complementary application of Indigenous Peoples' understandings and scientific understandings of wildlife ecology (Isaac 2015).

In the context of wolf research, assessment, and management, coproduction of knowledge occurs when agency scientists, managers, and Indigenous wolf experts develop a mutual understanding of a research problem before the research proposal is written. Both contribute to a shared understanding of the research question, and their individual perspectives and contributions support and often fuse into a new and distinct understanding (Bartley and Brooks 2021, Brooks 2022) of how to best conduct wolf research, collect and analyze data, and interpret results to inform decision-making, wolf management, and harvest regulations. Successful coproduction is verified by discussing and arriving at consensus on the credibility, usefulness, and mutual benefits of the analysis, results, interpretations, implications, and final products. Out of respect, the agencies should bring Indigenous experts into projects as early as possible so they may make real contributions where both sets of values and knowledge contribute to the research goals, design, methods, and qualitative analyses (Johnston 2020, Andrews 2021, Brooks 2022).

Account for people in species status assessments

Under the Endangered Species Act, federal agencies are not authorized to consider social, cultural, and economic issues when making a listing determination. The agencies are only directed to consider the status of the species itself. The Alexander Archipelago wolf exists in an environment that is shaped by human beings and does not exist independently of the effects of human actions. Therefore, the status of the subspecies is closely intertwined with the status and viability of human communities, and federal agencies should account for that in their wildlife assessment frameworks. To properly understand wolves and humans, the agencies should include and consider human culture and society in their assessments and deliberations. Indigenous partners recognize when these aspects are omitted, and these oversights can present substantial barriers to developing better relations and consultations between agency personnel, Tribes, and Indigenous experts. Upon comparing the Tlingit model of Wolf (Figure 3) and the USFWS's assessment framework (USFWS 2016; Figure 4), a logical first step would be for the parties to begin talking about how to co-develop a framework that includes the Tlingit model.

The Tlingit value of *Wooch Yaḡ* reflects aspects of community ecology that could be applied to broaden the agency's single species approach, especially for predators that coexist with human communities. Both frameworks include components and parameters related to wolves, ungulates, and humans. The agency focuses on wolves and their long-term viability, while the Tlingit focus on the long-term viability of all 3 as interdependent beings living in a balanced socioecological system. It is reasonable to say there are key commonalities between the 2 frameworks in terms of ecosystem health, sustainability, resiliency, and long-term viability. Conservation biology and ecosystem

management dictate that humans are part of the ecological setting (Meffe et al. 1997, Cordell and Bergstrom 1999). The 3Rs as concepts of conservation biology, are compatible with socioecological systems and can be applied to ecological communities in approximately the same manner as they are applied to single species and their ecological settings. This is especially the case if analysts highlight a species' role and position in an ecological community that includes people and sociocultural practices involving that species. In cases where a petitioned predator population coexists with Indigenous Peoples or other human groups, as is the case for the Alexander Archipelago wolf in a large portion of its range, we recommend the parties work together to share focus and coproduce a species status assessment tool that frames species viability within its larger sociocultural and socioecological contexts.

MANAGEMENT IMPLICATIONS

There are several implications of this work for wildlife management agencies and Tribal nations to consider. In light of the time and specialized personnel required to co-produce and complete a comprehensive TEK study that can meaningfully contribute knowledge and facts to wildlife assessments and other management decisions, state, federal, and Tribal governments must work together to build capacity for agencies and Tribal nations by increasing and enhancing personnel, expertise, and funding. Before decisions are made and pen is put to paper, federal wildlife management agencies must begin the process of partnering with Indigenous experts with robust and meaningful government-to-government consultations between top agency officials and leaders of Tribes; the key decision makers must be present. To have meaningful consultations, wildlife managers need to focus their time and energy on building trust and relationships in Indigenous communities and among Indigenous knowledge experts and leaders, paying close attention to the sociocultural dimensions of TEK described in this article.

To design TEK research for application to wildlife assessments and management decisions that affect Indigenous communities and homelands, wildlife managers, agency scientists, and Indigenous experts must co-develop research proposals, objectives, and methods and provide opportunities for the Indigenous experts to interpret results and formulate recommendations on an equal footing with Western scientists. Pursuing a coproduction approach to wildlife research and management will require federal agencies and Indigenous leaders to formulate viable and effective research protocols and policies using formal cooperative agreements, memoranda of understanding, or other authorities and funding mechanisms.

Wildlife managers, regulators, policy experts, and law makers must amend legal timelines that constrain these types of projects. It is necessary to allow more time to include sociocultural and social-ecological factors in SSA processes conducted under the Endangered Species Act and other wildlife regulatory analyses. The partners need time to develop and improve wildlife assessment frameworks that are guided by Indigenous and Western scientific understandings of ecosystems and species' viability. Lengthening legal and regulatory timelines may require federal rule making processes and congressional actions.

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CONFLICT OF INTEREST STATEMENT

The authors declare no conflicts of interest.

ETHICS STATEMENT

Indigenous knowledge holders were given an informed consent form to read and sign beforehand, which was signed by the principal investigator. Each Indigenous research partner was compensated with an honorarium, and all agreed to be identified by name as one of the interviewees. We followed the ethical research principles and guidelines of Sealaska Heritage Institute (2004), the Alaska Native Knowledge Network (2000), and the United States Interagency Arctic Research Policy Committee (2018). The audio recordings and transcripts are securely archived for storage and controlled access at Sealaska Heritage Institute in Juneau, Alaska.

DATA AVAILABILITY STATEMENT

Research data are not openly available but may be shared in part or full, on a case-by-case basis, upon request to Sealaska Heritage Institute, Juneau, Alaska, USA.

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