CARIBOU MIGRATION, SUBSISTENCE HUNTING, AND USER GROUP CONFLICTS IN NORTHWEST ALASKA:

A TRADITIONAL KNOWLEDGE PERSPECTIVE

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A

THESIS

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Abstract

Alaska Natives of northwest Alaska are highly dependent on barren-ground caribou (*Rangifer tarandus*) for meeting their nutritional and cultural needs. The Alaska Native village of Noatak borders the Noatak National Preserve (NNP), an area historically and presently used by Iñupiaq for subsistence caribou hunting and other traditional activities. Interactions between local and non-local caribou hunters were analyzed through the lens of common pool resource theory, which I linked to traditional Iñupiaq management of access and use of resources. This study examined changes in caribou migration and its effect on local caribou hunting success, which have been perceived to be the result of the interaction with non-local hunters and commercial aircraft operators transporting non-locals. Past research, decades old at this point, was undertaken prior to some regulations in place today, such as zoned use areas. To understand the implications of these changes, I documented the perceptions of local hunters by drawing on their traditional ecological knowledge (TEK), using a mixed methods approach to capture information on caribou ecology and human-caribou interactions. Mixed methods included a survey of active hunters, semi-structured participatory mapping interviews with local caribou experts of Noatak, key informant interviews, and participatory observation. Local hunters reported that caribou migration has changed, and there has been a decrease in the population of the region's caribou herd, the Western Arctic Herd (WAH). Hunters also reported that caribou hunting has changed substantially in the last five years, with fewer caribou harvested and hunters adapting to accommodate caribou migration shifts. Local hunters ranked aircraft and non-locals hunters as having the greatest negative impact to caribou migration and local hunting, followed by predation, climate change and habitat change. Noatak hunters perceived

that their harvest of caribou is most impacted by non-local activity in the Noatak region. As well, local hunters reported that aircraft are a greater disturbance than on-the-ground non-local hunters. Participatory mapping revealed that use-areas are shared by local and non-local users along the Noatak River corridor, including both inside and outside zoned use areas. Suggestions by respondents for improved caribou management and conflicts with non-locals ranged from reducing non-local activity, working together with non-locals and aircraft operators, improving economic development for Noatak, and teaching youth of the village traditional hunting practices. Findings of this research demonstrate that local hunters have a rich, localized knowledge of human-caribou systems, which can contribute further to understanding of caribou-human interactions and in turn help to inform wildlife management decision-making.

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Chapter 1: Introduction

1.1 Background and objectives

Caribou are an important subsistence resource for residents of Noatak, an off-road rural community in northwestern Alaska (Figure 1.1), where residents continue to depend on barren-ground caribou (*Rangifer tarandus*) for economic, nutritional, and cultural needs (Foote & Williamson, 1966; Mikow, Braem, & Kostick, 2014; Norris, 2002; Uhl & Uhl, 1979). Noatak caribou hunting and Noatak interactions with non-local hunting activities provided a case study to examine the links between caribou behavior and migration, user group interactions, and changes to subsistence caribou hunting. Contextual insight into the Noatak human-caribou system includes both ecological and social dimensions.

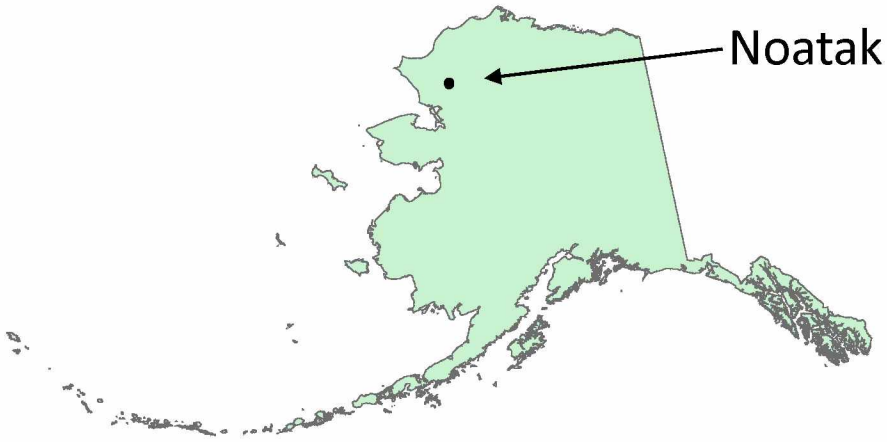


Figure 1.1 Location of Noatak, Alaska.

There are three components to the Noatak social-ecological system interrelated in my research, Noatak hunters, other users of caribou, and caribou (Figure 1.2). The first element, Noatak hunters, is closely linked to caribou for subsistence uses. Caribou are also used by other

users, both for hunting and recreational purposes. Herein I refer to a "subsistence hunter" or "local hunter" as a caribou harvester from Noatak. A "non-local user" is any person or group of people who were hunting or camping in the Noatak National Preserve (NNP), but did not reside in Noatak. My research used general terms to designate local and non-local hunters, recognizing that Noatak hunters themselves refer to non-locals hunters primarily as "sports-hunters". "Transporters'" refers to aircraft operators who drop off/pick-up non-local hunter clients.

The three elements, Noatak hunters, other users of caribou, and caribou, are explored through the conceptual framework of common-pool resource theory (Ostrom, 1990; Schlager & Ostrom, 1992), with the study of human-caribou system dynamics informed by Traditional Ecological Knowledge (TEK) (Berkes, 2012; Fienup-Riordan, 1999; Huntington, 2000). Institutional arrangements for the management of caribou in Alaska, including legislation which governs access that shapes the interaction of these three components are discussed.

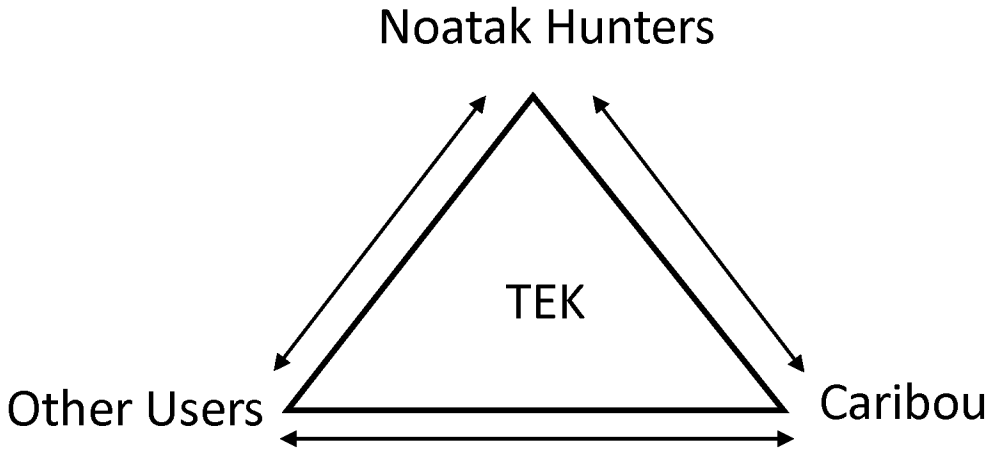


Figure 1.2 Three elements to the Noatak Social-Ecological System.

Wildlife management involving multiple groups using a finite resource is potentially problematic. Local people's use of caribou is based on legislation and historical context. Non-locals also have some historical base in the region, although predominantly beginning at the 20th century (Anderson, Anderson, Bane, Nelson, & Towarak, 1998; Uhl & Uhl, 1979) including access and use of caribou through legislation. How groups interact will impact management decision-making in the areas of access and use and can potentially affect the sustainability of the resource. Knowing how multiple users perceive interaction with one another over resource use can potentially provide resource managers with insights to address conflicts between users and sustain the resource.

1.2 Rationale for study

For decades, Noatak hunters have expressed concerns that human activity is affecting caribou migration, which is impacting their subsistence hunting of caribou (Georgette & Loon, 1988; Jacobsen, 2008). My research was motivated by the need to document user conflicts in the region and understand the extent to which TEK could enhance knowledge of the system and contribute to caribou management. This study was part of a greater NPS study that included:

1. Traditional knowledge of caribou and user interactions between local and non-local hunters in the Noatak National Preserve (This study),
2. Perceptions of non-local hunters in the NNP and commercial activity in the NNP,
3. Study of acoustics in the NNP during peak hunting,

4. Assessment of caribou migratory movements based on GPS collars in the NNP.

1.3 Organization of thesis and research questions

This thesis is organized around two major topics areas: 1) caribou migration, changes to caribou migration, and perceived effects of changes on subsistence hunting, and 2) the interactions of local and non-local hunters and perceived impacts of non-local activities on subsistence hunting. Following these topic areas, the thesis is guided by two overarching research questions. They are:

Question 1: How do Noatak hunters perceive changes to caribou migration and behavior and how have those changes affected their hunting?

Question 2: How do Noatak hunters perceive and experience interactions with other user groups?

This chapter includes a general introduction, problem statement for the research, and presentation of research questions. Chapter 2 provides the theoretical orientation of the study, including a summarization of relevant theory and the conceptual framework. Chapter 3 presents the methods used for the research. Chapter 4 is an overview of the study area, background on the Western Arctic Herd (WAH), and management history and current co-management structure for the WAH. Chapters 5 and 6 reports results, organized to address each of the two research questions. Chapter 7 provides discussion and Chapter 8 presents questions for caribou management and provides a concluding statement.

Chapter 2: Theoretical Orientation

2.1 Common pool resource theory and its link to traditional Inupiaq society

Common-pool resources (CPRs – also referred to as common property resources) are shared resources, defined as having a high cost of exclusion and being subject to subtractability (Bromley, 1992; Ostrom, 1990). High cost of exclusion refers to the fact that CPRs can be challenging (financially, institutionally, and/or socially), but not impossible to excluded users from that resource (Ostrom, 2009). Subtractability is a condition in which a unit of the resource used by one individual is no longer available to another user due to the limitation of the resource. CPRs can also be subject to congestion of use. CRPs can be managed through a variety of institutional arrangements, formal and informal rules that govern human behavior use of the resource and interaction among resource users (Kofinas, 2009; Schlager & Ostrom, 1992; Young, 2002). Institutional arrangements for management of CPRs are a key determinant in whether use is sustainable or unsustainable. Institutional arrangements can also be a contributing factor in users' livelihoods, well-being, and cultural survival (Kofinas, 2009). Management of CPRs is critical in the Arctic context where there is a history of indigenous resource use and land occupancy, colonialism, and contested claims over resource uses (Osherenko & Young, 1989; Spaeder, 2005). In my research, migratory caribou are considered a CPR, which has undergone unique management changes in use and access through the development of complex and sometimes conflicting land management regimes in Alaska.

Research by Ostrom (1990) and others identified eight attributes of successful CPR management systems. These attributes pertain to the Noatak case study by pointing at

potential problems areas when a diverse group of users interact, such as local and non-local caribou hunters, and highlighting how traditional resource management by Inupiat contrast with current management systems. Ostrom's attributes align with traditional Noatak hunter's use of caribou in that traditional commons use required territorial boundaries, appropriate rules of conduct, and sanctions, to manage the access and use of the resource. Current subsistence hunters must now navigate their use of the commons, such as caribou hunting through state and federal regulations, and interaction with multiple stakeholders (not just traditional users) who have a say in resource policy making. This situation does not align with traditional arrangements, thus potentially creating areas of conflict and value clashes.

Table 2.1 Attributes of successful common-pool resources	
1.	**Clearly defined boundaries** - of the individuals and the CPR
2.	**Congruence between users and resource conditions**– appropriate rules of conduct for specific attributes of resource
3.	**Collective choice arrangements** – those who use resource have some say in operational rules
4.	Monitoring – monitors are accountable to users
5.	**Sanctions** – sanctions are in place for those who break rules of use
6.	Conflict-resolution mechanisms – low-cost avenue for conflict resolution between users and officials
7.	Minimal recognition of rights to organize – rights of users to use their own institutions are not challenged by external government authorities
8.	**Nested institutions** – multiple layers within communities of users

Note: adapted from Ostrom 1990, p. 90. Those in bold are especially relevant to the Noatak case study.

A historical perspective on traditional institutional arrangements for management of CPRs, in this case caribou, provides additional and important context for local perceptions of user conflicts in the Noatak area. Erlich and Magdanz (1994) drew parallels between CPR

theory and Iñupiaq historical management of resource access and use. Understanding linkages between social rules and values, and arrangements for common-pool resource management both past and present, illuminates the relevance and complexity of traditional knowledge of Noatak caribou hunters and user group conflicts addressed in this study. Important in the dynamics of this system are traditional Iñupiat views of the commons in which there is local control of both access and resource users (Erlich & Magdanz, 1994).

Burch (1998) argued that historical Iñupiaq societies had "dominion over separate territories" (Burch, 1998, p. 8), and operated under locally designed rules of resource access and use. Burch (1998, 2006) and Ray (1967) discussed the role of distinct nations or societies in northwest Alaska, which controlled resource use in their respective territories. Hunting, fishing, and gathering practices existed in clearly defined territories, with rights to resource use based on territorial use. Decision-making occurred through councils with access and use of the resource controlled by collective arrangements (Ray, 1967). As Ray states, "the influence of their [Iñupiaq] government extended over a definitely bounded territory within which the inhabitants were directed by a system of rules and laws" (p. 373). The main method used by traditional Iñupaiq was control of access and use of resources, such as caribou harvest areas or specific rivers for fishing (Burch, 1998; Ray, 1967). Community ties, kinship, and distinct yet adaptable societies within Iñupiaq tradition controlled resource uses through decision-making, including war (Burch, 2006). An 'outsider' to a region was not allowed to simply come in a use at will. Sanctions could include having action taken against them, often in the form of punishment or even death (Burch, 2006).

The theory of common-pool resource management, as applied to traditional Iñupiaq society (Erlich & Magdanz, 1994), shows how scales of ownership over the resource, exclusion of potential users of the resource, and structured use of the resource depended on who benefited (Burch, 1998). This arrangement meant that in times of resource surplus, control of resources by Iñupiaq was adaptive, with higher degrees of sharing and trade, and allowable use of the resource by other groups between distinct Iñupiaq societies (Ray 1967). Governance of common pool resources, therefore, rested among the Iñupiaq (Erlich & Magdanz, 1994), with use rights and appropriate resource use determined as understood by local people (Schlager & Ostrom, 1992). Communal regimes functioned within Iñupiaq traditional hunting and gathering, dependent upon mutual values based in community needs of successful harvest.

Historic institutional arrangements for governance of resource use were not an open-access free-for-all, but a system based on traditional knowledge of the human-caribou system and local control in governance. These arrangements of governance by the Iñupiat today remain as elements of a worldview structured by culture and values. Including a sense of homeland and ownership over place by Noatak residents, these values underpin Iñupiat traditional ecological knowledge, and are the backdrop for the research of this project.

2.2 Traditional ecological knowledge

My research builds on and adds to the expansive and growing body of research on TEK and more specifically, TEK of caribou. Incorporating TEK in wildlife management has received much attention in academic literature and continues to be a facet of research (Eicken, 2010; Ferguson & Messier, 1997; Huntington, 2000; Huntington, 2011; Kofinas, 2005; Moller, Berkes,

Lyver, P. O. B., & Kislalioglu, 2004; Norbert, 2007; Padilla & Kofinas, 2014; Polfus, Heinemeyer & Hebblewhite, 2014). Berkes (2012) defined TEK as, "a cumulative body of knowledge, practice, and belief, evolving by adaptive processes and handed down through generations by cultural transmission, about the relationship of living beings with one another and their environment" (p. 7). Authors have identified TEK as an empirical basis for observation, "reflect[ing] an understanding of the natural world based on a massive set of scientific experiments continuing over generations" where "[people] have literally staked their lives on [TEKs] accuracy and repeatability" (Quakenbush & Huntington, 2010, p. 5).

It has been argued that TEK provides numerous kinds of utility and can play many roles in the cultural systems of Indigenous peoples (Brody, 1981; Watson & Huntington, 2008). For example, TEK has helped to assess and evaluate the dynamics of changes in social-ecological systems (Berkes, 2012; Folke, 2004; Huntington, 2011; Kofinas et al., 2010). Cases show how integrating TEK with western science in decision-making has been valuable (Moller et al., 2004; Wilson, Raakjær & Degnbol, 2006). Gilchrist and Mallory (2007) refer to TEK as "reliable data, including information collected independently from western science [can] help more informed wildlife management decisions" (p. r1). Literature on TEK, however, has pointed out that TEK, like all systems of knowledge, including western science, is limited, and the perspectives of resource users can provide information and understandings not found in scientific research (Huntington, 2000; Huntington, 2011; Russell, Kofinas & Griffith, 2000).

Research on TEK and its use into resource management systems, however, finds divergence in the literature. Authors have been critical of TEK's 'integration' with western

science, due to differing relationships of power with conflicting world views and authoritative state-dominated management institutions (Nadasdy, 1999). And still other authors have framed TEK, not as a "as a translatable knowledge about things", (Watson & Huntington, 2008, p. 257) but as inseparable from its relationship to spiritual and ethical guidelines (Alaska Native Science Commission, 2014; Fienup-Riordan, 1999; Watson & Huntington, 2008), with the integration of cultural values, belief systems, and social relations inseparable in TEK's function within a social realm (Fienup-Riordan, 1999). Other scholars of TEK have emphasized its cultural value and traditional content, inter-generational transfer of knowledge (largely by oral means) (Cruikshank, 1981; Cruikshank, 1998), and its modern development through emerging forms of communications and analysis with different media and technologies (Bonny & Berkes, 2008).

Proponents of TEK have also argued that false dichotomies exist between 'science' and traditional knowledge (Kawagley, Norris-Tull & Norris-Tull, 1998), asserting that "scientific and indigenous categories are not mutually exclusive" (Kassam, 2009, p. 182). By this definition, TEK can stand on its own, and also works to enhance western science understandings of social-ecological processes and adds a complementary informational flow between western science and traditional knowledge (Berkes, 2009b; Kofinas et al., 2001). Previous studies (Berkes, 2007; Kendrick, 2003; Kofinas, Aklavik Village, Village of Old Crow & McPherson, 2002; Kofinas et al., 2001; Parlee, Manseau & Lutsel K'E Dene First Nation, 2005) show how multiple information sources contribute to caribou management and continued engagement with communities can provide increased ability in dealing with resource uncertainty.

Documenting caribou ecology and evaluating human and environmental impacts, such as climate change, have received attention due to their focus on change to both caribou migration and hunter behavior (Jacobsen, 2011; Katz, 2010). Other studies have illustrated the importance of monitoring caribou health by using hunter knowledge to evaluate caribou body condition (Kofinas et al., 2001; Lyver, P.O.B. & Lutsël K'é Dene First Nation, 2005; Moller et al., 2004), and information about caribou health, population dynamics (Moller et al., 2004) and migration (Parlee & Manseau, 2005). Research on caribou habitat selection has also produced the "first [study] to quantitatively compare TEK-based habitat models" (Polfus et al., 2014, p. 6) with resource selection functions. Geographic Information Systems (GIS) is also being used to document and present data on caribou habitat use that produces results able to better integrate with management (Schramm, Krogman, Hudson & Freeman, 2002). TEK on caribou often occurs within a wildlife management context where resource users and wildlife managers must contend with both science and traditional knowledge, for the use of caribou by subsistence hunters. Findings from caribou TEK research illustrated the importance of the local perspective in contributing unique and diverse information to science and management. Research has evaluated caribou TEK both as a limitation to resource management due to its context-specific nature (Padilla & Kofinas, 2014) and as a means to maximize available "spatial and temporal scope" of caribou historical studies (Ferguson & Messier, 1997, p. 17).

In summary, CPR theory and TEK complement and intersect with each other through this study, with institutional arrangements for caribou management and people's knowledge of the resource both shaping the interaction of users with caribou and with among people. As demonstrated in the findings below, a greater understanding of institutional arrangements and

a local user group's knowledge system of the resource help to decipher dynamics of the social-ecological system and thus, giving insight into the nature of resource management conflicts.

Chapter 3: Study Area

3.1 Noatak, Alaska

The case study for this research is Noatak's subsistence hunting of caribou and Noatak's hunters' experiences interacting with non-local hunting activity in the NNP. People of Noatak have a long history of land use, land occupancy, and caribou hunting in northwestern Alaska, and continue primarily to harvest caribou (Burch, 1998, 2012; Foote & Williamson, 1966; Norris, 2002; Uhl & Uhl, 1979). Scant archeological evidence supports people living along the Noatak River since the fifteenth century (Burch, 1998). Pre-colonization settlements (prior to approximately 1900) included year-round settlements and seasonal camps situated in proximity of the migration patterns of game (Foote & Williamson, 1966; Uhl & Uhl, 1979). Today most Noatak residents are descendants from three groups which occupied different sections of the Noatak River, the Napaaqtuġmiut, the Nuataaġmiut, and the Nunamuit, with groups converging seasonally for gatherings (Burch, 1998; Uhl & Uhl, 1979).

Noatak was established as a permanent settlement in 1908 by missionaries of the Friends Church. The settlement of Native people in Alaska into both religiously, governmentally, and economically 'productive' communities was largely the result of government policies (Uhl & Uhl, 1979). Settlement into villages was mostly achieved by the late 1930s, with some exceptions after WWII (Norris, 2002; Burch, 1998). The Native Village of Noatak (NVN) organization was established in 1939 under the Indian Reorganization Act (IRA) and was merged under the Alaska Native Claims Settlement Act (ANCSA) with the NANA Regional Corporation in 1972 (State of Alaska, 2015). Populations of Iñupiaq pre- and post-settlement have ranged from 945 in 1850 to 290 in 1978, with the most-recent census of 2010, recording

the population of Noatak at 514 with 94.7% of residents being Iñupiat Eskimo (U.S. Census Bureau, 2010).

In the 21st century, Noatak and many other Alaska Native communities continue to rely on "subsistence hunting, fishing, and gathering for nutrition and to support their customary and traditional ways of life" (Magdanz, Braem, Robbins & Koster, 2010, p. 2). The economy of Noatak is best described as a mixed subsistence-cash economy (Foote & Williamson, 1966; Wolfe & Walker, 1987). Economic activities are predominantly based around traditional subsistence hunting and gathering, with employment centered around tribal administration, a local store, the school, and including about 25 full- and part-time residents working at Red Dog Mine, a near-by zinc-lead mine (NANA Regional Corporation Inc., 2015; State of Alaska, 2015). Air transportation is the main source of shipping goods to Noatak, replacing river barge transport in 1979 (H.W., personal communication, March 13, 2015), making access to supplies and fuel expensive. For example, in the year 2015, gas prices in Noatak were $ 9.99/gallon (E.F., personal communication, April 24, 2015) as compared to the U.S. national average in 2015 of $2.74 (U.S. Energy Information Administration, 2015).

Although there are fluctuations of use based on harvest of caribou, 79-95% of Noatak households used caribou through direct harvest or sharing between the years 2010-2011 and 2011-2012, respectively (Braem & Kostick, 2014; Mikow et al., 2014). For example, in 2007, 76% of surveyed households in Noatak had an estimated total harvest of wild foods at 144,899 edible pounds with a mean household estimate of 1,610 pounds (Magdanz et al., 2010). Residents reported caribou as the species that provided the most in edible poundage, with an estimated harvest of 60,061 lb., 32% of total harvest (Magdanz et al., 2010). Residents of

Noatak, while living inland, also retain a close link to sea mammals, indicating that, "Noatak is eclectic in the sense that we hunt beluga, seal, geese, fish, and caribou" (interview respondent #61), a community characteristic also supported by comprehensive survey results provided by the Alaska Department of Fish and Game (ADF&G; Magdanz et al., 2010; Mikow et al., 2014).

Noatak residents primarily hunt caribou of the Western Arctic Herd (WAH) in the fall and winter seasons, with some harvesting of the smaller Teshepuk Herd (TH). Fall travel by Noatak hunters is restricted mainly to the river and most local caribou harvesters employ a hunting strategy of waiting in boats and key locations on the migration route for caribou to cross the Noatak River. A few local hunters hike into the surrounding hills to hunt caribou and 'pack' the game back to the river. Winter hunting generally occurs north and north-west of the village, typically in the Kivalina Flats with use of snowmobiles for access.

3.2 The Western Arctic Herd

The WAH is located in northwestern Alaska (Figure 3.1). It is Alaska's largest caribou herd, migrating over five National Parks Units (Joly, 2012) over an area of 157, 000 square miles (Western Arctic Caribou Working Group, 2011). Adjacent to the WAH are the TH and Central Arctic herd.

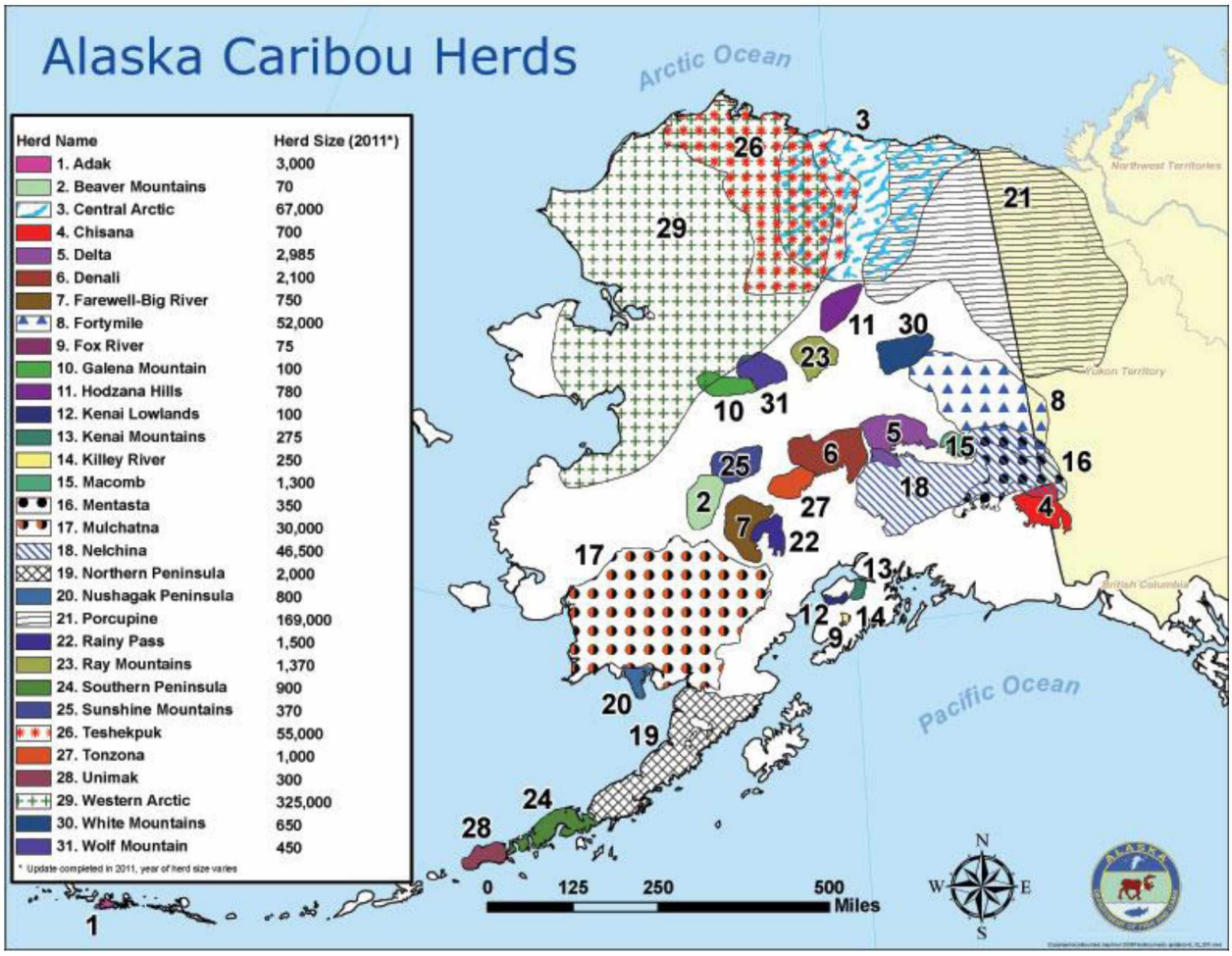


Figure 3.1 Caribou herds of Alaska. Source: www.adfg.alaska.gov

The WAH follows a northward migration in the spring (typically between April 1-June 15), and a southward migration in the fall (typically between September 1-November 30) (Joly, 2012) (Figure 3.2). Calving occurs in the spring in the Utukok Hills, with summer ranges occupying the Wulik Peaks and Lisburne Hills (Joly, 2012). Summer range movements are eastward across the Brooks Range, with fall caribou becoming the most dispersed than any other time of the year as they migrate southward (Dau, 2011). Winter ranges have included a wide expanse of land including the Seward Peninsula, the Nulato Hills, the upper Koyukuk River, and areas of the North Slope (Joly, 2012). In addition, peripheral range included those collared

caribou that have been detected to have migrated farther than typical areas, expanding into other regions (Dau, 2011).

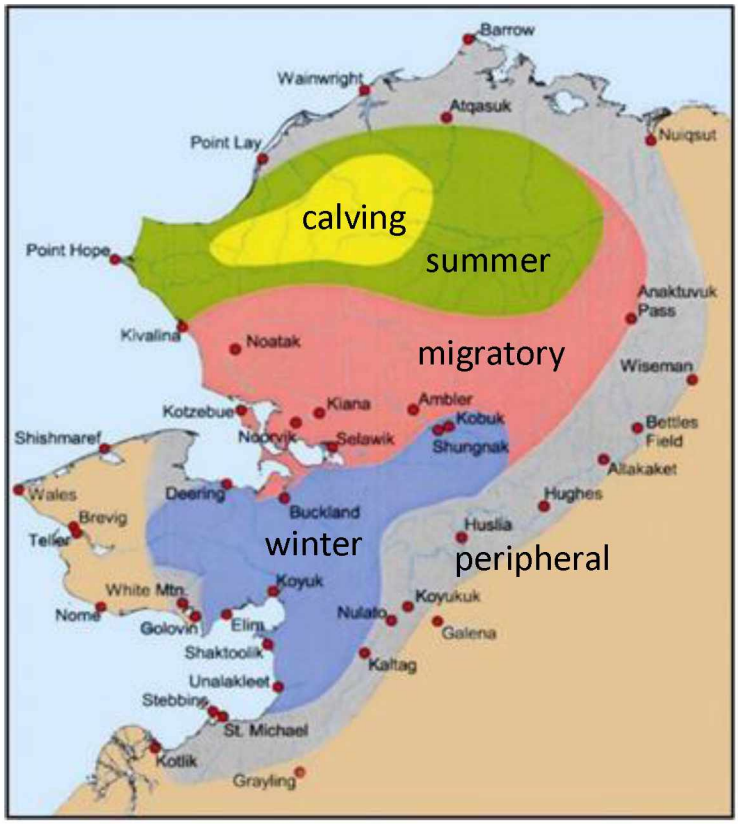


Figure 3.2. Range of the Western Arctic Caribou Herd. Source: www. adfg.alaska.gov

The TH, although less frequently harvested by Noatak hunters than the WAH, has its range sandwiched between the WAH and the Central Arctic Herd with some overlap with the WAH. TH caribou have been detected over-wintering in WAH range, with some collared TH caribou having joined breeding groups of the WAH (Person et al., 2007). Radio-collar data have shown that caribou of near-by herds, or over-lapping ranges will sometimes occupy a neighboring range, but these cases are generally considered anomalous with the vast majority of caribou retaining fidelity to calving grounds (Valkenburg, 2011). In addition, WAH caribou

have also been joined by domestic reindeer due to the expansive nature of herd ranges, both wild and domestic (Mager, Colson, & Hundertmark, 2013).

Since the early 1970s, biologists have documented increases and decreases in the population of the WAH (Figure 3.3). The herd was estimated at a low in 1976 of 75, 000 animals, which was contrasted with a steady growth and peak of 490,000 animals in 2009 (Dau, 2011). The WAH has since declined to 235,000, according to the most recent July 2013 census (ADF&G, 2014). As illustrated in Figure 3.3, the accuracy of low population levels in the mid-1970s was a source of disagreement and conflict between Alaska rural residents and agency biologists, as many local residents dismissed the accuracy of census counts by agencies (Klein, Moorehead & Braund, 1999; Kruse, Klein, Braund, Moorehead & Simeone, 1998).

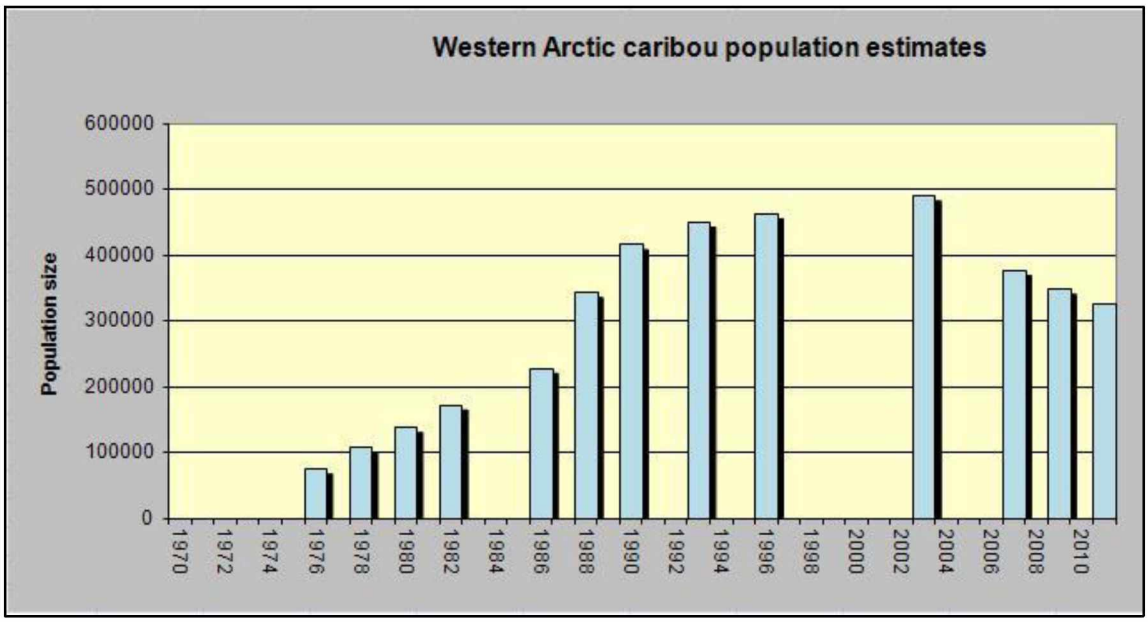


Figure 3.3 Western Arctic caribou population estimates. Source: Dau, 2014

The recent population decline has been attributed to reduced calf production, calf survival, range condition, parasites and disease, and harvest, among other reasons (Dau, 2011). About 14, 000 caribou from the WAH were harvested in 2013-2014, and roughly 10, 100

harvests from Unit 23 by resident hunters (Dau, 2014). Non-local or nonresident hunters typically harvest about 500-800 caribou from Unit 23 (Dau, 2014).

3.3 Caribou co-management

Co-management is the sharing of power in decision making on a resource between users and managers (Pinkerton, 2011) and can take many forms (Berkes, 2009a). Caribou co-management in northwest Alaska was largely initiated by the crash in population of the WAH in the late 1970s, which prompted area biologists and managers to heavily restrict local harvest of caribou (Klein et al., 1999; Kruse et al., 1998; Usher, 1995). Many Alaska Native hunters of the WAH range disagreed with the accuracy of the population census of 75, 000 caribou, which resulted in subsequent years of distrust and disagreement between caribou users and agency managers of the WAH (Kruse et al., 1998). Development of a cooperative management group for the WAH began in the late 1990's, following exploratory state-wide workshops on wildlife and harvest co-management (J. Kruse, personal communication, November 5, 2013). These were further motivated by an apparent and growing rifts between Alaska Native and non-native users, and state and federal agencies (J. Trent, personal communication, December 2, 2013). In 1996 a conference was held called, *Understanding Harvest Assessment in the North*, which initiated proceedings of a co-management framework for caribou in Northwestern Alaska (Trent, Kruse & Leask, 1996). As a result the Western Arctic Caribou Herd Working Groups (WACHWG) was formed, which created a formal cooperative multi-stakeholder body of user groups to review and provide advice on caribou management policy for the herd. The initial Caribou Cooperative Management Plan was written in 2003, and revised in 2011 (Western

Arctic Caribou Working Group, 2011). The WACHWG is comprised of a 20-seat members board, including subsistence hunters, conservationists, an aircraft transporter representative, hunting guide's representatives, and a member of the Reindeer Herders Association, and meets annually. Agency staff sit as observers and not as formal committee members. As a part of the arrangement, a Technical Committee of biologists and managers also meet to advise on technical issues related to herd management.

The WAH Cooperative Management Plan contains a purpose statement, which supports, "working together to ensure the long-term conservation of the Western Arctic caribou herd… [and] to maintain the traditional and other uses for the benefit of all people now and in the future" (Western Arctic Caribou Working Group, 2011, p. 1). Two principles to the plan are relevant to my research; 1) "Recogniz[ing] the centuries-old customs, traditions, and spiritual needs that have developed in communities within the range of the herd", and 2) "Bas[ing] management decisions for the herd on scientific knowledge, traditional ecological knowledge of Alaska Native users, and knowledge of all users" (Western Arctic Caribou Working Group, 2011, p. 3). Documenting TEK and understanding its legitimacy as a way of knowing, aligns with the purposes as outlined in the management plan for the WAH.

3.4. Relevant legislation and access regulations

Relevant to my research is the legislation and definition of subsistence in Alaska. The discovery of oil at Prudhoe Bay in 1968 precipitated finalizing the question of Alaska Native land claims. The Alaska Native Claims Settlement Act (ANCSA), passed by the US Congress in 1971, extinguished all aboriginal title and claim to land and resources (including hunting and fishing

rights) and granted Natives 44 million acres, one billion dollars in compensation, and the establishment of 12 regional Native corporations, with the main intent of "provid[ing] a vehicle with which Alaska Natives could determine their own path into the corporate economy" (Catton, 1997, p. 81). In 1978, the State of Alaska enacted its first subsistence law, which stated that subsistence uses were to be given preference over other consumptive uses, such as commercial or sport, but did not define who subsistence users were (Norris, 2002). The Alaska National Interest Lands Conservation Act (ANILCA), passed by Congress in 1980, established federal land holdings and included recognition of subsistence for 'rural' users. The provision of ANILCA was a compromise with Alaska Natives, since a preference based on ethnicity would not have been carried out by the State of Alaska (Catton, 1997). After the passage of ANILCA, the State of Alaska also adopted rural subsistence preference, which was upheld until 1989. In that year and as a consequence of court rulings questioning Alaska state constitutionality of the rural preference, the Alaska Supreme Court struck down the state subsistence law as unconstitutional and thus, the State of Alaska went out of compliance with federal subsistence legislation (Norris, 2002). This outcome was due in large part to pressures and anti-subsistence coalitions formed largely by urban sports hunting and fishing interests, and legally in the court case of McDowell v. State of Alaska (Norris, 2002). While the State of Alaska was no longer in compliance to federal subsistence rural preference, it retained preference for subsistence *uses* without regard to their geographic residence in Alaska, and therefore ruled that *all* Alaskan residents could qualify as subsistence users (Norris, 2002).

As a result of legislation, dual management in Alaska means that state and federal regulations define subsistence users differently. The dual management system of the State of

Alaska and the federal government now authorize multiple users with state regulations applying to state lands and federal applying to federal lands. Both systems have slightly differing definitions of subsistence, but generally subsistence is defined as, 'customary and traditional' use of resources, which exclude commercial or sport use (Fall, 1990). Additionally, Alaska remains a destination for non-resident hunters seeking wilderness and hunting opportunities. Some federal park and preserve lands have also allowed use of recreational hunting in Alaska, which differs from some other national preserve lands outside of Alaska. In the case of the NNP, the National Park Service (NPS) has provides hunting opportunities to both local people and their "11, 000 year old subsistence way of life", and non-local people who wish to hunt and recreationally use the Preserve (National Park Service, 2009, p. 9). Due to the mosaic of land ownership in Alaska, interactions or convergence between rural and urban hunters, resident and non-resident users, and Alaska Native and non-natives continues to exist.

In the case of Noatak, research on user interactions was used to establish a controlled use area (CUA) between local and non-local hunters (Georgette & Loon, 1988). The ADF&G submitted proposals to the Alaska Board of Game, based on the research done by Georgette and Loon (1988) in order to establish some access controls between hunters. The Noatak CUA was expanded in 1994 and is represented by the pink polygon (Figure 3.4).

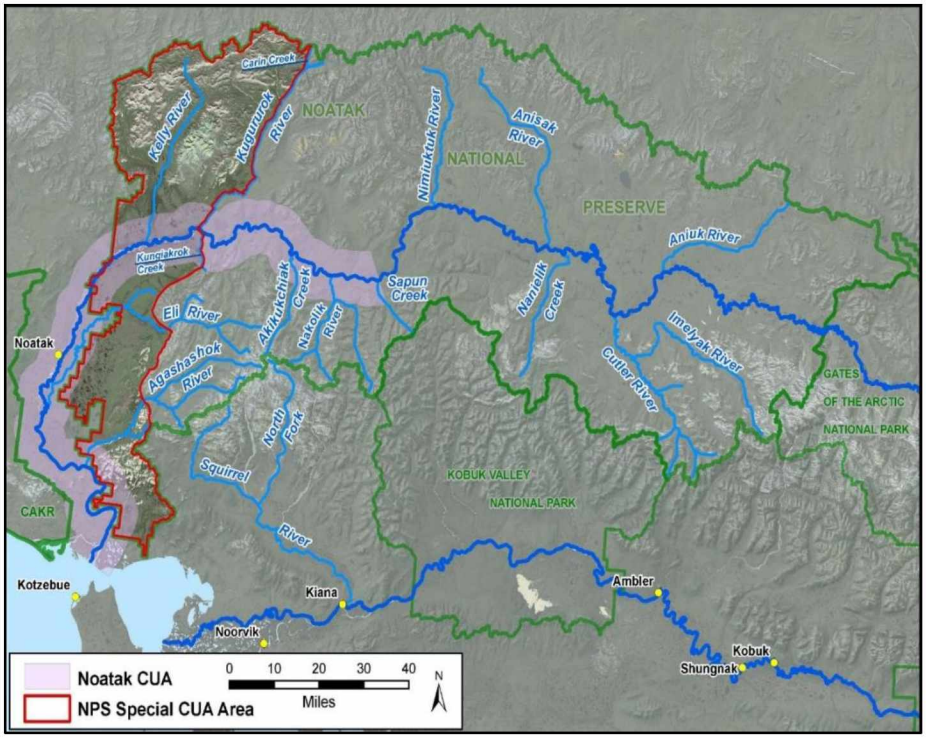


Figure 3.4 Village of Noatak, Alaska and the Noatak National Preserve, including the Noatak Control Use Area and the NPS Special Commercial Use Area. Source: National Park Service.

This area, the Noatak CUA, is designated closed for a five-mile corridor, on either side, of the Noatak River for aircraft from August 15th to September 30th. Specifically aircraft, which is used for big game hunting, including the transportation of big game hunters, their hunting gear, or parts of big game, except between publicly own airports, is constrained in this zone (Noatak CUA: Figure 3.4). Additionally, the National Park Service established a Special Commercial Use Area (NPS Special CUA Area: Figure 3.4) to also limit interactions between local and non-local caribou hunters, represented by the red outlined polygon. This controlled area specifically targets non-local caribou hunters arriving by aircraft, which allows access only after September 15th, unless specified by the NPS Superintendent for Western Parklands (National Park Service, 2014a). This zone has also been referred to as a 'delayed entry zone' where the Superintendent may consult with commercial operators, other agencies, and local villages to offer earlier or

delayed caribou hunting access in the area for non-local hunters, depending on the WAH migration in a given year.

Evaluation of subsistence legislation is important to understand, as both state and federal land jurisdiction protect subsistence practice in different ways. Provisions in place for local subsistence hunters, on either federal or state land, such as the Noatak CUA, may indicate that local issues are being addressed. But despite some changes to access and resource use, user conflicts continue despite zones and other access control issues. Understanding traditional and cultural values can increase awareness of local people's connection to not only a resource, such as caribou, but the ways in which access and use of the resource may impact their perception of other users.

Chapter 4: Methods

4.1 General overview

This research used a mixed methods approach (Creswell, 2013) and community engagement, including participatory methods, surveys of Noatak hunters, semi-structured interviewing of caribou experts, and participant observation. The project was undertaken in several stages, an initial period of planning and trust building, interviewing, analysis, and reporting.

The initial stage of the study included visits to present information and gain approval for the project from the Noatak Village Council. During this time I conducted informal interviews with elders of Noatak about caribou for general background information and pilot-tested the survey instrument.

Research methods for this project were reviewed and granted Human Subjects approval by the University of Alaska-Fairbanks Institutional Review Board (Appendix A), the US Office of Management and Budget, the Northwest Arctic Borough, and the Native Village of Noatak (Appendix B).

Community involvement was undertaken using several approaches. Communication to residents included informational posters and village radio (house-to-house VHF radio). A local three-person project steering committee was established to give feedback on the research instruments, to identify respondents, and provide general guidance in the research process. Numerous update meetings were held, including a community informational meeting about the project to answer question and later, to thank survey participants.

Data collection and participant observation occurred over a two-year period between 2012 and 2014. Participant observation occurred through daily activities, which allowed for increased understanding of the "physical, social, cultural, and economic contexts in which study participants live" (Mack, Woodsong, MacQueen, Guest & Namey, 2005, p. 25). I spent about 7 weeks total in Noatak, over 4 different time periods, forming relationships between community members, and research participants. Being able to observe and participate in community life expanded the "iterative research process" (Mack et al., 2005, p. 32), meaning that interview topics and framing of interview questions were shaped by the time spent in Noatak.

I used two different types of instruments to collect data 1) the Active Hunter Survey (Appendix C), conducted in November of 2013, and 2) the Knowledgeable Hunter Interview (Appendix D), with participatory mapping conducted in February 2014.

4.2 The Active Hunter Survey

The objective of the Active Hunter Survey was to document a variety of perceptions and experiences of a large number of caribou harvesters in Noatak. This survey documented local hunter's behavior, such as seasonal hunting patterns, perceptions of impacts to hunting, perceptions of impacts to caribou, encounters with other users, and perceptions of the efficacy of management agencies to Noatak hunters. Active hunters were defined as anyone over the age of 18 and having hunted three seasons out of the last four years. The survey was divided into 12 categories (Table 4.1).

Table 4.1 Active Hunter Survey

1. Demographics
2. Personal hunting history
3. Concepts of hunter success
4. Information about "last years" caribou hunting
5. Changes to caribou & hunting in the "last 5 years"
6. Cost of fuel affecting caribou hunting
7. Perceptions of negative impacts to caribou migration & caribou hunting
8. Perceptions of caribou population & migration change
9. Encounters with other users "last fall"
10. Locations of positive & negative encounters with other users "last fall"
11. Knowledge of caribou management & the Western Arctic Caribou Herd Working Group
12. Open-ended questions on suggestions for management improvement of caribou & non-local hunting

Selection of potential respondents was compiled by members of the local steering committee. A list of potential active hunters in the community was generated by committee members. Each list was corroborated between each member. I then deleted those on the list agreed by all three committee members who were no longer actively hunting (e.g. older individuals), had moved out of town, or were under age. Survey respondents were paid $50 for each survey completed and the survey took roughly 30-60 minutes to complete. Extensive note-taking was used to record open-ended question responses.

4.3 The Knowledgeable Hunter Interview

The Knowledgeable Hunter Interviews were semi-structured and conducted over a two-week period in Noatak in February 2014. The objective of these interviews was to capture stories and descriptions from both active and non-active hunters, such as elders, considered in the community as 'experts' (Table 4.2). The Knowledgeable Hunter Interview incorporated

participatory mapping (Bryan, 2009; Lynam, De Jong, Sheil, Kusumanto & Evans, 2007; Tobias, 2000, 2009) to spatially locate knowledge about caribou behavior and caribou hunting to create a broader story of general caribou knowledge and hunter experience.

Selection of respondents was based on a grouped system. The project advisory committee individually grouped all previously surveyed active hunters, as well as compiled a list of elders who were not captured in the survey due to inactive hunting. Group one had names agreed upon by all three advisory committee members. Group two had the names of those where two committee members agreed upon potential respondents. Group one was contacted first, then Group Two people were contacted. A sample profile was identified of at least 20% elders (>65 years of age), 60% adults (30-65 years of age), and 20% young adults (18-29 years of age). One elder's interview was removed from the data because he did not understand the questions. This was determined by myself and the interview assistant when we realized that he was not able to make logical sense of the questions we asked.

Table 4.2 Knowledgeable Hunter Interview

1. Hunter's information • First caribou hunt • Teachings about caribou
2. Lifetime & five-year use areas
3. Caribou • Seasonal behavior (fall, winter, spring, summer) • Ecologically important areas for caribou • Body condition, health & population • Predation • Other disturbances
4. Caribou hunting use areas and hunter interactions and locations • Local hunters • Non-locals • Guides • Transporters
5. Ideas for improved management on caribou & caribou hunting
6. Use of traditional ecological knowledge in decision-making & management
7. What to communicate to the public about caribou & caribou hunting

The two methods of mapping included use of a digital (touchscreen) and hand-drawn maps on plastic clear sheets (Grafix Dura-Lar Polyester Film Rolls), depending on spatial scale and ease of use for each respondent. The interviews were recorded with a digital audio-recorder as well as a video camera. All interviews were transcribed.

Longer quotes in the results chapters are all from the Knowledgeable Hunter Interviews, including two tables which used descriptive narrative to organize responses thematically (Table 5.4 and 6.4). Qualitative data contained in the remainder of tables are from open-ended questions from the Active Hunter Survey (Tables 5.2, 5.3, 6.1).

4.4 Historian interviews

Additional data for this project were gathered by interviewing select 'caribou historians', those who are currently or previously were involved in research of the WAH or herd management, managers of state and federal agencies located in the northwest region, Alaska Native members who served on various advisory boards, and WACHWG members who have worked in various state or federal agencies. A total of eight interviews were conducted between 2013 and 2014, and interviews lasted from one hour to five hours. These interviews helped to inform a greater understanding of caribou ecology and management context in the northwest Arctic. Historian interviews were coded using Atlas.ti (version 7.0.77, Atlas.ti GmbH, Berlin, Germany).

4.5 Elder's filming project

As a part of the overall ethnographic and exploratory nature of this research it was important that I spend time in Noatak, to get to know residents, and build a basis for a trusting work relationship. In October of 2013 I filmed 13 elder's talking about their lives and the importance of caribou, in a setting chosen by each individual. Interviewing elders proved to be an invaluable experience from which grew community connections, my own knowledge of the system, and trust between community participants and myself (the researcher). Wilson (2008) writes, "What I've learned from Elders …is that focusing on the positive in Indigenous research focuses on harmony. It forms a relationship that pulls things together" (p. 109) and that building relationships, especially with Elder's in a community is about "enter[ing] into conversation" (p. 113) with the greater community. Following some of the guidelines of Indigenous methodology, I found that trust and openness were guiding principles for my

research. The videos are not included as part of this thesis, but were part of the research process. Each video was individually edited and given to each elder and their family, as well as entire sets given to the Noatak Tribal Council (IRA), the Noatak high school, the Northwest Arctic Borough, and the National Park Service.

4.6 Data analysis

Analysis of quantitative data used Microsoft Excel Version 2013 (Microsoft, Redmond, Washington) and IBM SPSS 22.0 (IBM Corp., Armonk, NY). Frequencies of data were calculated for all responses. Cross tabulation analysis was used to identify possible links between categorical variables and variability among types of respondents.

Qualitative data from the Active Hunter Survey were entered into Microsoft Excel Version 2013 (Microsoft, Redmond, Washington) and then coded in Atlas.ti. Codes were generated using an open coding method (Elo & Kyngäs, 2008; Fonteyn, Vettese, Lancaster & Bauer-Wu, 2008) and organized thematically. Coded responses were used to provide insight and highlight related quantitative questions though narrative. Sub-codes under these themes were developed for a more specified and focused list of content. The Knowledgeable Hunter Interview transcripts were exported into Atlas.ti and open coded with sub-codes as well.

Spatial analysis occurred in ArcMap Version 10.2 (ESRI, Redlands, California). All transparency maps were scanned and digitized and joined, with each corresponding digital version per respondent. All maps were drawn using three feature classes available in ArcMap, which consisted of points, lines, and polygons.

Specific methods for mapping included mapping caribou movements and locations, predation, and hunter use areas. Nineteen respondents provided locations on current fall migration routes and fourteen respondents provided information on past fall caribou locations. Respondents were not limited to a pre-determined time-frame of caribou migration in the 'past' as questions were open-ended and interpreted by each respondent in their own manner. Caribou migration features included both directional lines and land-use polygons, where caribou are known to travel, move through, or stay during fall time.

In order to visualize and understand user interactions better, we mapped Noatak hunters' five-year use areas for caribou and areas of interaction with non-locals and aircraft. Nineteen respondents reported both their five-year use areas and lifetime use, with multiple areas identified by respondents. Non-local activity included aircraft transporters landing/taking off on gravel bars, areas where a local hunter encountered aircraft flying overhead, on-the-ground hunters, camps of non-locals, and other observed activities of non-local hunters. Transporters were specifically aircraft oriented encounters. Non-local hunters were on-the-ground caribou hunters and their camps or other activity, such as floating the Noatak River.

Frequency of encounters by local hunters with others was evaluated for the fall 2013 hunting season. Criterion of fall encounters was used as it is considered the main convergence period between local and non-local hunters in the NNP (Georgette & Loon, 1988; Jacobsen, 2008). Mean encounters were calculated from all survey respondents who hunted in fall 2013, with maximum encounters being a single respondents' account.

The "quality" of the hunting experience, as perceived by local caribou hunters, was measured by asking about several aspects of the hunting experience, including harvest success, seeing other locals hunting, spending time with family or friends, spending time on the land, among other reasons. Success in harvest was further explored because it is a critical element of subsistence. This evaluative framework was based on the idea that a hunt may have low harvest success, but high quality in other areas, such as an individual teaching family members camping or hunting skills or spending time out on the land. Respondents evaluated quality of the hunting experience and success in harvesting on a 5-point scale of reduction or improvement, which I then pooled. The pooled responses are as follows; 'greatly reduced' and 'somewhat reduced' became reduced, and 'slightly improved' and 'greatly improved' became improved.

Many community members spoke to me during my time spent in Noatak about changes to caribou migration, which led me to include questions on potential negative impacts to caribou. For questions regarding negative impacts to caribou migration or caribou hunting, respondents ranked variables on a five-point scale (low, medium, high, no negative impact, or do not know). Negative impacts are defined as conditions, such as human activities or the presence of predators that alter caribou movements from what locals define as their 'typical' migration routes or behavior.

4.7 Limitations of methods and challenges

All participants spoke English and no language translation was needed when administering the survey or mapping interviews. Regardless of our common language, it is

noteworthy that some level of cross-cultural difference did exist between the researchers and residents of Noatak. From my perspective, language and cultural understandings (norms, cues, and ways of speaking) likely played a role in understanding both the questions asked and answers delivered. Respondents were given the freedom to speak as much or as little as they wanted.

The survey was pre-tested with three community members and hunters in May 2013 with additional invaluable feedback received by the time it was administered (November 2013. Due to time and funding constraints of the project, the survey thus went through only one community feedback session. Within the survey, for example, question #7 asks: 'I will read you a list of events, please tell me which scenario represents a successful caribou hunt for you?' The choices vary, but the wording of answer 'h': 'Not seeing non-local people while hunting', confused participants and the accuracy of results may have been affected by the lack of clarity from both participants and my own communication or explanation of the question.

Several survey questions depended on accurate re-call of number of hunter encounters a participant had experienced, as well as other frequency-based questions, such as time on land, number of trips, and so on. Temporal re-call, however, comes with its own set of assumptions about how well a participant can re-call events from the past. Acknowledging the limits to this method assumed variance in respondents' recall.

Lastly it was challenging to communicate some concepts and terms in English. The term most questioned by respondents was 'management'. This term seemed to invoke multiple meanings. Re-wording the question was necessary and sometimes a small discussion of what I meant was needed so the respondents would grasp the question's meaning. Similarly

participants were often unable to distinguish between different state and federal agencies and the roles they play locally, which made certain questions in the survey difficult to answer.

Time was also a limiting factor. Hearing place names and stories from the land is a powerful experience, but having the opportunity to actually see the land and experience it with people carries with it a completely different connection. Because this research was not ethnographic in its approach, my time in the community was limited, which may have affected some individuals' willingness to participate in interviews.

Chapter 5: Results: Perceptions of Changes to Caribou

5.1 Respondent demographics

A total of 113 people were identified as active hunters in the community. Out of that pool, three people were away at work or camp. Response rate was calculated as the number of completed surveys out of the total number of eligible respondents (Vaske, 2008). Forty-eight individuals declined to participate when asked, for a response rate of 56%.

The Active Hunter Survey respondents were between the ages of 18 and 78, with the highest percentage of respondents in the 25 to 49 category. A breakdown of respondents' age and sex is found in Table 5.1

Table 5.1 Demographic percentages of survey respondents

Age Class	Sex		Total %
	Male	**Female**	
<24	16	0	16
25-49	37	11	48
>50	29	7	36
Total %	82	18	100

The Knowledgeable Hunter Interview respondents were initially identified from the survey pool and included 17 men and three women. Three additional names, those of elders, were added to the Knowledgeable Hunter Interview as they were no longer 'active hunters', so were not selected from the survey pool. The sample of respondents matched values pre-established to achieve a cross section of age groups. Four elders (20%), 12 adults (60%), and four young adults (20%) were estimated demographic groups. Seventy-five percent of

respondents came from Group One, with the remainder of 25% coming from Group two. Other demographic data on respondents for this survey, such as place born, and employment, are found in Appendix E.

5.2 Introduction

Part of my research focused on perceptions of change to caribou, based on local hunters' knowledge. Changes to caribou and hunting were a central component in discussion with local users, and my research on change reflected the importance of this feature in daily subsistence practice.

Respondents reported on their perceptions of population change for WAH (Figure 5.1), with 42% of respondents indicating that caribou population had decreased in the last ten years. Almost as many respondents, 36%, reported they were unsure ("do not know") of herd population change, with a much smaller percentage, 8%, indicating a population increase. Fifteen percent reported no change in caribou population.

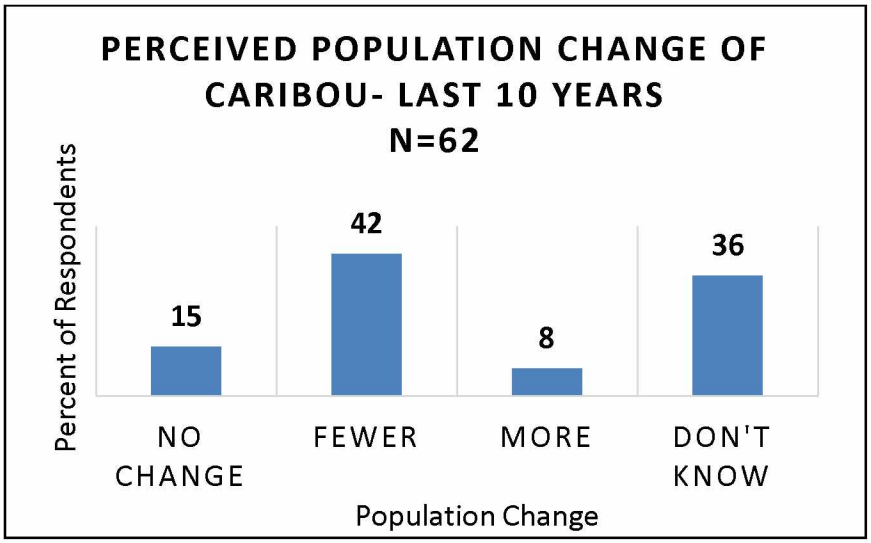


Figure 5.1 Respondents perception of caribou population change

Respondents reported several explanations of why the population of caribou has changed. Themes indicate both the cause of change and why respondents held their perception, including the source of information that informed their perception. Qualitative narratives regarding population change were organized thematically (Table 5.2).

Table 5.2 Themes related to caribou population change in the last ten years

Population Level	Reason	# of Respondents*
Fewer Caribou	Weather & Climate Impacts	n= 9
	Sports Hunters & Planes	n= 7
	Caribou in Smaller Groups	n= 6
	Caribou Have a Natural Cycle	n= 5
	Predators	n= 4
No Change	Numbers are Steady	n= 5
	Caribou in Smaller Groups	n= 1
More Caribou	Agencies Communicate Increase in Population	n= 2
	Caribou Mating with Reindeer	n= 1

Notes: Do not know (fewer caribou) n= 7; Do not know (no change) n= 4; Do not know (more caribou) n= 1. Do not know (no response) n= 22. *Respondents may have had more than one answer.

Some respondents explained that changes are a part of nature and represent the normal caribou cyclical fluctuations of a caribou herd population. As respondents indicated, elders have told them that population 'crashes' may occur before recovering again.

> "[Caribou] will go way up and crash. Probably a cycle. The old timers I know they got stories of how hard it used to be to get caribou."
>
> *(Respondent # 8)*

Bears, wolves, and human hunters were reported to be on an increase in the Noatak River area by most respondents, which were thought to be reducing caribou numbers. Respondents reflected on why wolves and bears were increasing in the Noatak River corridor, and most agreed that decreased hunting of predators by both locals and non-locals had increased predator populations. As one respondent noted, 'no one hunts [predators] anymore', including locals and registered hunting guides that used to hunt along the Noatak.

> "It's [the caribou population] been declining every year. Mostly [because of] hunting and predators. That's what causes decline. That's more hunting and more predators today than twenty years ago. They don't give the caribou enough time to multiply."*(Respondent # 16)*

Climate and weather impacts were reported as drivers of change as well, with respondents indicating that warming temperatures and a changing Arctic climate are negatively impacting caribou numbers.

> "It's just how bad our snow fall is for the winter…if they run out of their food there, they go find another place to eat and sometimes where they go find another place to eat, the snow gets blown there. So, they have to dig through the snow to get to it."*(Respondent #2)*

Respondents who reported an increase in WAH population also said that numbers can fluctuate, but that the herd was still on the increase. Two respondents noted that information on caribou population increase came from local wildlife management agencies. Those respondents who indicated they had not seen a change in caribou population, stated they were seeing caribou move in smaller size groups but hunting remained successful.

5.2.2 Perceived changes to caribou migration

Changes to caribou migration focused exclusively on fall migration change. For instance, respondent #62 spoke of the past as the last five years, when he changed his hunting pattern to reflect where caribou have been migrating through;

> "I'm sure they still cross up the Noatak, but they've been coming down all the way to the mouth even. I've hunted down there in the last five years." *(Respondent #62)*

Respondents also reported that caribou used to be closer to the village, predominantly located across the Noatak River from the village site.

> "They're not coming through the flats [across the village] like they used to. These were like 20 years ago, they were close." *(Respondent # 16)*

Respondents mapped both current caribou fall migration movement as well as past areas caribou were seen in more frequently (Figure 5.2). As respondent #20 reported, caribou continue to travel all over with multiple crossing through the Noatak River and its' drainages.

> "In our area...not dramatic changes. It might be four or five miles upriver or downriver...ten miles, twenty miles, maybe a hundred. It's always along the river." *(Respondent # 20)*

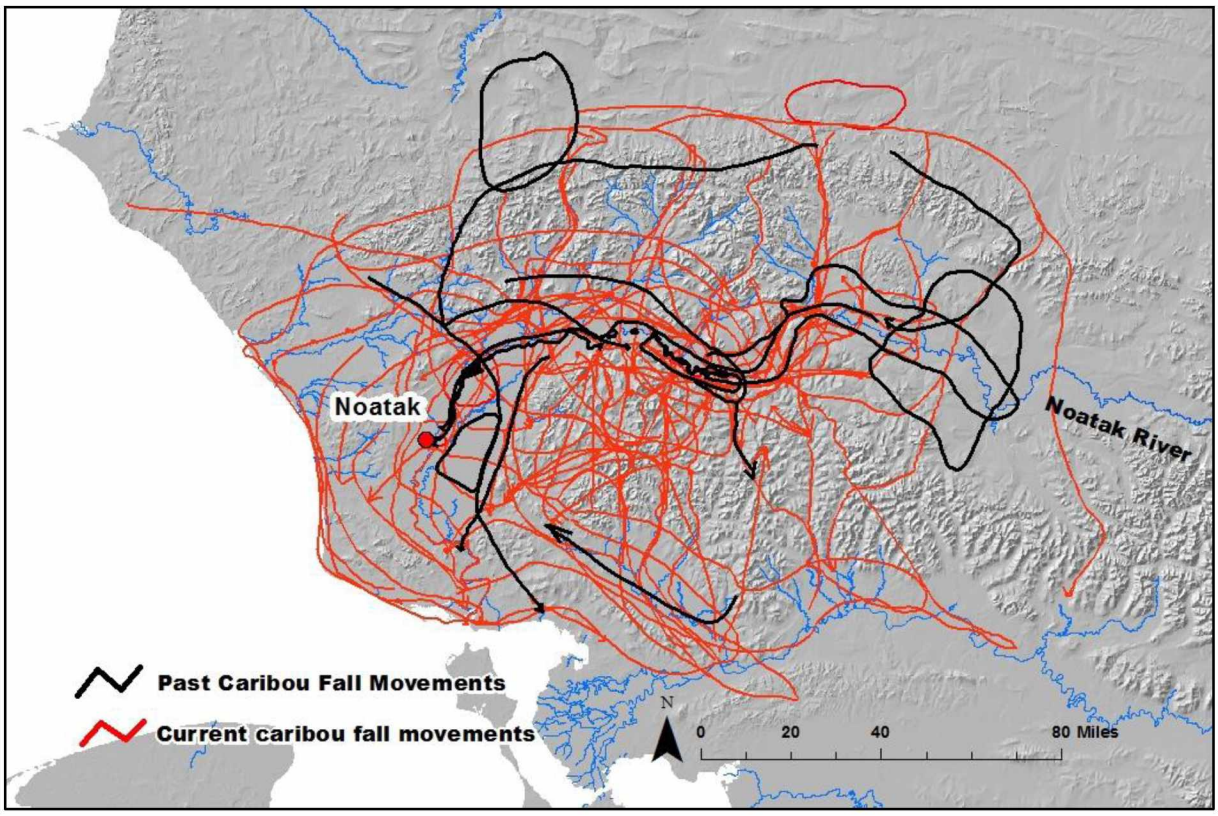


Figure 5.2. Current and past caribou fall migration movements as reported by Noatak respondents.

Mapping of past and present migration movements revealed that current caribou fall migration patterns were reported as throughout the Noatak River region, its drainages, and the surrounding landscape. Fall current migration appeared to funnel through river valleys, the outer edge of the Noatak River, with crossing locations scattered across the River. Coastal movements are also present with a funneling southward towards the Kobuk River. Fall migration characterized as past movements were supplied by only 74% of respondents, leading to less marked locations than current migration lines by 100% of respondents. In this case no

major migration corridors for past caribou movements were reported, except along the Noatak River.

More respondents indicated having a knowledge of caribou migration change, than a knowledge of caribou population. A majority of respondents, 57%, reported that caribou migration has changed considerably ('a lot') in the last ten years (Figure 5.3). Thirty-four percent stated that caribou migration had changed 'a little', with only 7% reporting that they either did not know (7%), or believed there has been 'no change' (3%).

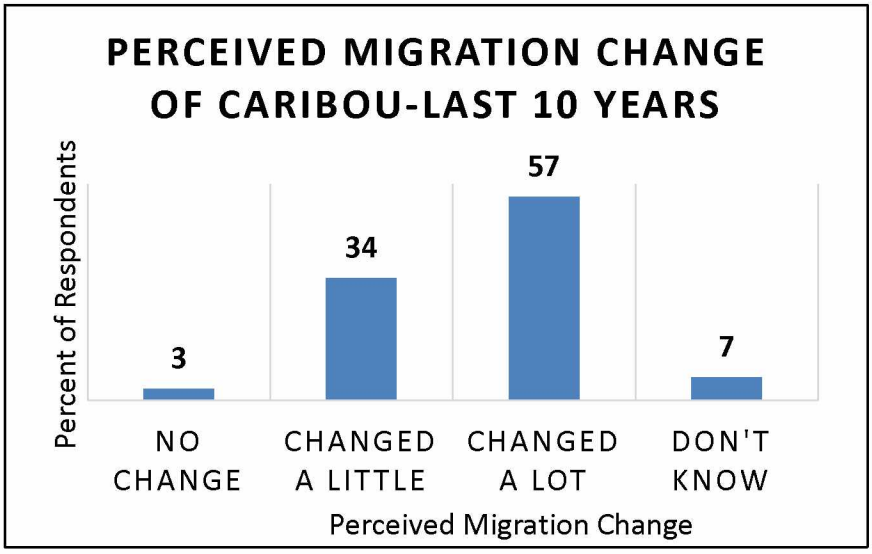


Figure 5.3 Respondents perception of caribou migration change

Respondents indicated a number of reasons for caribou migration change (Table 5.3). Four themes were shared between responses for changed 'a little' and 'a lot'. For example, 'Weather and climate impacts' and 'Sports hunters and planes' were reported under both responses.

Table 5.3 Themes related to caribou migration change in the last ten years		
Migration Change	Reason	# of Respondents *
A little	General Migration Change	n= 9
	Migration is Later	n= 9
	Weather & Climate Impact	n= 8
	Sports Hunters & Planes	n= 6
	Fires	n= 5
	Caribou Food Impacts	n= 4
No Change	Only timing of migration has changed	n= 1
A lot	General Migration Change	n= 21
	Sports Hunters & Planes	n= 17
	Weather & Climate Impacts	n= 13
	Predators	n= 5
	Caribou Have a Natural Migration Cycle	n= 3
	Red Dog Road	n= 3

Notes: Do not know (little) n= 1; Do not know (no change) n= 1; Do not know n= 4.
***Respondents may have had more than one answer.**

Reports of 'general migration change' included comments on caribou using different routes than in the past, caribou crossing at locations further up river, and caribou seen further from the village than roughly ten years ago.

> "Early in September we [would] get caribou, but now it's later, like October or November. It's been set back. That's why we say change. We don't get them like we used to in September. Usually, a couple weeks after school or Labor Day we get caribou; now it's later than that." *(Respondent #22)*

> "Yeah, ten years ago it was like a north, south trend. But, these past few years an east, west trend is how they are traveling."*(Respondent #16)*

Similarly to caribou population change, predators, weather and climate, and human disturbances were perceived to affect migration.

> "We got so many wolves, so many bears and sport hunters for the bears, so a lot of the migration routes change from the pressure of the predators." *(Respondent # 2)*

Weather and climate were described as affecting how caribou move and how the changing weather is 'fooling' the animals. Caribou were reported to move through Noatak River drainages and other major caribou crossing corridors later in the fall season. Respondents indicated that caribou move south from the North Slope later in the fall season as weather is staying warmer longer (thus caribou may avoid insect harassment longer by staying in cooler northern regions), and that caribou may wait for firmer ground to travel, which is happening later in the fall season as well, due to later freeze-up.

> "From what I understand, it's temperature. When it's too warm, they won't move. Soon as its starts getting cool enough for them to travel, they're moving." *(Respondent # 61)*

Aircraft use along the Noatak River was perceived to be changing caribou migration. Behavior of aircraft was perceived to disturb caribou by not 'letting caribou cross' the Noatak River. This was described as 'scaring' or 'pushing' caribou from the river to the upper hills and mountains, aircraft landing along migration routes, and sports-hunters seen camping along migration routes. In general non-local or big-game hunters' presence and behavior were reported to be influencing where caribou cross the Noatak River. One hunter stated:

> "They [sports-hunters] go all over. They [transporters] drop them off I guess. I've seen people walking way up river. On the mountains. They walk all over. That's one of the main reasons that caribou change migration. Too much traffic." *(Respondent # 58)*

Additionally, respondents indicated that vegetation growth for caribou is changing, which is impacting migration and areas that caribou inhabit.

> "When they've eaten up their food supply in a certain area or I guess it could have a bad lightning fire and they had to move because there's no food growth or cause the way I heard that lichen take years and years to come back." *(Respondent #2)*

Survey respondents who reported no change in caribou migration (3.2%), explained that timing of migration has changed, but not the migration routes.

5.2.3 Variables impacting caribou migration

Respondents ranked fourteen different potential impact variables to caribou migration. The highest ranked as having a high negative impact are small airplane activity, non-local hunters, predation by wolves and bears, climate change, and habitat change (Figure 5.4).

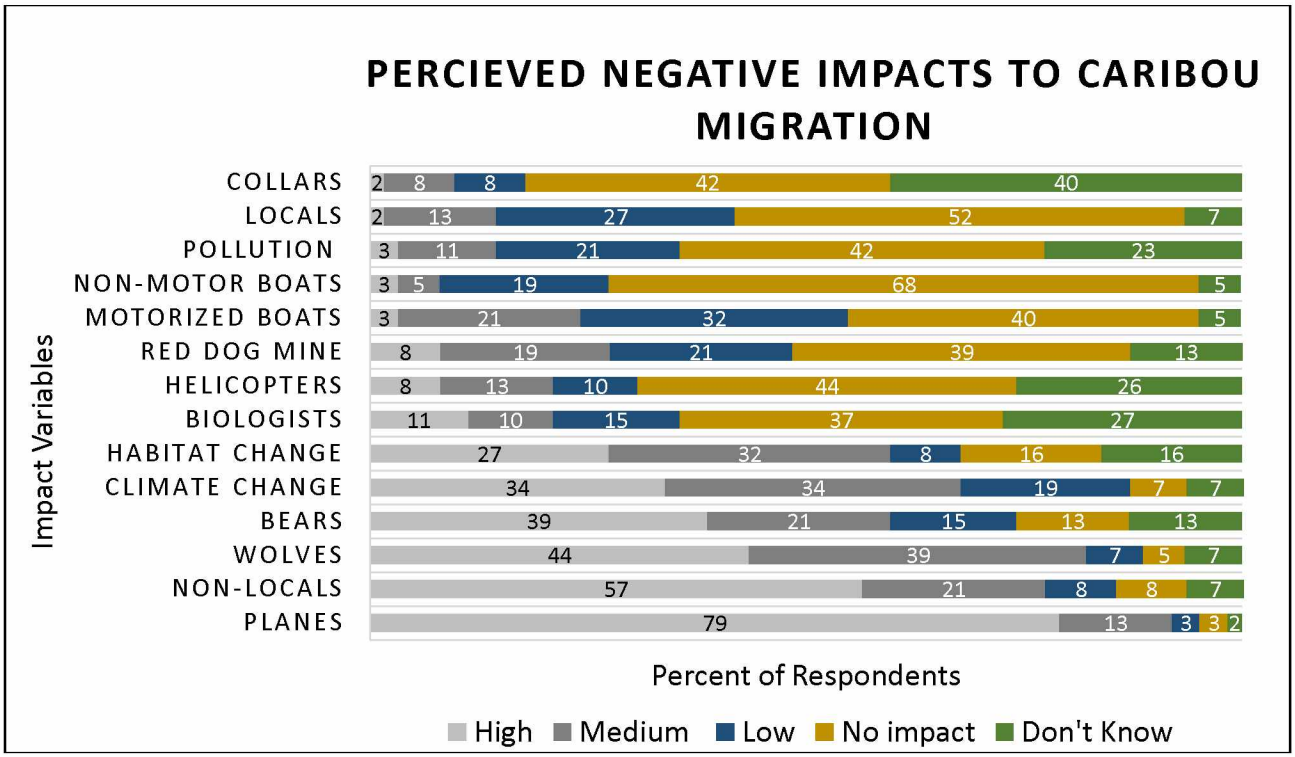


Figure 5.4 Respondents rank variables to caribou migration, n=62.
Notes: collars refer to satellite or GPS collars on caribou. Locals refer to local Noatak hunters. Biologists refer to biologists who track wildlife in planes. Non-locals refer to any group of non-regional hunters.

Seventy-nine percent of respondents indicated a high negative impact by airplane activity to caribou migration, with 57% stating non-local hunters have a high negative impact. Table 5.4 provides a list of the non-local activities perceived by respondents to impact caribou, which are divided into three categories, I) general disturbance, II) disturbance by transporters, non-local camp disturbance, III) and other.

Table 5.4 Impacts to caribou by non-local activity
I) General disturbance: • 'Scaring' caribou into hills/mountains – away from the Noatak River • Diverting caribou off former/typical migration routes
II) Disturbance by transporters: • Aircraft move non-locals multiple times to new areas to hunt, often 'right in the path of the caribou' • Noise from aircraft impacts caribou • Low-flying, 'swooping', 'buzzing' aircraft impact caribou • Dropping hunters' on the side of the Noatak where caribou is on/coming towards • Aircraft diverting caribou towards waiting sports hunters
III) Non-local camps disturbance: • Located on the side caribou is on/are coming towards • Non-local camps too close together, too many in some locations • Non-locals hunters walk/travel away from the river into the hills to pack caribou out • Non-locals leave trash on the land • Non-locals shoot caribou leaders, diverting path of caribou group
Other: • Recognition that some disturbance to caribou is 'unintentional'

Notes: Frequency of responses not calculated due to the importance of showing narratives of responses based on themes, not each individual coded response. A 'caribou 'leader' was identified by respondents as a caribou cow with calf whose movements established trails for the following caribou, whereas some respondents reported a bull caribou as the 'leader'.

Predation by wolves was identified by 44% of respondents, and 39% of respondents identified bears, as having high negative impacts to caribou migration. Variables perceived to have the least negative impact on caribou migration were reported as non-motorized boats (no negative impact: 67.7%), local hunters themselves (no negative impact: 51.6%), collars on caribou (no negative impact: 41.9%), pollution (no negative impact: 41.9%), helicopters (no negative impact: 43.5%), and motorized boats (no negative impact: 40.3%). Respondents stated, when faced with assessing caribou migration impact variables, that the lack of visibly *seeing* a phenomenon on the landscape often prohibited their judgment of the event.

5.2.4 Mapping caribou ecology

Respondents provided spatial information on caribou ecology, including herd ranges, habitat, areas of fire, and changes to caribou migration, among other features, all of which are in Appendix D. Below I present maps on two distinct spatial features, predator use areas, and important habitat locations identified for caribou.

Predators (predominantly bears and wolves) were noted to be on the increase in the Noatak River area by survey respondents and blamed for 'scaring' caribou into the hills and mountains (away from the river) and reducing caribou population. Respondents mapped predator use areas in the Noatak (Figure 5.5), which included wolves, bears, and other, such as fox or wolverine.

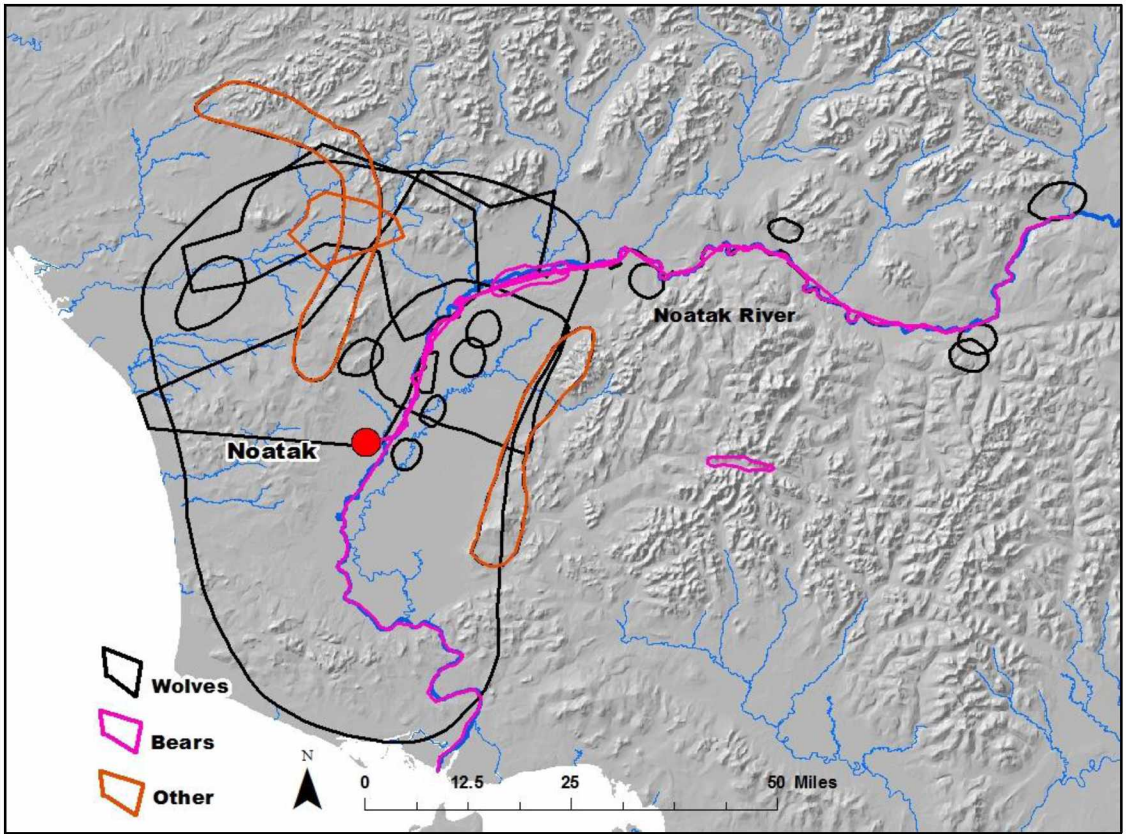


Figure 5.5 Locations of observed predators reported by Noatak interview respondents. Notes: 'Other': wolverine, fox.

Bear activity was reported as spanning the length of the Noatak River (pink areas), with wolves (black areas) and other predators (orange areas) scattered in the general fall and winter hunting regions of respondents. One hunter described how predators are one of the main reasons for migration change:

> "A lot of it is, just their food supply, or predators. Main thing is just predators. We've got more predators than when I was younger. I mean, bears weren't that bad. You'd go five miles up the river and you'd finally see a bear. Then, you'd maybe go ten or twenty miles, then you'd finally see another bear. Now days, you can go around every other corner and there's a bear on the beach already." *(Respondent #2)*

A warming climate or climate change was identified by about a third (34%) of the respondents as having a negative high impact on caribou migration. Respondents who spoke of climate change described how caribou 'will not move' while the weather is warm, preferring cooler climates of the North Slope to the warmer weather as they would migrate south during the fall time.

> "I've had people go up [river] for caribou and camp for almost two weeks, they come back with nothing because the weather is too warm and [the caribou are] not moving. And even the pilots that come and drop off hunters even say that there's not any caribou. It's too warm. Everything is up further north."*(Respondent #2)*

Similarly, unpredictable weather was reported to alter caribou behavior, with rain/snow and cold/warmth as drivers of caribou movement. Insect harassment of caribou was also noted as an impact to caribou, influenced largely by warmer temperatures.

> "That's [migration] dramatically changed in the last few years. The weather patterns, like no other. Its snow freeze up and then melt all over. Rain. The weather patterns been...it's not like cooling off and stay cold and then freeze. It's like, do that real fast and then comes a heat wave. Caribou knows when to move. They know what the weathers gonna do. They just stay till it cools off but there's too many bugs when it's warm...mosquitos."*(Respondent #20)*

The perceived impact of climate change on caribou migration was followed closely by habitat change, with 27% of survey respondents reporting how increased willow growth, fire, or decrease in lichen productivity could lead caribou to search for food elsewhere.

"I've read some and I heard some from biologists, just looking at the internet and so, the lichen don't grow back as quick as the other plants do. So if they [caribou] know there's no food in the area, they won't come through that area then."*(Respondent #2)*

Respondents mapped important caribou habitat areas which included summer and winter feeding areas (Figure 5.6).

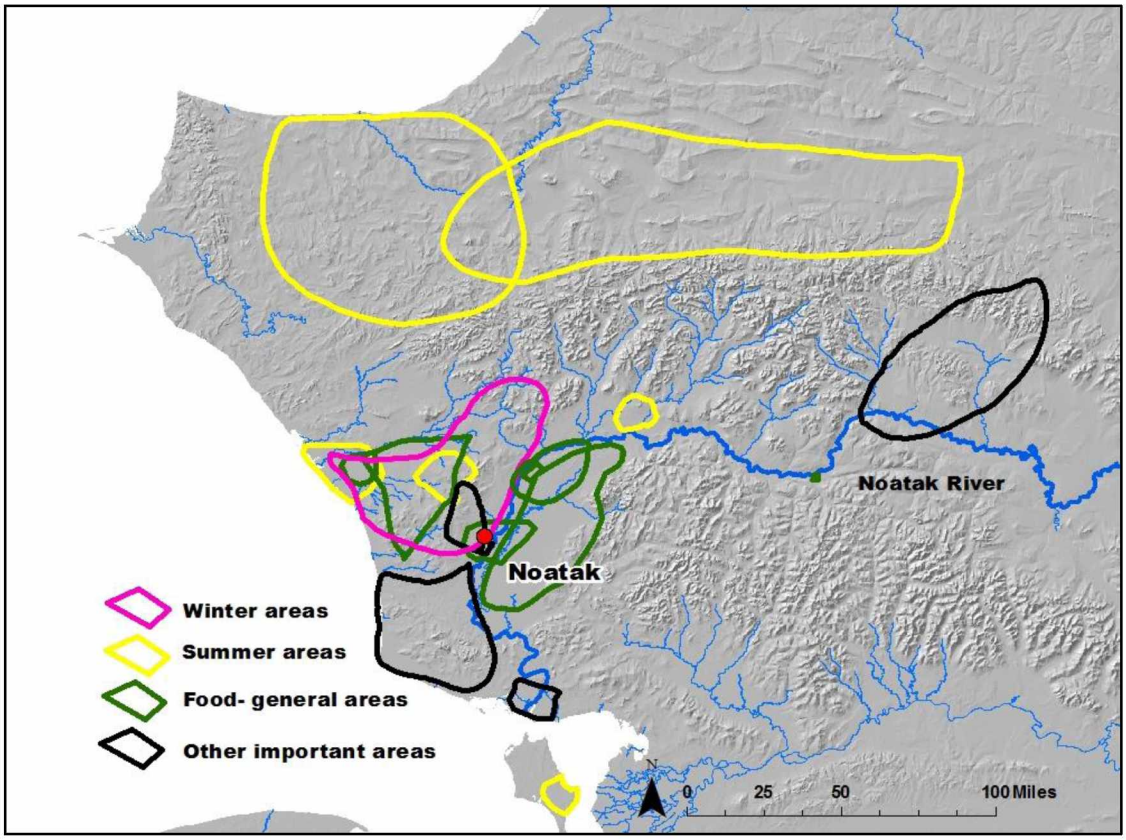


Figure 5.6 Important areas for caribou reported by Noatak interview respondents

Interestingly, the two largest areas (yellow = summer areas) attributed to important habitat for caribou coincided with caribou calving and post-calving areas for the WAH. Winter areas in pink, slightly northwest of the village site, are also winter snow-machine areas for caribou hunting. General food areas, in green, were also

identified as important lichen or feeding areas for caribou. Black areas, characterized as 'other' were either areas were a hunter successfully harvested fat caribou, or were unexplained by the respondent in any detail.

5.3 Conclusion

Documenting ecological and social conditions provided baseline information that can be used to compare variation over space and time. Results from my research show that caribou hunters of Noatak perceive changes in the WAH in herd movements and population. Change to caribou has been attributed to human disturbance, predation, climate, and habitat change. Specific details of human disturbance, in the form of aircraft and non-local hunters, were provided by respondents, with altered caribou migration as the predominate form of change. Ecological factors that impact caribou were reported as well, with narrative providing detail on plant growth, climate impacts to caribou migration, and the increase in abundance of predators.

Chapter 6: Results: Perceptions of Interactions with Other Users

6.1 Introduction

My second research question addressed how Noatak hunters perceive the impact of non-local hunting activity and use of aircraft in the Noatak area and NNP. This question has relevance to management since both user groups hunt on or close to the Noatak River, with local hunters accessing the region via boat, and non-locals predominantly via aircraft. As noted in Chapter 2, areas near and on the Noatak River have been zoned for multiple user groups to control interactions.

6.1.1 Spatial over-lap and use areas of non-local hunters and respondents

Respondents identified areas where they have hunted for caribou in the last five years, for all seasons, including where they encounter non-local activity (Figure 6.1). Fall caribou hunting is primarily restricted to the Noatak River, where travel by local hunters is via motorized boat. River travel can extend as far east as the Cutler River (Figure 3.4), and as far southwest as the mouth of the Noatak at Hotham Inlet. Winter travel, by snow-machine, is predominantly west of the village, and north and northwest towards Kivalina, Alaska and the Red Dog Mine. This spatial representation corresponds with other research, which has shown subsistence use for caribou along the Noatak River, with predominate activity occurring around an estimated 60 mile circumference area around the village (Braund, 2009).

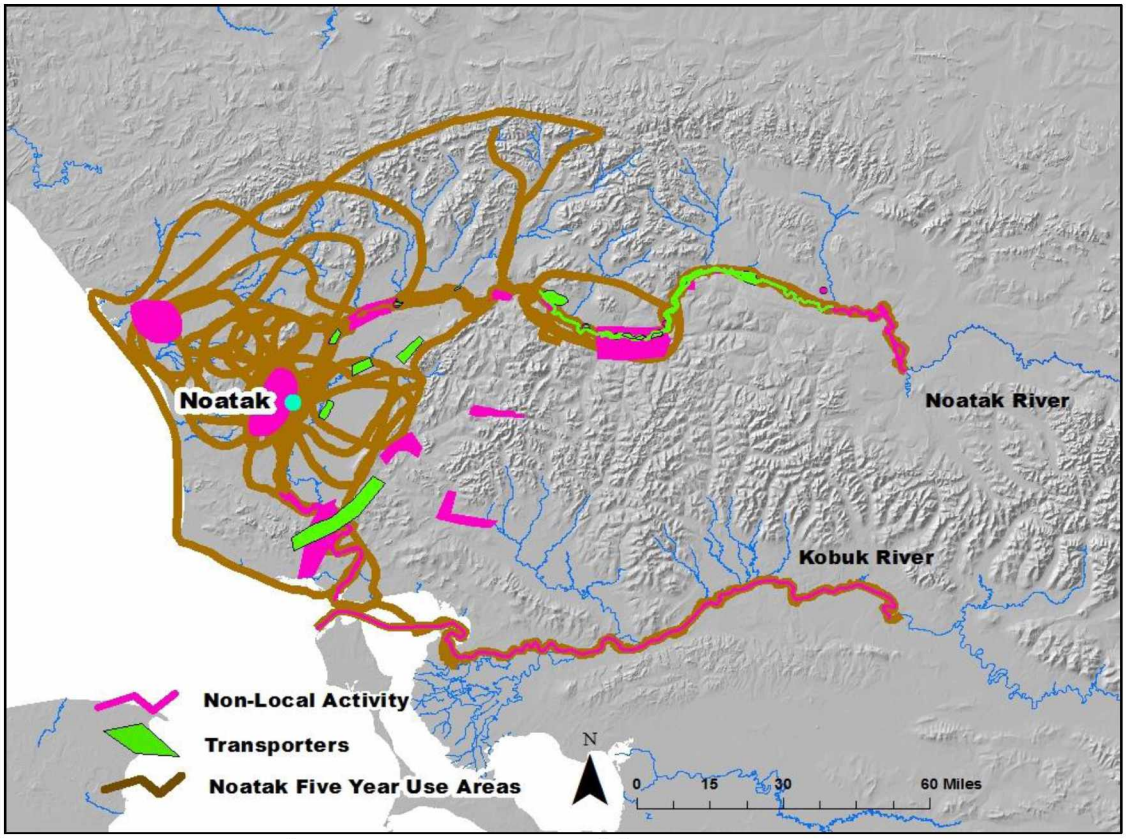


Figure 6.1. Use areas for Noatak respondents' five-year use caribou hunting areas and non-local activity. Notes: Five years use areas include all seasons for caribou hunting. Identification of non-local activity is non-season restricted, although occurs primarily during fall hunting. Respondents could identify more than one location, n=19.

Areas of overlap were identified where spatial locations are most used by all three user groups, as well as locations which respondents experienced negative interaction with non-locals (Figure 6.2). Negative encounters between local respondents and non-locals occurred predominantly within the Noatak CUA, with a high incidence of negative encounters, which occurred outside the Noatak CUA near the Nimiuktut and Ninnuqtuchiaq Creeks. The highest proportion of negative use areas also corresponded with areas of caribou fall migration river crossings. The majority (58%) of respondents mapped caribou crossings at Sapun and Niaqulik

Creeks, also identified as areas of high negative encounters between users. Fifty-three percent of respondents reported that common or frequently used areas for caribou crossings also include the Nimiuktut and Ninnuqtuchiaq Creeks.

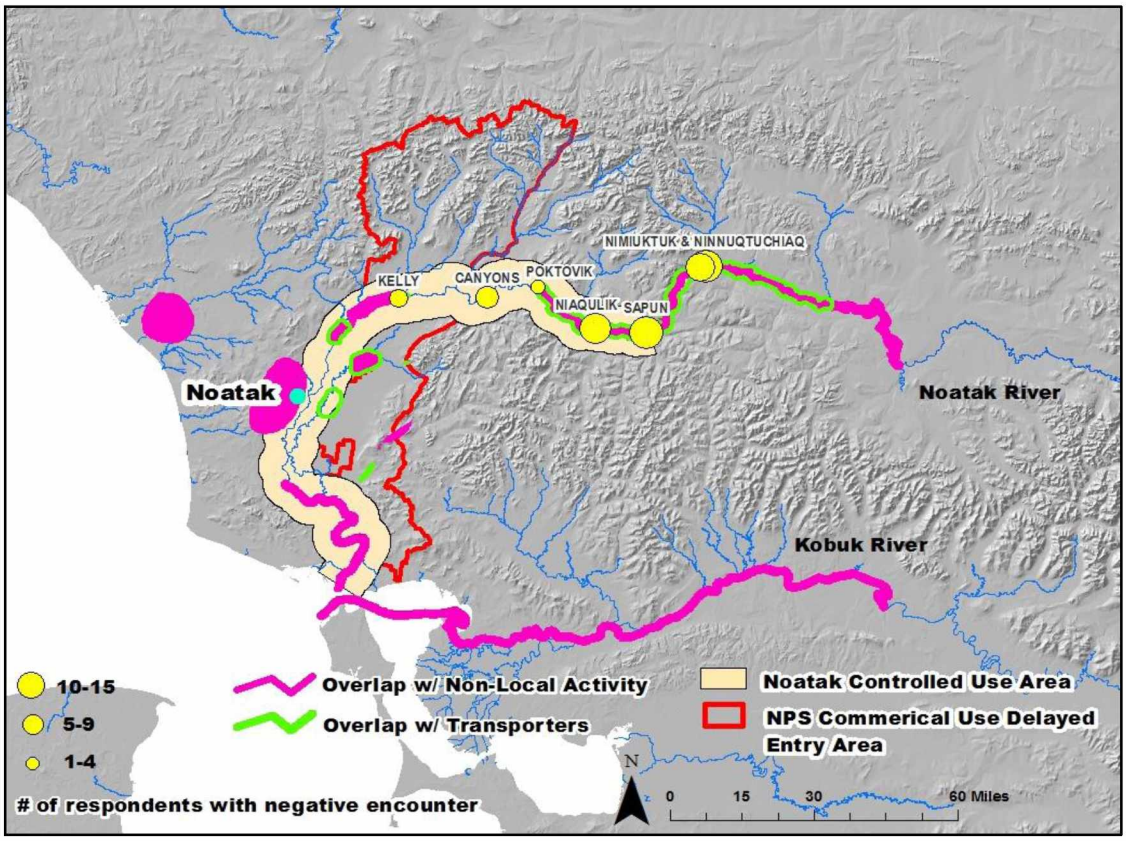


Figure 6.2. Areas of overlap use between Noatak interview respondents' and non-local users. Green lines and polygons delineate overlap areas with observed transporters. Notes: Pink lines and polygons are non-local users observed in the area and overlapped with local hunters. Yellow circles represent the number of respondents who had a negative encounter with non-locals in specified locations. Respondents could identify more than one location, n=19

6.1.2 Concepts of successful hunting for respondents

Respondents ranked variables of successful hunting (Figure 6.3). Variables considered were pre-determined by researchers based on literature and background research, and refined through a pilot-test of the survey. Along with safety, harvest of caribou ranked the highest for a hunt to be successful. Harvesting more than one caribou, spending time with family and friends, seeing fellow locals on the land, camping, and going to a favorite spot were also reported as important. In contrast, seeing non-locals on the land was attributed to a relatively low level of importance for a successful caribou hunt, along with having good weather.

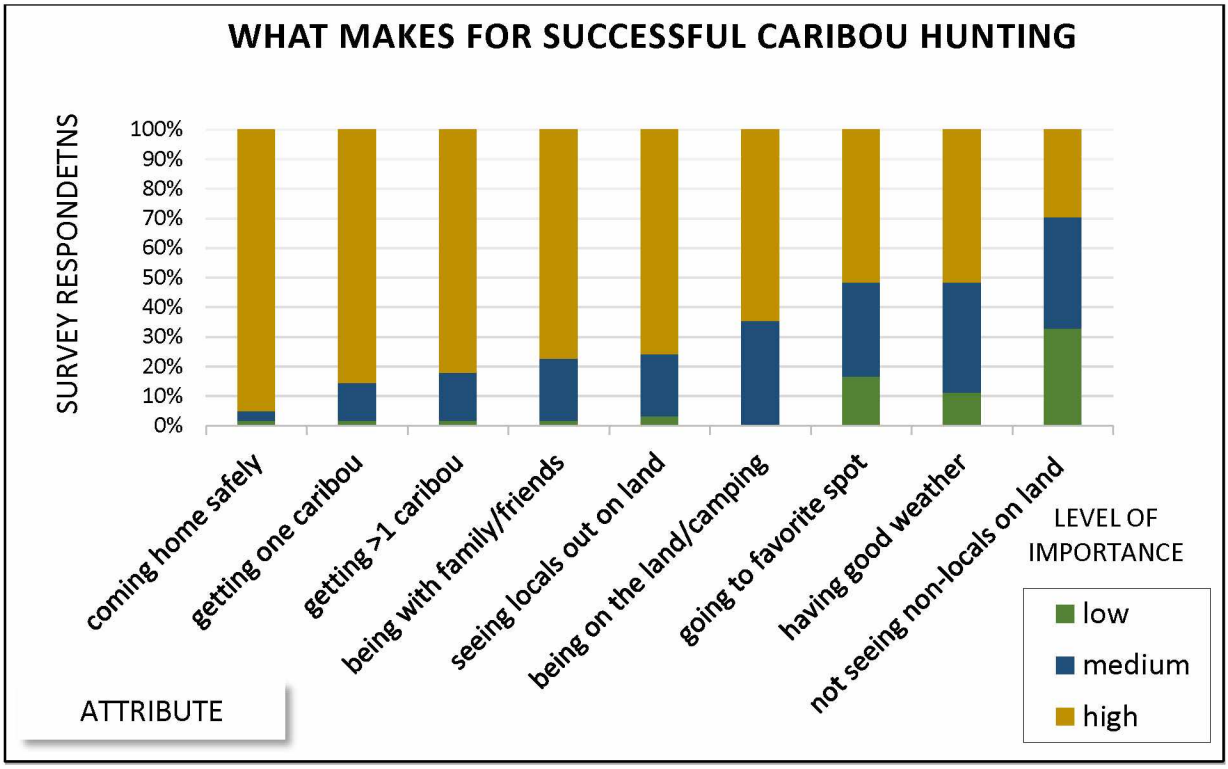


Figure 6.3: Respondents rank attributes of successful caribou hunting

In addition, I followed up the question of what defines successful hunting with an open ended question, giving respondents the ability to add other reasons. Roughly a third of

respondents added additional attributes as to what constitutes successful hunting (Table 6.1). Even though some of the reasons are repeated from the previous nine options (Figure 6.3), adding them in as additional important themes for respondents revealed the importance of other attributes. Respondents noted the importance of not seeing non-locals out hunting, teaching youth, seeing local Noatak hunters, providing meat for elders, among other characteristics.

Table 6.1 Attributes of successful hunting in respondents terms
Lack of non-locals/sports-hunters /aircraft activity
Teaching young people
Getting meat for elders
Knowing other local hunters getting meat and out hunting
Sharing meat
Performing other activities while caribou hunting; such as fishing
Spiritual connection, peace, getting closer to God

Notes: all responses 1% or less of total respondents (n=1-4, per item)

6.1.3 Impacts to respondents hunting

Hunters were asked to assess 14 different variables that may impact caribou hunting. This portion of the results is directly related to the same set of variables that were asked to respondents about perceived impacts to caribou migration. When a hunter was asked about impacts to caribou migration (Figure 5.3), they were then asked about that variables impact to caribou hunting (Figure 6.2). A similar pattern was reported with aircraft and non-local hunters (Figure 6.4), for questions regarding impacts to caribou migration and impacts to caribou hunting.

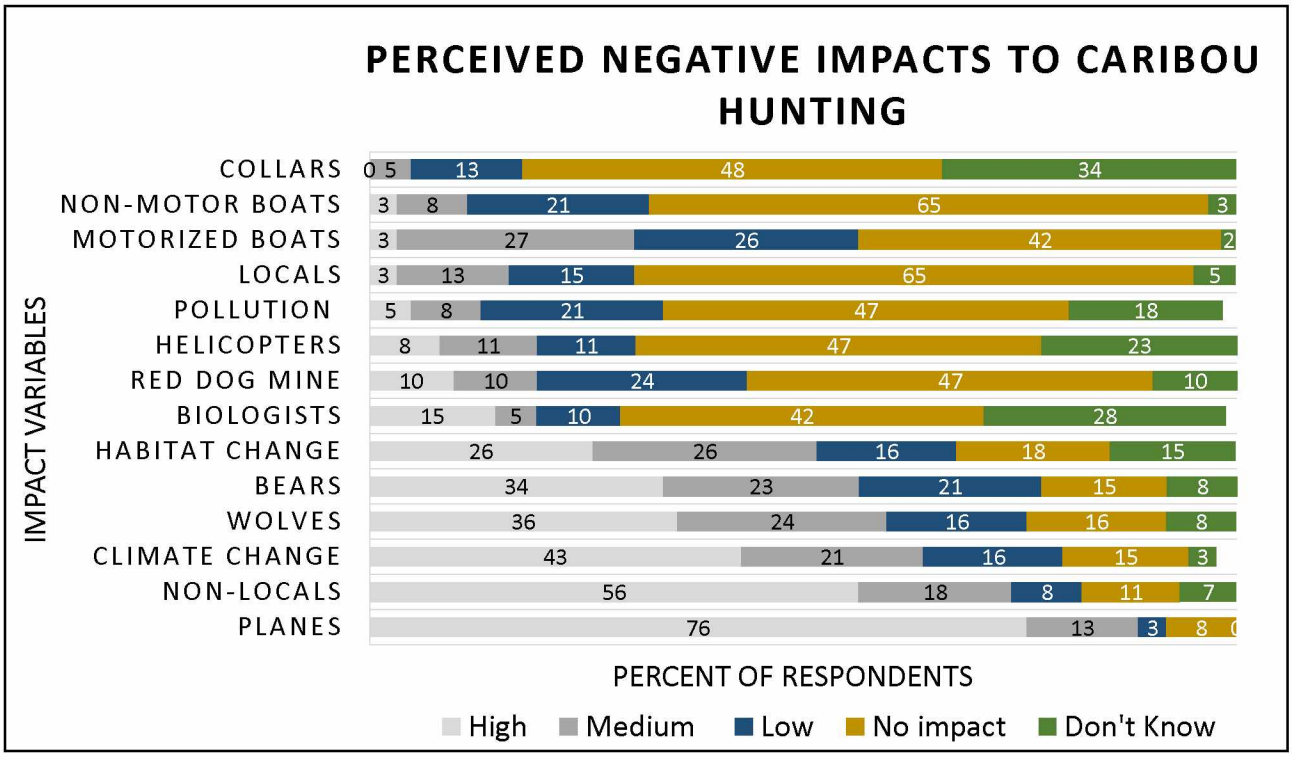


Figure 6.4 Respondent's rank of variables to caribou hunting, n=62.
Notes: Collars refer to satellite or GPS collars on caribou. Locals refer to local Noatak hunters. Biologists refer to biologists who track wildlife in planes. Non-locals refer to any group of non-regional hunters. Pollution, biologists, climate change; missing response: one each.

Seventy-six percent of respondents indicated that aircraft had the highest negative impact to local subsistence caribou hunting, followed by non-local hunters (56%). Climate change ranked as the third highest impact to local hunting, with predation by wolves and bears in fourth and fifth, respectively. Collars on caribou were reported by respondents as the highest response of "do not know" (34%), meaning these respondents were unsure about collars' impact pertaining to local hunting, following closely by biologists who track wildlife in planes (28%). Many variables were characterized in the 'low negative impact' category, namely non-motorized boats, other local hunters, pollution, helicopters, and the Red Dog Mine road.

In addition, Noatak respondents evaluated the extent of change they have experienced with caribou hunting in the last five years (Table 6.2).

Table 6.2 Changes to caribou hunting in the last five years

	% OF TOTAL RESPONDENTS		
	More	No Change	Fewer
# of trips taken	**37%**	**36%**	**26%**
	Longer	N/C	Shorter
length of trips	**52%**	**34%**	**15%**
	Later	N/C	Earlier
Fall timing of trips	**47%**	**42%**	**11%**
	More	N/C	Fewer
# of total days caribou hunting	**40%**	**40%**	**19%**
	More	N/C	Fewer
# of people seen while hunting	**54%**	**31%**	**13%**
	More	N/C	Fewer
# of caribou harvested	8%	19%	73%

Notable changes included increased number of trips taken, and longer trips for caribou hunting in the last five years. The majority of respondents, 54%, reported seeing more people while out hunting, with 73% reporting an overall reduction in caribou harvest.

Encounter frequencies with other users were reported based on respondents' recall of the previous fall hunting season from when the survey was administered. On average, Noatak hunters reported 13 encounters with other local hunters (maximum 45) during the fall 2013 season. Noatak hunters also reported an average of five encounters with non-local hunters (maximum 24), and with aircraft, an average of eight encounters (maximum 62) (Table 6.3).

Table 6.3 Number of encounters with others by Noatak hunters; fall 2013					
	Other locals from Noatak	Hunters from regional villages	Non-locals from outside the NW	Planes	Non-motorized boats
Mean # of encounters by individual	13	1	5	8	3
Max # encountered by individual	45	4	24	62	15
Respondents per variable, n=	39	41	32	49	36
% of respondents reported no encounter or did not hunt Fall	37%	34%	48%	21%	42%

Notes: A 'group' is defined by within sight or sound. Minimum encounter = zero.

In order to evaluate respondents' perception of interactions with other users, respondents were asked to assess both their quality of their hunt and harvest success, based on two variables, *frequency* of encounters with other users, and the *behavior* of, other users. Each question regarding frequency and behavior was asked from the same closed survey question. Noatak respondents primarily expressed two main concerns with encounters with non-locals, that there were many non-locals in the region and they did not act in accordance to local hunting traditions.

Respondents identified other features of hunt quality which were part of successful hunting, such as seeing other locals, harvesting for elders, or being out on the land with family and friends. I compared respondents' perceptions of impact between non-locals to fellow Noatak hunters, since that ranked high on success evaluation ('seeing other locals out on the land'). A high majority of respondents reported that quality of hunting was reduced by

encounter frequency of non-locals and aircraft, 68% and 72%, respectively (Figure 6.5). Interactions with other local hunters, on the other hand, were assessed as having no influence to quality of the hunt, with 14% of respondents indicating other locals actually improve hunt quality.

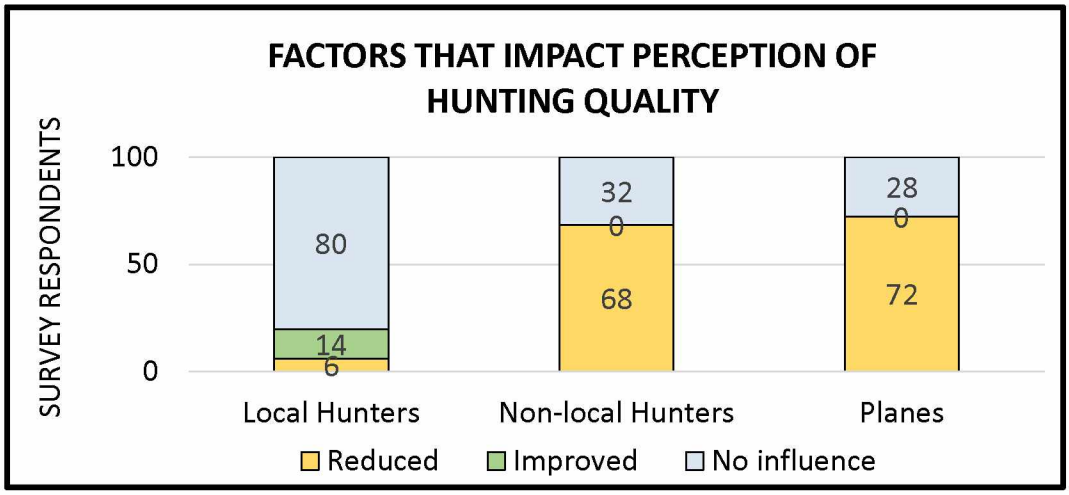


Figure 6.5 Respondents rank impacts to hunt quality based on frequency of encounters with other user groups.

Respondents then reported on the impact to their perception of hunting success impact due to the behavior of non-locals or aircraft (Figure 6.6).

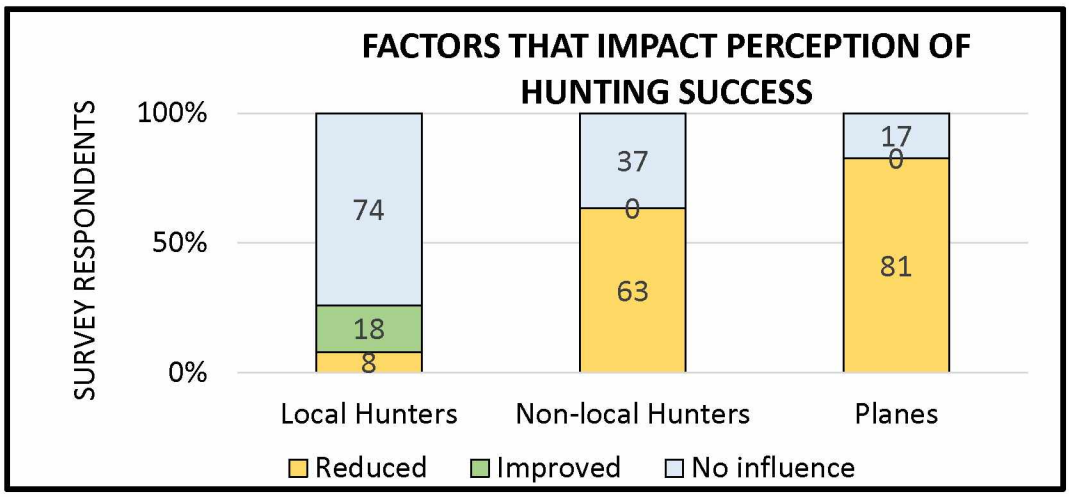


Figure 6.6 Respondents rank impacts to hunt success based on behavior of user groups.

A greater percentage of respondents (81%) attributed reduced impact to success by planes than the quality of the hunt (72%). Non-local hunters, on the other hand, are less associated with impacting hunt success (63%) than hunt quality (68%). Local hunters continue to be reported by respondents as largely having no impact to success or quality with just a slight increase of respondents (8%) indicated the locals reduced their hunting success, compared to 6% that reduced their hunting quality.

In open-ended questioning in the interviews, respondents reported disturbance to caribou hunting and subsistence practice in general. When coding qualitative data, I divided responses into three categories, I) socio-economic, II) value-based differences, and III) other (Table 6.4).

Table 6.4 Impacts to caribou hunting by non-local activity
I) Socio-economic • Scaring away 'our food source' • Non-local visitors to area not contributing to local economy • Locals spending lots of money for hunting, coming home empty handed • If no caribou harvested, money is spent on 'store meat'; economically unsustainable
II) Value differences: • Non-local hunters shooting for antlers; 'shooting for sport, not food' • Non-locals discarding meat/letting meat spoil in the field • Dissatisfaction knowing that non-locals are 'out there' on the land • Non-locals & aircraft 'too plentiful'; more than local hunters • Official hunting guides used to work on the Noatak; more respectful than transporters
III) Other: • Dissatisfaction that transporters are 'unregulated' • Transporters do not follow rules; reduce aircraft ID numbers, change paint schemes on planes to avoid local reporting of behavior • Transporters seen as 'big business', able to influence decision-makers • Recognition that some positive interactions between locals & non-locals occurs; communication while hunting about caribou locations

Notes: Frequency of responses not calculated due to the importance of showing narratives of responses based on themes, not individual coded responses.

Some respondents also indicated that simply knowing sports hunters were active in the area impacted the quality of their hunting. Others expressed discomfort that sport-hunters were largely after the antlers. Some respondents stated that they understood non-natives and/or non-locals wished to hunt caribou, but that sports-hunters who prioritized caribou antlers' over meat continued to be a problem.

> "There's enough caribou for everyone but the headhunters just want to the head and that's it." *(Respondent # 62).*

> "The main thing is they [transporters] drop them off and they [sports hunters] walk all over [the hills and/or mountains]. Nowadays they [sports hunters] are required to take all the meat out before they take the trophy, the antlers. I don't

know if they do that, off the river they can do anything. Where there is hardly any boat traffic, they can just bury them and take the head part, the antler part." *(Respondent # 58).*

Other respondents linked the presence of non-locals hunter to larger socio-economic impacts, such as cultural and economic changes.

"We hurt a lot. No meat. Now we gotta go to the store and buy it. Most of the people around here don't have steady jobs....We work and have to get what we can get. We like the fat from the caribou. That's the prime, you know. It taste good. So we hurt a lot when we don't have that. We live with it and we raise up with it. We share it with the elders and everybody. When we don't have it, it hurt a lot of people around here." *(Respondent #7).*

"I'm out supplying food for my family or for my village. I know they're out there just for sport. A lot of time, they don't even come into our village. They don't buy from our grocery store. They don't buy gas from our store. So, we're not getting any income for them coming on our river." *(Respondent #2).*

Respondents also differentiated between the impacts of sports hunters and transporter aircraft that drops and moves non-locals to hunting areas. A few respondents also articulated that there is a difference between the impacts of commercial hunting guides, transporters, hunters' on rafts or floating the Noatak, non-locals who are friends of local Noatak residents, and non-locals dropped off for hunting.

"I know the guided hunts are good, but we hardly have any more guided hunts. I wish all of them would go guided. We'd have no conflicts because they'd be guided and they'd catch their catch. It's more successful than transporters. There's

no cap on transporters. They can drop as many as they want in one year. They got a cap on guides. But not on transporters. It's getting worse." *(Respondent # 16)*.

Other respondents reported they had never experienced negative interactions with non-local users, indicating either neutrality or a purposeful lack of interaction.

"They [non-local users] don't really bother me. I just see them here and there. They bother some other hunters, that see them camping or see the caribou turn back around and go up the hill." *(Respondent # 54).*

"We just wanted to get an idea of if they've [non-local hunters] seen some caribou or not. That's when I'll talk to them. I usually don't talk to them that long though, just stop on the river and take off right away." *(Respondent #33).*

Interestingly, respondents noted that seeing other Noatak hunters had a positive impact on their quality or success of hunting. Themes that emerged from data indicated that communication and visiting with local hunters provided a sense of camaraderie. Getting advice from other Noatak hunters, sharing information on caribou, and feeling like local hunters were working towards the same goals contrasted with the majority of reports from respondents regarding negative encounters with non-local users.

6.1.4 Comparing perceptions and experiences of respondents

The findings above showed that Noatak respondents differentiated between other users. Teasing out the differences between general non-local (on-the-ground) hunters and transporters may be a critical for understanding the nature of user conflicts, where frequency and behavior of user groups is evaluated on the relative perceived and potential impact to both caribou and subsistence hunters. I evaluated the level of agreement there was between a perception (Question 14; 'what is likely to have a negative impact on caribou hunting?') and respondent's actual experience (Question 17; 'did the behavior of [non-locals/aircraft] affect your success [in the fall of 2013]?'). To do that, I cross-tabulated results from the two survey questions (Table 6.5). Results indicate that 27% of respondents agreed that there were high negative impacts to caribou hunting and also perceived that their hunting success was greatly reduced. Comparatively 22% of respondents perceived that non-local have a high negative impact to caribou hunting, but that it had no influence on the hunting success.

Table 6.5 Comparing perception and experience: impact by non-local hunters

	Impact Success			
	Greatly Reduced	**Slightly Reduced**	**No Influence**	**n**
Negative Impact to Caribou Hunting	*% of total respondents*			
None	2	0	5	3
Low	2	2	2	3
Medium	2	7	7	7
High	27	20	22	28

On the other hand, aircraft are perceived in a different way, which revealed a greater difference in perception of impact between aircraft and non-locals (Table 6.6). Thirty-eight percent of respondents indicated that aircraft have a high negative impact to local hunting and that a respondent's personal success was greatly reduced. Comparatively, only 11% of respondents had no influence due to aircraft, but assigned aircraft as having high negative impact to local caribou hunting.

Table 6.6 Comparing perception and experience: impact by aircraft

	Impact Success			
	Greatly Reduced	**Slightly Reduced**	**No Influence**	**n**
Negative Impact to Caribou Hunting	*% of total respondents*			
None	2	0	4	3
Medium	4	9	2	7
High	38	28	11	37

A variety of indicators show that Noatak respondents characterized a difference in perception of other users, which primarily include non-local hunters, aircraft, and other local hunters. Frequency of interactions, the behavior of user groups, spatial overlap, and change to respondents hunting practice all play a role in how perceptions of respondents are shaped in response to other users in the Noatak region.

6.2 Suggested solutions by respondents

Respondents were asked what ideas they had for improving both caribou management in the area and how best to deal with the local/non-local caribou hunting issue. Primarily reduction of non-locals and transporters was the main theme from the Active Hunter Survey data (Table 6.7). This foremost suggestion was followed by other ideas which were stated may improve local people's hunting, such as, lower fuel prices, teaching youth traditional ways, working together with commercial operators (non-locals), having state and federal agencies play a stronger role in problem-solving, and the recognition that local preference should be given to subsistence hunters.

Table 6.7 Ideas for improving management of caribou hunting in the Noatak area

Theme	General Comments
Stop or lessen sport hunting (n=45)	• Less drop off hunting • Less planes in migration areas • Less non-local, non-resident hunters • Ban flying and sports hunting • "Sports hunters got to respect our village and food; some people won't be able to eat as a result" • Change when planes can fly seasonally • "When it's our turn to hunt they shouldn't fly" • Planes not to fly in or around river • "Bothers" respondent that outsiders come and use the land to "tickle their fancy"; glad to see locals on the river as it makes him feel safer • "Non-locals need to respect our lands, they leave trash and carcasses; they are not following rules"
Reduce gas prices (n=11)	• Lower gas prices, respondent spent $800 going up river • Lower gas for hunting/subsistence • "Lower gas prices for hunting; agencies should help with that, people [locals] pitching in a lot nowadays"

Teach youth traditional ways (n=10)	• "Young kids not listening to older experienced hunters" • "Elders have good information" • Education of younger people on traditions and rules of hunting is very important • "Younger hunters need training, the young men need to listen; they want to be the first to get caribou and that is greedy" • "Don't toss out old ways of hunting or managing the herd" • "Life blood of people here is caribou, we know how and when to hunt, there is lots of local information passed on from elders to youth"
Work together (n=8)	• "Locals and sports hunters need to settle on agreement, this needs to get resolved" • Work with transporters to salvage meat, especially for low income people or people with no boats • More non-locals and sports hunters/self-guided hunters should work with Noatak; set up programs to work together • "Non-locals have to understand some of what we do (such as letting the 1st herd pass, allowing large herds to cross the river), but need defined dates for non-locals too when they can hunt caribou" • "All user groups have their rights including recreational groups (sports hunters, fishing, sight-seeing), we need to work together with all user groups so each get their catch; do what they want as long as we get our share"
Agencies play a role (n=8)	• "ADFG to take a bigger role with tagging, studies; they have lots of info and needs to be communicated more" • More agency representatives on the river • More trips to the village from agencies • Need more communication on population (from ADFG, biologists), more newsletters, "we hardly know anything" • Control no-fly zone (CUA) more, extend dates of no-fly times • "Do the state and feds really hear our concerns? There are two groups, us and them and we are all alone in everything" • "Good to know BOG is there to oversee what we have out here and biologists giving us information" • Respondent: Locals do not know who to contact if there is an issue to planes/non-local hunters

	• Changes to regulations should be passed down to inform locals
Local preference needed (n=5)	• Local people should get their first shot at hunting • "Make it easier for local people, keep fighting and going to the law" • Local people to be used as guides using boats (be transporter with a boat)

Notes: More than one suggestion was offered by respondents with comments a mix of general responses and verbatim, n=62.

Specific comments on improving caribou hunting management in the region also came from the Knowledgeable Hunter Interviews, which suggested boundaries and limits to non-local activity, such as, letting 1000 caribou pass before shooting, closing the Aggie River corridor, and appropriately spacing non-local camps. Detailed comments and recommendations from the interviews can be found in Appendix E.

6.3 Conclusion

The research question of this chapter addressing user interactions drew on spatial, quantitative, and qualitative data. I used an evaluative framework of caribou hunting success to determine how both harvest of caribou and the hunting experience are perceived to be impacted by non-local hunters. Noatak hunters differentiated between commercial transporter operators and non-local hunters, and attributed loss of harvest success primarily to aircraft transporters. Impact to subsistence hunters was also indicated spatially, as interaction areas overlapped both inside and outside zoned areas along the Noatak. Areas where local subsistence hunters experienced the highest incidence of negative interactions were also areas where the majority of respondents mapped the most common caribou crossing locations. The

data also show that perception and experience more closely matched in response regarding impact to hunting by aircraft transporters, than with non-local users.

Chapter 7: Discussion

I explored the relationship among caribou, local hunting, and non-local activity through the lens of TEK by documenting the perceptions, values, and experiences of caribou hunters of Noatak village. Dynamics in this human-caribou system included caribou migration, interactions of Noatak hunters with other users, and the overall impact of changes to local hunting success. The documentation of the system is incomplete because it did not include the perspectives of other groups or other knowledge sources. The perspectives of sport hunters was documented by a separate study funded by the NPS. However, the perspectives of local subsistence hunters in the NNP region are not well documented. This research addressed local concerns, provided insight into Alaska Native perceptions of change, generated information about subsistence harvest, and identified relationships as viewed by locals that affect social-ecological system dynamics.

7.1 Perceptions of local hunters are underpinned by TEK

The TEK of Noatak caribou hunters is based on expertise through a lifetime of personal experience interacting with human-caribou systems and knowledge passed down through many generations. As evidenced by the hunters who participated in the study, TEK provided an integrated approach to this system by linking relationships among caribou behavior, perceived human impacts, and observed social and ecological changes, thus providing a holistic perspective as experienced by subsistence users.

For example, respondents reported that non-local hunters and transporters have a multi-dimensional impact on subsistence activities. Non-locals were identified as not supporting

the village economically or interacting with locals. In addition, non-locals were also reported as a leading cause of disturbing caribou migration. Observations of non-local behavior were specific, such as seeing non-locals camping on caribou migration routes or being dropped off on the 'wrong' side of the Noatak River, affecting the flow of caribou groups towards the Noatak River. For local hunters, witnessing multiple negative impacts may further embed the notion that the values a specific user group, such as non-locals or transporters, are not aligned with traditional values.

Respondents' relationship with subsistence exists within a social domain, meaning aspects that are perceived to influence caribou ecology, may be perceived to impact the social, economic, and cultural fabric of the community. Hence, non-locals and transporters are generally viewed in a negative way, as they are not only seen to impact caribou migration, but also may impact the social and economic dimension of the Noatak community.

As argued by the Alaska Native Science Commission (2014), TEK is based on a set of criteria, such as long-term knowledge and substantive prediction in local areas, but with a weaker understanding for spatially distant locations. In the Noatak case, documenting perceptions provided an opportunity to explore dimensions of TEK not available from other sources of evidence. My research showed that TEK, as held by respondents, was unique, common among most hunters, but also divergent in some areas.

7.1.2 Depth and complexity of TEK-consensus and divergence among a community of respondents

The depth and complexity of information shared by respondents is evident in narratives and topic areas covered. TEK is inseparable from people's relationship to spiritual and ethical

guidelines, integrating cultural values, belief systems, and social relations (Alaska Native Science Commission, 2014; Fienup-Riordan, 1999). Recognition of this holistic framing of TEK as a values/beliefs/practice system should be viewed from Ferguson's and Messier's (1997) statement that "it is unlikely [that respondents of a study] represent a complete pictures of all indigenous knowledge…" (p. 23). Traditional knowledge is therefore based on a set of relationships about a system (Wilson, 2008), demonstrating that respondents share complex, detailed, and variable information.

Results from my research show that more respondents referenced caribou migration change than caribou population change. This difference in local perceptions of migration versus population change has been documented elsewhere (Kofinas, 1998) and likely reflects the difficulty of hunters assessing overall herd numbers at a localized scale. While caribou may continue to move though the Noatak River area and be observed by local harvesters, it will likely be difficult for those hunters to evaluate if numbers are increasing or decreasing. On the other hand, a significant change in migration by the herd may indicate that caribou are more spatially and temporally distributed. Unpredictable distribution and movement of caribou may make caribou more challenging to access and harvest.

Consensus was evident in agreement among respondents regarding human disturbance to caribou. Non-locals and aircraft disturbance were reported with a higher rate of agreement between respondents, in comparison to other variables which were more heterogeneous in response. For instance, collars on caribou, biologists who track wildlife in planes, and helicopters, ranged in scale of response indicating variance in respondents' assessment. Although I found little variance in data when evaluated with independent variables, such as age

or gender, other features of a respondent, such as amount of TEK of the system, amount of agency or management information, or interest in the subject, may have influenced individual response. However, respondents acknowledged that if they did not see a phenomenon, they did not feel qualified to comment on it, supporting Kassam's (2009) argument that complexity of knowledge systems may vary with the holders' attributes, including "age, gender… level of experience… access to oral tradition, and even interest in the subject" (p. 88).

Additionally, variance in response can also be explained by the dynamic nature of TEK, which assumes that knowledge is always changing. Respondents indicated that their knowledge was influenced by both Elder's *and* regional biologists and/or wildlife managers. If an event or phenomenon was not observed or experienced directly, respondents generally declined to answer or responded that they did not know. This supported the assertion that the "acknowledged local expert ….is just as concerned with getting the facts right as the researcher" (Johannes, 1993, p. 36). Research using TEK depends on the empirical nature of the information as, "people [are] constantly observ[ing] wildlife movements and changes in the environment" (Schramm et al., 2002, p. 14), but certain biases can exist with these data. Bias may include hunting season, mode of transportation, travel routes, age, lifestyle, and occupation (Schramm et al., 2002), including historical basis of values/knowledge and political relationships to other users. Lack of response may also be politically-minded; respondents may be choosing what information to share based on knowledge and experience of state regulatory bodies (Erlich & Magdanz, 1994).

Spatial information given by Noatak respondents was detailed, with each respondent sharing information on predator locations, important caribou habitat, and changes to fall

caribou migration. Information on predator locations and habitat were not comparable over time, and provided base-line documentation of caribou ecology. Although detailed, spatial information on caribou fall movements, past and present, did not provide any obvious pattern, such as main crossing routes or areas, regarding caribou migration change. Respondents' spatial knowledge of fall caribou movements show caribou continued to travel the entire Noatak River watershed. Travel by caribou appeared in river corridors, crossed the Noatak River in many locations, and caribou were observed in the foothills and valleys of the region. Respondents reported similar elements of dispersal and wide distribution of animals migrating southward in the fall, as caribou collar research indicates (Joly, 2012). Respondents' narratives identified change to migration as a feature of caribou and caribou hunting, but no clear consensus was given spatially. As Kendrick et al. (2005) pointed out, "spatially, traditional knowledge is often perceived to be highly 'localized'" with TEK "generally assumed…to develop over a long span of time" (p. 186). In the case of Noatak, when I attempted to capture long-term TEK, information about past movements appeared to be less available than TEK literature has suggested. With less respondents able to identify 'past' caribou movements, it is difficult to assess, over a watershed scale, how caribou movement has changed.

To what extent is knowledge limited by mode of access or hunting styles? As most Noatak hunters hunt via motorized boat on the Noatak River, knowledge of caribou movements may be restricted to both the river and its drainages or land features visible from the river. Agreement among respondents on caribou movement may be easily generalized, but difficult to specify. In addition, a respondents' knowledge spanned a life-time and mapping change may be difficult to conceptualize when comparing over decades.

How does change in the caribou system impact a hunter's knowledge? How do ecological or human-impact factors play into a hunter's ability to continue to predict the movement of caribou? Changes in weather and climate may also be impacting a hunters' ability to continue hunting in the same fashion as previous. Weather and climate change were noted to impact river freeze-up dates, with less predictable ice-free river days affecting access to hunting grounds. Additionally, the price of fuel was indicated as a significant driver in subsistence hunting practice. These factors, in combination with aircraft and non-locals, illuminated a multi-dimensional system local hunters must navigate to successfully harvest caribou.

7.2 Key features of user interactions

Understanding how local people view non-local hunters in the Noatak region was the subject of my second research question about perceptions and experiences of non-local hunting. This research project was also a means by which respondents could provide ideas to management agencies for resolving conflict issues between locals and non-locals (Appendix E). Below I discuss the main finding of my research into user interactions in the NNP.

7.2.1. Differentiation of levels of impact by different types of users

The differentiation by respondents of aircraft transporters and non-local hunters is important to the discussion of non-local activity in the NNP. Both quality of locals' hunting and harvest success were reported to be impacted differently by each user type. My research results show that across responses, aircraft are perceived as more negative to local hunting and

caribou than the presence and behavior of non-local hunters. Aircraft were perceived to have a greater negative impact due to the perceived disruptive nature by which transporters attempt to find caribou for hunter clients before landing. Negative impacts to caribou migration by aircraft span reasons, including the perception that sports-hunters (brought by aircraft) take away meat from the community and that locals feel disrespected by wasteful practices of some sport-hunters (for example, hunting for antlers or meat spoilage). Non-local users' lack of interaction with the village of Noatak, for fuel or supplies, and the subsequent perception of lack of economic gain from this user group, was problematic for respondents.

The concept of hunt quality, which included success in harvesting, is important for differentiating type of users perceived by Noatak hunters. Perceptions of reduced hunting success due to aircraft (more than non-locals) could indicate that movement and noise may play a role in caribou response to certain features on the landscape. Observations of caribou behavior ('spooked' caribou, deflected caribou groups from river crossings) due to aircraft are likely witnessed as a dramatic event not easily forgotten by a waiting Noatak hunter. Whether the aircraft intentionally or unintentionally may be 'influencing' caribou movement, observing 'scared' caribou can be a powerful experience for hunters. Observations of caribou disturbance may impact the quality of a good hunting experience for a subsistence hunter. Respondents who perceived that caribou are impacted by the behavior of aircraft may evaluate their own harvest success to the interaction between aircraft and movement of caribou. On the other hand, non-local hunters were also identified as not following local hunting etiquette, such as non-locals shooting the first caribou in a group, the caribou leader. Interestingly, one respondent proposed that a beneficial regulation may be to allow the first 1000 caribou to

cross the Noatak, before non-local hunters can shoot caribou. This was perceived to allow trail to be 'set' by migrating caribou, allowing for other groups of caribou to move through the area. This apparent disconnect between social rules within different user groups should be addressed in order to mitigate for potential conflict between local and non-local hunters in the Noatak.

In addition to impacts associated with caribou or hunting, Noatak respondents indicated that they often saw transporters as 'big business', with their activity in the region solely focused on profit. The lack of interaction with local residents did not go unnoticed by respondents. As transporter operators may be based out of urban areas, such as Fairbanks or Anchorage, this group's role was viewed differently than hunting guides, who stay with their clients for the duration of the hunt. Commercial guides (who are currently absent from the Noatak) were seen to have greater respect for local people and traditions, as they typically may be more invested locally. Further research is required to tease out interactions between locals and transporters or guided hunts.

7.2.2 Mode of access

Perceptions by local hunters are evaluated not only on general observations of who is using a resource, but pertain to the specifics of how resources are accessed. The issue of means of transportation for hunters in the Noatak was also highlighted by the findings. Access to caribou hunting areas required analysis as Noatak respondents and other users' access caribou hunting grounds differently. Both styles of access (motorized boat or aircraft), and objective of hunting (subsistence or sport), interact in the Noatak system. Although characterizing a dichotomy between objectives, such as subsistence and sport, may overly-simplify a complex

issue, local user's persistence of identifying non-locals as 'sports hunters' revealed that a sharp contrast exists from the local perspective. User interactions and potential conflict are also linked economically and socially, for example, with high fuel prices and cost of living. These elements may impact perceptions of unfair advantage with non-local hunters who may be viewed as more easily accessing an area via aircraft, or 'taking away' from subsistence harvest.

For local hunters' who hunt primarily via motorized boat in the fall season, boating was not perceived as a great disturbance to caribou migration or hunting. As caribou continued to cross the Noatak despite the presence of hunters on the river (local boats), may indicate to Noatak hunters' that their hunting method is a better fit to the region than non-local hunters', who are observed to deflect caribou. Narratives from respondents who described unacceptable behavior by non-locals detailed non-local hunters being dropped on the 'wrong' side of the river, camping at caribou crossing locations along the river, or camping in river beds most used by crossing caribou. Locals expressed frustration that non-local hunters do not let caribou 'come' to the hunter, but 'push' or 'scare' them back into the hills, away from the Noatak River. There are clearly local acceptable behaviors to hunting caribou, which appeared dictated both by traditional hunting methods and harvest techniques.

Fall is a critical period for caribou users in the NNP. Addressing key features, such as mode of access, is important in that it draws specific use and access issues to the foreground of potential conflict in the region. Ideas for alleviating potential conflicts in the NNP should focus on issues of transportation.

7.3 Common-pool resource theory for migratory resources

Migratory resources, such as barren-ground caribou, present a unique set of conditions for decision-making. Alaska's dual management system of providing for subsistence use, presents challenges on both state and federal lands. The WAH migrates over both land jurisdictions, and as a communal resource shared between multiple users, requires arrangements pertinent to its ecology.

Schlager et al., (1994) stated that migration of a resource "aggravates common-pool problems" (p. 298). This research illustrated the 'aggravated problems' of barren-ground caribou managements by identifying three perspectives, 1) "users are more likely to attribute flow declines [spatial movement of the resource] to the behavior of users elsewhere… 2) users in any one location cannot control the flow even if they act collectively" (Schlager et al., 1994, p. 289), and 3) restraint by some users does not necessarily create benefits for other users. Recognition of these attributes provided a useful theoretical approach to the practical problem in the NNP.

Communal resource use may consist of the notion that one user group perceives resource decline (or change, such as migration of caribou) due to the impact by another user group. How can management support local (rural) people, whose subsistence practice is protected on federal land, while recognizing the nature of communal resources often means dissatisfaction by one group's use of a resource? In addition, how can the NPS continue to support commercial use in the area, via transporters and non-local hunters, if restraint of these users does not carry perceived benefits to others, in this case, local Noatak hunters? While

Schlager et al., (1994) advocated for "allocate[ing] space and time slots that ensure access to mobile flows while reducing conflict" (p. 308), the case of Noatak and the historical nature of Inupiaq control of use and access suggests a different story. Spatially and temporally transporters and their clients are restricted within the Noatak Control Use Area (Noatak CUA) and the NPS Commercial Use Area Special Area (NPS CUA). Analysis revealed overlap of users to heavily occur past the NPS CUA special area, with occasional use occurring roughly below the Noatak Canyons. As Fix and Harrington (2012) reported, further zoning due to social values conflicts, is likely not a solution, whether or not interaction areas exist. Knowledge that a resource continues to be used by a particular group may cause conflict or dissatisfaction by another group, even if zoning restrains their interaction.

Despite past research on user conflict and concerns in northwest Alaska (Georgette & Loon, 1988; Jacobsen, 2008), the enduring perceptions of locals do not appear to have dramatically shifted despite regulated constraint zones or user group interactions through various stakeholder working groups. Government supported institutional arrangements, such as the WACHWG, may help to share perspectives and information, an important component to successful communal resource use (Ostrom, 1990). The extent to which change of attitude and value conflicts will interact remains to be seen, especially if caribou population and migration may undergo change. The 'flow control', identified by Schalger et al. (1994), cannot be controlled by users, although collective harvest restrictions require careful consideration of how the 'flow' of migrating caribou is impacted by harvest, and thus how restrictions should be accorded to each group.

Users' values continue to influence the Noatak social-ecological system of caribou hunting. Cultural contexts are essential to acknowledge and attention must be paid to this element in wildlife management (Reo & Whyte, 2012). Participation in a management system that offers users a place in decision-making requires continued development and strategies for sustained involvement. As user groups continue to converge spatially and temporally in the NNP, understanding different dimensions of user behavior may influence decision-making in this region.

Chapter 8: Further Questions and Conclusion

My research showed that Noatak subsistence caribou hunters perceived that migration of caribou and their own hunting experience are negatively impacted by non-local users in the NNP. This perception raises several questions. Is the NPS, a federal agency responsible for providing protection for rural subsistence users, adequately supporting rural subsistence caribou hunters? What more can the NPS do? How can rural priority for subsistence be balanced with other NPS mandates to allow multiple groups access and benefits from the caribou hunting system in the NNP? Providing for multiple users with different objectives will require policy decisions based on provisions for both subsistence hunters, non-local hunters, and commercial operators. A number of facets are important to the discussion of user conflicts; regulation and rural subsistence preference, education, and zoning. I explore these questions below and include suggestions for addressing these questions made by the study's respondents.

8.1 Further questions: regulations and harvest

For state and federal managers and decision-makers, the Noatak situation between local subsistence hunters and non-locals remains challenging. How to resolve the dissatisfaction expressed by local people and to provide opportunities for other hunters and commercial operators will continue to be an issue explored by wildlife and land management agencies and the WAHWG. Access and use will likely continue as a key issue of user interactions.

In regards to regulations and restricted harvest, how will local subsistence hunters respond to regulatory change if the WAH continues to decline? Harvest restrictions of the WAH would not only impact Noatak, but could affect the roughly 40 communities dependent on the

herd. Since subsistence users take the majority of caribou harvest (Dau, 2011), are rural people more likely to be impacted by reduced harvest than non-locals? Due to dramatic herd declines, recent recommendations were made to the Board of Game in 2015, with support of the WACHWG and other advisory boards, to restrict harvest of the WAH to both resident and non-resident hunters (Dau, 2015; Rogers, 2015). Although representatives of the different boards who created harvest restriction proposals (based on the WAH Cooperative Plan) did not want to restrict subsistence harvest, "representatives eventually agreed that everyone needed to share the burden of reducing harvests regardless of where they live or why they hunt caribou" (Dau, 2015, p. online). In this case, the institutional response, in the form of cooperative management, created an arena where all user groups could be involved. Hunter objectives (subsistence, sport) were not the central focus of regulations on harvest restriction. Additionally, in June 2015, federal regulations are being assessed in order to be consistent with state regulations of harvest restrictions (Dau, 2015).

Due to the WAHs decline in population, how will change in migration continue to be perceived by local hunters? My results show that, at the time of research, respondents were less aware of population change in the WAH and that migration change was a central focus to hunters. Is there a difference in perception by locals when caribou are abundant? How much are local perceptions impacted by knowledge of the overall health of the WAH? Or will local hunters continue to attribute negative impacts to caribou to events they directly observe, such as aircraft disturbance?

8.2 Further questions: education and zoning

The WACHWG must wrestle with issues of user conflict in the region, and in particular Noatak. Fix and Harrington (2012) argued that education, not zoning, in an area of user interaction, is more beneficial for dealing with social values conflicts in many cases. Participation on boards of multiple users and stakeholders can potentially facilitate education and social learning. For local hunters, hearing the concerns of commercial operators (and vice versa), as well as the facts concerning non-local hunting in the region, are important as this may have the potential to educate stakeholders and increase awareness. Social learning between user groups may potentially alleviate the contentious and emotional nature of this issue. But what sort of education is necessary and what best practices can be put into place for education of user groups?

Currently all commercial pilots must take a mandatory Unit 23 Pilot Orientation training in order to fly for the purpose of big game hunting and transport of hunters (ADF&G, 2015). This regulation is required by both state and federal agencies, and pilots must retain the certificate of training completion, subject to enforcement by Alaska State Troopers and federal law enforcement (ADF&G, 2015). This form of education supplies the pilot with suggestions in order to reduce user conflicts within Unit 23 and the NNP. In addition the NPS requires mandatory meetings and an orientation process for commercial operators for the purpose of sensitizing non-locals to user conflicts and local traditional values (National Park Service, 2014b). In addition, other forms of education material have been developed for users of the WAH, such as an active website for the herd. But how best to approach education when user

groups have differing objectives, or do not actively engage one another? As results of this study show, respondents perceived that non-locals did not enter the village or interact with the community. To what extent do direct interactions between individuals facilitate social learning and education about cultural difference, norms, and values? Should commercial pilots (or their clients) also be required to participate more actively or to engage economically with the community? How much education should be based on *suggested* actions, as is the case with the mandatory pilot orientation, or through legally required means?

8.3 Further questions: respondent suggestions for change

Respondents offered a variety of general and specific suggestions for improving management of caribou hunting in the NNP (Appendix G). Respondents' suggestions shed an interesting light on user interactions, specifically noting how detrimental non-locals are seen to impact both caribou migration and local hunter's experience. Would results of this research be different if the population of the WAH was at its peak of 450, 000 caribou in 2003? Despite recent regulations that decided both resident and non-resident (local or non-local hunters) would share the burden of harvest restriction, my research showed that a disconnect still exists between who should be allowed access and when. Questions remain as to best policies to manage contentious issues between user groups when collective perceptions may still drive majority thinking in a community.

Although the majority of respondents suggested reducing non-locals in the area, education could play a major role for change. Specifically, respondents mentioned that user conflicts could be resolved by locals and non-locals working together. For example, programs

could be established for salvaging meat for the village by commercial operator's clients, or that locals could be hired as guides. Although respondents suggested reducing sports hunting, others recognized the legal nature by which non-locals were allowed to hunt in some National Preserve lands. Other suggestions were more specific and suggested a variety of actions such as appropriately spacing campsites of non-locals, not camping on caribou migration routes, letting 1000 caribou pass before shooting, and waiting until Noatak village had hunted before letting non-local activity occur in the region.

Respondents also recognized that young hunters in Noatak should learn more about the traditional ways of hunting. The knowledge of Elder's was mentioned as an invaluable source of information. Not shooting the caribou leader (the first caribou in a group), applied to local young hunters learning traditional hunting skills, as well as non-local hunters.

Engaging local communities in resource management is key to sustainable management and use of a resource (Agrawal & Gibson, 1999; Lynam et al., 2007). My research project used the TEK of Noatak hunters who provided information not only on caribou migration and change, but also insight into subsistence hunting and issues with other user groups. The findings of this study can provide managers insight not only in the case of Noatak, but also in the methods by which this research was employed. Gilchrist and Mallory (2007) refer to TEK as "reliable data… information collected independently from western science [that can] help [make] informed wildlife management decisions" (p. r1). In addition to TEK, continued research on caribou ecology, particularly on caribou distribution and movement, can provide more information to the system, adding to knowledge required for best caribou management and the

continued success of subsistence hunters. Integration of science-based wildlife research and TEK is a frontier in knowledge co-production that is worthy of more effort.

8.4 Conclusion

The knowledge Noatak subsistence hunters have about the Noatak human-caribou system provided insight otherwise unavailable. As "resource managers are increasingly engaging with tribes and…looking for methods to incorporate their perspectives" (Reo, 2011, p. 1) more research into local systems can provide unique opportunities to understand multi-dimensional experiences, in this case, of subsistence hunters. Included as a part of the Noatak traditional knowledge system are beliefs and values based on historical arrangements for access and use of caribou resources. Access and use are shaped by an understanding of social-ecological system dynamics of how and where caribou move, what impacts their survival, and what influences subsistence hunting success. Access and use has changed over time with the introduction of non-local hunters into the system, which has included land administration changes. My research focused not only an ecological change, but also the change in the social system and human-use patterns of resource use, providing temporal and spatial level perspectives. As Moerlein and Carothers (2012) state, "…these communities [of northwestern Alaska], face a total environment of change, whereby environmental changes and broader socioeconomic challenges are jointly shifting and remaking human-environmental relationships" (2012, p. 7). Human-environmental relationships continue to shift within rural Alaska and the Noatak case study revealed complexities of a particular system between subsistence hunters, caribou, and other user groups.

My analysis revealed that user conflicts in the NNP contain many elements between different groups and institutions and were established through a complex arrangement of the development of ANCSA, ANILCA, state and federal definitions of subsistence, historical use of caribou by Iñupiaq, and the NPS' mandates. The NPS faces a challenge when protecting for subsistence priority and providing for other users, when other users are seen to negativity impact subsistence. Careful consideration must be given to the local perspective as it is Noatak hunters who depend on the "unimpeded movement" of the WAH as an "essential subsistence resource" (National Park Service, 2009, p. online), an important aspect to the NNP's Foundation Statement.

Current management practices, including zoning non-locals and providing for a multi-stakeholder forum for recommending policy in the form of the WACHWG, all contribute to adaptive practices by multiple user groups. The challenges faced by policy makers in managing common-pool resources require adaptation in management, ranging from processes of reviewing, redefining, and enforcing rules, providing for a supportive co-management process, and continuing to supply information to users (Ostrom, 1990; Schlager et al., 1994). Effective management based in user engagement and recognition of values differences are critical for successful resource use as they may allow diverging sides to arrive at common-ground solutions. As one hunter put it, "We should try to keep the traditional ideas alive about hunting caribou". This quote exemplifies the notion that tradition underpins the belief system and behavior of subsistence hunters who rely on particular resources, such as caribou, to continue their way of life.

Knowledge of human-caribou systems is important for both a good quality hunt and successful harvest as understanding caribou ecology can help predict harvest (Jacobsen, 2011; Parlee & Manseau, 2005). Temporal and spatial limitation to knowledge may define when, where, and how local hunters interact with variables, thus influencing how perceptions are formed about migration and population impacts and changes. As Padilla (2010) argued, TEK's "context-specific nature" (p. 90), supports the notion that knowledge is attributed to place and experience. More importantly, TEK and the local perspective can be viewed as part of an on-going process to increasingly include local people in research and management on dynamic processes they encounter on a daily basis.

As with western science of caribou, TEK contributes observations and theory into the larger pool of perspectives about the human-caribou systems. As resource health and abundance shifts, questions remain to how the health and well-being of subsistence communities will also transform. It is the experiences and perceptions of local people that open rich spaces of understanding and relevance, especially in times of rapid change, and it is change and the capacity for adaptation that will ultimately define the future of Alaska subsistence for years to come.

References Cited

ADF&G. (2014). Western Arctic Caribou Herd Numbers 235, 000. *Alaska Fish & Wildlife News* Retrieved March 2015, 2015, from http://www.adfg.alaska.gov/index.cfm?adfg=wildlifenews.main&issue_id=136

ADF&G. (2015). Unit 23 Pilot Orientation Retrieved June 2015, 2015, from http://www.adfg.alaska.gov/index.cfm?adfg=unit23pilot.main

Agrawal, A., & Gibson, C. C. (1999). Enchantment and disenchantment: the role of community in natural resource conservation. *World Development, 27*(4), 629-649.

Alaska Native Science Commission. (2014). What is Traditional Knowledge? Retrieved September, 2014, from http://www.nativescience.org/

Anderson, D. B., Anderson, W. W., Bane, R., Nelson, R. K., & Towarak, N. S. (1998). *Kuuvanmiut* Subsistence: Traditional Eskimo Life in the Latter Twentieth Century. (pp. 329). Kotzebue, Alaska: National Park Service; Department of Interior.

Berkes, F. (2007). Understanding uncertainty and reducing vulnerability: lessons from resilience thinking. *Natural Hazards, 41*(2), 283-295. doi: 10.1007/s11069-006-9036-7

Berkes, F. (2009a). Evolution of co-management: role of knowledge generation, bridging organizations and social learning. *Journal of Environmental Management, 90*(5), 1692-1702.

Berkes, F. (2009b). Indigenous ways of knowing and the study of environmental change. *Journal of the Royal Society of New Zealand, 39*(4), 151-156.

Berkes, F. (2012). *Sacred Ecology*. New York, New York: Routledge.

Bonny, E., & Berkes, F. (2008). Communicating traditional environmental knowledge: addressing the diversity of knowledge, audiences and media types. *Polar Record, 44*(03). doi: 10.1017/s0032247408007420

Braem, N., & Kostick, M. (2014). Subsistence Wildlife Harvests in Elim, Golovin, Kivalina, Koyuk, Noatak, and Wales, Alaska, 2010-2011 *Special Publication No. SP2012-04* (pp. 66). Fairbanks, Alaska: Alaska Department of Fish & Game.

Braund, S. R. (2009). Red Dog Mine Extension Aqqaluk Project Supplemental Baseline Report: Subsistence Use Areas and Traditional Knowledge Study for Kivaline and Noatak, Alaska In S. R. B. Associates (Ed.). Seattle, WA: U.S. Enviornmental Protection Agency.

Brody, H. (1981). *Maps and Dreams*. Vancouver: Douglas & McIntyre.

Bromley, D. W. (Ed.). (1992). *Making the Commons Work, Theory Practice and Policy*. San Francisco: Institute for Contemporary Studies.

Bryan, J. (2009). Where would we be without them? Knowledge, space and power in indigenous politics. *Futures, 41*(1), 24-32.

Burch, E. S. (1998). *The Iñupiaq Eskimo nations of northwest Alaska*: University of Alaska Press (Fairbanks).

Burch, E. S. (2006). *Social Life in Northwest Alaska: The Structure of Inupiaq Eskimo Nations*. Fairbanks, Alaska University of Alaska Press.

Burch, E. S. (2012). *Caribou Herds of Northwest Alaska, 1850-2000*: University of Alaska Press.

Catton, T. (1997). *Inhabited wilderness: Indians, Eskimos, and national parks in Alaska*: University of New Mexico Press Albuquerque.

Creswell, J. W. (2013). *Research design: Qualitative, quantitative, and mixed methods approaches*: Sage.

Cruikshank, J. (1981). Legend and Landscape: Convergence of Oral and Scientific Traditions in the Yukon Territory. *Arctic Anthropology, 18*(2), 67-93.

Cruikshank, J. (1998). *Social Life of Stories: Narrative and Knowledge in the Yukon Territory*. Omaha: University of Nebraska.

Dau, J. (2011). Units 21D, 22D, 22B, 22C, 22D, 22E, 23, 24, and 26A caribou management report. In P. Harper (Ed.), *Caribou management report of survey-inventory activities 1 July 2008-30 July 2010* (pp. 187-250): Alaska Department of Fish & Game.

Dau, J. (2014). *Western Arctic Caribou Herd Overview*. Western Arctic Caribou Herd Working Group. ADF&G. Kotzebue, Alaska.

Dau, J. (2015). Managing the Western Arctic Caribou Herd: Negotiating the Regulatory Process. *Alaska Fish and Wildlife News*. Retrieved from http://www.adfg.alaska.gov/index.cfm?adfg=wildlifenews.view_article&articles_id=719

Eicken, H. (2010). Indigenous knowledge and sea ice science: What can we learn from indigenous ice users? *SIKU: Knowing Our Ice* (pp. 357-376): Springer.

Elo, S., & Kyngäs, H. (2008). The qualitative content analysis process. *Journal of advanced nursing, 62*(1), 107-115.

Erlich, J., & Magdanz, J. (1994). Qikiqtagrunmiut Subsistence: Conservation in an Inupiaq Context. Kotzebue, Alaska: Kotzebue IRA Council.

Fall, J. A. (1990). The division of subsistence of the Alaska Department of Fish and Game: an overview of its research program and findings: 1980-1990. *Arctic Anthropology*, 68-92.

Ferguson, M. A. D., & Messier, F. (1997). Collection and analysis of traditional ecological knowledge about a population of Arctic tundra caribou. *Arctic*, 17-28.

Fienup-Riordan, A. (1999). Yaqulget qaillun pilartat (what the birds do): Yup'ik Eskimo understanding of geese and those who study them. *Arctic*, 1-22.

Fix, P. J., & Harrington, A. M. (2012). Measuring Motivations as a Method of Mitigating Social Conflict. *Human Dimensions of Wildlife: An International Journal, 17*(5), 367-375.

Folke, C. (2004). Traditional knowledge in social-ecological systems. *Ecology and Society, 9*(3), 7. Retrieved from http://www.ecologyandsociety.org/vol9/iss3/art7/

Fonteyn, M. E., Vettese, M., Lancaster, D. R., & Bauer-Wu, S. (2008). Developing a codebook to guide content analysis of expressive writing transcripts. *Applied Nursing Research, 21*(3), 165-168.

Foote, D. C., & Williamson, H. A. (1966). A Human Geographical Study. In N. J. Wilimovsky & J. N. Wolfe (Eds.), *Environment of the Cape Thompson Region, Alaska*. Springfield, Virginia: United States Atomic Energy Commission.

Georgette, S., & Loon, H. (1988). The Noatak River: Fall Caribou Hunting and Airplane Use (D. o. Subsistence, Trans.). Kotzebue, Alaska.

Gilchrist, G., & Mallory, M. L. (2007). Comparing expert-based science with local ecological knowledge: what are we afraid of. *Ecology and Society, 12*(1), r1.

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

Huntington, H. P. (2011). The Local Perspective. [Comment]. *Nature, 478*.

Jacobsen, C. (2008). Fall Hunting in Game Management Unit 23: Assessment of Issues and Proposal for a Planning Process (D. o. W. Conservation, Trans.). Kotzebue, Alaska: Alaska Department of Fish and Game.

Jacobsen, P. (2011). *"With a Connection to the Land, Our Spirit is Strong": Tlicho Traditional Knowledge of Climate Chnage and Impacts for Caribou Hunting: Implication for Traditional Knowlegde Research.* (M.A.), University of Northern BC, Prince George, BC, Canada.

Johannes, R. E. (1993). Integrating traditional ecological knowledge and management with environmental impact assessment. *Traditional ecological knowledge: concepts and cases*, 33-39.

Joly, K. (2012). *Caribou vital sign annual report for the Arctic Network Inventory and Monitoring Program: September 2011-August 2012. Natural Resource Data Series NPS/ARCN/NRDS-2012/406*. Fort Collins, Colorado.

Kassam, K. A. S. (2009). *Biocultural diversity and indigenous ways of knowing: Human ecology in the Arctic*: University of Calgary Press.

Katz, S. (2010). Traditional Knowledge on Caribou Ecology: Vegatation, Caribou, Wolf Food Chain. Inuvik, NT: Aurora Research Insitute.

Kawagley, A. O., Norris-Tull, D., & Norris-Tull, R. A. (1998). The indigenous worldview of Yupiaq culture: Its scientific nature and relevance to the practice and teaching of science. *Journal of research in science teaching, 35*(2), 133-144.

Kendrick, A. (2003). Caribou co-management in northern Canada: fostering multiple ways of knowing. In F. Berkes, J. Colding & C. Folke (Eds.), *Navigating social–ecological systems: building resilience for complexity and change* (pp. 241-268). Cambridge: Cambridge University Press.

Kendrick, A., Lyver, P. O. B., & Lutsel K'E Dene First Nation. (2005). Denesoline (Chipewyan) Knowledge of Barren-Ground Caribou (Rangifer tarandus groenlandicus) Movements. *Arctic, 58*(2), 175-191.

Klein, D. R., Moorehead, L., Kruse, J., & Braund, S. R. (1999). Contrasts in use and perceptions of biological data for caribou management. *Wildlife Society Bulletin*, 488-498.

Kofinas, G., Aklavik, Arctic Village, Old Crow, & Fort McPherson. (2002). Community Contributions to Ecological Monitoring: Knowledge Co-Production in the US-Canada Arctic Borderlands. In I. Krupnik & D. Jolly (Eds.), *The Earth is Faster Now: Indigenous Observations of Arctic Environmental Change* (pp. 54-91). Fairbanks, AK: ARCUS.

Kofinas, G. P. (1998). *The costs of power sharing: community involvement in Canadian Porcupine caribou co-management.* (Unpublished doctoral dissertation). University of British Columbia, Vancouver, BC.

Kofinas, G., Lyver, P., Russell, D., White, R., Nelson, A., & Flanders, N. (2001). Towards a protocol for community monitoring of caribou body condition. *Rangıfer, 23*(5), 43-52.

Kofinas, G. P. (2005). Caribou hunters and researchers at the co-management interface: emergent dilemmas and the dynamics of legitimacy in power sharing. *Anthropologica*, 179-196.

Kofinas, G. P. (2009). Adaptive Co-management in Social-Ecological Governance. In F. S. Chapin, G. P. Kofinas & C. Folke (Eds.), *Principles of Ecosystem Stewardship: Resilience-Based Management in a Changing World* (pp. 77-102). New York: Springer-Verlag.

Kofinas, G. P., Chapin, F. S., BurnSilver, S., Schmidt, J. I., Fresco, N. L., Kielland, K., . . . Rupp, T. S. (2010). Resilience of Athabascan subsistence systems to interior Alaska's changing climateThis article is one of a selection of papers from The Dynamics of Change in Alaska's Boreal Forests: Resilience and Vulnerability in Response to Climate Warming. *Canadian Journal of Forest Research, 40*(7), 1347-1359. doi: 10.1139/x10-108

Kruse, J., Klein, D., Braund, S., Moorehead, L., & Simeone, B. (1998). Co-management of natural resources: a comparison of two caribou management systems. *Human Organization, 57*(4), 447-458.

Lynam, T., De Jong, W., Sheil, D., Kusumanto, T., & Evans, K. (2007). A review of tools for incorporating community knowledge, preferences, and values into decision making in natural resources management. *Ecology and Society, 12*(1), 5 [online].

Lyver, P. O. B., & Lutsël K'é Dene First Nation. (2005). Monitoring barren-ground caribou body condition with Denésoliné traditional knowledge. *Arctic, 58*(1), 44-54.

Mack, N., Woodsong, C., MacQueen, K. M., Guest, G., & Namey, E. (2005). Qualitative Research Methods: A Data Collectors Field Guide. Research Triangle Park, North Carolina: Family Health International.

Magdanz, J. S., Braem, N. S., Robbins, B. C., & Koster, D. S. (2010). Subsistence Harvests in Northwest Alaska. Kivalina and Noatak, 2007. *Technical Paper 354*: Alaska Department of Fish & Game.

Mager, K. H., Colson, K. E., & Hundertmark, K. J. (2013). High genetic connectivity and introgression from domestic reindeer characterize northern Alaska caribou herds. *Conservation Genetics, 14*(6), 1111-1123.

Mikow, E., Braem, N., & Kostick, M. (2014). Subsistence Wildlife Harvests in Brevig Mission, Deering, Noatak, and Teller, Alaska, 2011-2012 *Special Publication No. 2014-02* (pp. 55). Fairbanks, AK: Alaska Department of Fish & Game.

Moerlein, K. J., & Carothers, C. (2012). Total environment of change: impacts of climate change and social transitions on subsistence fisheries in northwest Alaska. *Ecology and Society, 17*(1), 10.

Moller, H., Berkes, F., Lyver, P. O. B., & Kislalioglu, M. (2004). Combining science and traditional ecological knowledge: monitoring populations for co-management. *Ecology and Society, 9*(3), 2.

Nadasdy, P. (1999). The politics of TEK: Power and the" integration" of knowledge. *Arctic Anthropology*, 1-18.

NANA Regional Corporation Inc. (2015). Noatak Community Profile, 2014., from http://nana.com/regional/about-us/overview-of-region/noatak/

National Park Service. (2009). *Western Arctic National Parklands: Noatak National Preserve Foundation Statement*. Alaska & Denver: National Park Service.

National Park Service. (2014a). Attachement C - Specific Provisions; Western Arctic National Parklands - 2014: Department of Interior.

National Park Service. (2014b). *Western Arctic Parklands; Attachement C, Park-Specific Provisions*. Kotzebue, AK: Western Arctic National Parklands.

Norbert, W. (2007). What if indigenous knowledge contradicts accepted scientific findings?-the hidden agenda: respect, caring and passion towards aboriginal research in the context of applying western academic rules. *Educational Research and Reviews, 2*(9), 225-235.

Norris, F. (2002). *Alaska Subsistence: A National Park Service Management History*. Anchorage, Alaska: US Department of the Interior.

Osherenko, G., & Young, O. R. (1989). *The Age of the Arctic: Hot Conflicts and Cold Realities*. Cambridge Cambridge University Press.

Ostrom, E. (1990). *Governing the Commons: The Evolution of Institutions for Collective Action*: Cambridge University Press.

Ostrom, E. (2009). *Understanding Institutional Diversity*: Princeton University Press.

Padilla, E., & Kofinas, G. P. (2014). “Letting the leaders pass”: barriers to using traditional ecological knowledge in co-management as the basis of formal hunting regulations. *Ecology and Society, 19*(2), 7.

Padilla, E. S. R. (2010). *Caribou Leadership" A Study of Traditional Knowledge, Animal Behavior, and Policy.* (MSc), University of Alaska, Fairbanks, Fairbanks, Alaska.

Parlee, B., & Manseau, M. (2005). Using Traditional Knowledge to Adapt to Ecological Change: Denésǫłiné Monitoring of Caribou Movements. *Arctic*, 26-37.

Parlee, B., Manseau, M., & Nation, Ł. K. é. D. F. (2005). Using traditional knowledge to adapt to ecological change: Denésołiné monitoring of caribou movements. *Arctic, 58*(1), 26-37.

Person, B. T., Prichard, A. K., Carroll, G. M., Yokel, D. A., Suydam, R. S., & George, J. C. (2007). Distribution and Movements of the Teshekpuk Caribou Herd 1990-2005: Prior to oil and gas Development. *Arctic*, 238-250.

Pinkerton, E. (2011). *Co-operative management of local fisheries: new directions for improved management and community development*: UBC Press.

Polfus, J. L., Heinemeyer, K., & Hebblewhite, M. (2014). Comparing traditional ecological knowledge and western science woodland caribou habitat models. *The Journal of wildlife management, 78*(1), 112-121.

Quakenbush, L. T., & Huntington, H. P. (2010). *Traditional knowledge regarding bowhead whales in the Chukchi Sea near Wainwright, Alaska*. Minerals Management Service, Department of the Interior.

Ray, D. J. (1967). Land Tenure and Polity of the Bering Strait Eskimos. *Journal of the West, 6*(3), 520.

Reo, N., & Whyte, K. (2012). Hunting and Morality as Elements of Traditional Ecological Knowledge. *Human Ecology, 40*(1), 15-27. doi: 10.1007/s10745-011-9448-1

Reo, N. J. (2011). The importance of belief systems in traditional ecological knowledge initiatives. *The International Indigenous Policy Journal, 2*(4), 8.

Rogers, J. (2015, March 29, 2015). Hunting restrictions on 2 Alaska caribou herds to take effect this summer, *The Arctic Sounder*.

Russell, D., Kofinas, G., & Griffith, B. (2000). Need and opportunity for a North American caribou knowledge cooperative. *Polar Research, 19*(1), 117-129.

Schlager, E., Blomquist, W., & Tang, S. Y. (1994). Mobile flows, storage, and self-organized institutions for governing common-pool resources. *Land Economics*, 294-317.

Schlager, E., & Ostrom, E. (1992). Property-rights regimes and natural resources: a conceptual analysis. *Land Economics*, 249-262.

Schramm, T., Krogman, N., Hudson, R. J., & Freeman, M. M. R. (2002). Caribou Mountains Critical Ungulate Habitat and Traditional Ecological Knowledge Study: A GIS Analysis. Edmonton, Alberta: Department of Renewable Resources: University of Alberta.

Spaeder, J. J. (2005). Co-management in a landscape of resistance: the political ecology of wildlife management in western Alaska. *Anthropologica*, 165-178.

State of Alaska. (2015). Alaska Community Database Online. *Department of Commerce, Community, and Economic Development* 2015, from http://commerce.state.ak.us/cra/DCRAExternal

Tobias, T. (2000). Chief Kerry's moose: a guidebook to land use and occupancy mapping, research design, and data collection. Vancouver, B.C.: BC Union of Indian Chiefs & Ecotrust Canada.

Tobias, T. (2009). *Living proof*. Vancouver, B.C. : Ecotrust Canada.

Trent, J., Kruse, J., & Leask, L. (1996). Understanding Harvest Assessment in the North. Girdwood, Alaska: Alaska Department of Fish & Game. Insitute of Social and Economic Research.

U.S. Census Bureau. (2010). American Fact Finder. *United States Census Bureau*, 2015, from http://factfinder.census.gov/faces/nav/jsf/pages/community_facts.xhtml

U.S. Energy Information Administration. (2015). Petroleaum & Other Liquids: This Week in Petroleum Retrieved March 2015, 2015, from http://www.eia.gov/petroleum/weekly/gasoline.cfm#tabs-retail-avg

Uhl, W. R., & Uhl, C. (1979). The Noatak National Preserve: Nuatakmitt: A Study of Subsistence Use of Renewable Resources in the Noatak River Valley *Anthropology and Historic Preservation Cooperative Park Studies Unit* Fairbanks, Alaska: University Of Alaska, Fairbanks.

Usher, P. J. (1995). Co-management of natural resources: Some aspects of the Canadian experience. *Human ecology and climate: People and resources in the Far North. Washington: Taylor & Francis*, 197-206.

Valkenburg, P. (2011). Herd size, distribution, harvest, management issues, and research priorities relevant to caribou herds in Alaska. *Rangifer, 18*(5), 125-129.

Vaske, J. J. (2008). *Survey research and analysis: Applications in parks, recreation and human dimensions*: Venture Publishing State College, PA.

Watson, A., & Huntington, O. (2008). They're here - I can feel them: the epistemic spaces of Indigenous and Western Knowledges. *Social & Cultural Geography, 9*(3), 257-281. doi: 10.1080/14649360801990488

Western Arctic Caribou Working Group. (2011). Western Arctic Caribou Herd Cooperative Management Plan; Revised December 2011 (pp. 47). Nome, Alaska: ADF&G.

Wilson, D. C., Raakjær, J., & Degnbol, P. (2006). Local ecological knowledge and practical fisheries management in the tropics: A policy brief. *Marine Policy, 30*(6), 794-801. doi: 10.1016/j.marpol.2006.02.004

Wilson, S. (2008). *Research is ceremony: Indigenous research methods*: Fernwood Publishing.

Wolfe, R., & Walker, R. J. (1987). Subsistence Economies in Alaska: Productivity, Geography, and Development Impacts. *Arctic Anthropology, 24*(2), 56-81.

Young, O. R. (2002). *The Institutional Dimensions of Environmental Change: Fit, Interplay, and Scale*. Boston: MIT Press.

Appendices

Appendix A

(907) 474-7800
(907) 474-5444 fax
uaf-irb@alaska.edu
www.uaf.edu/irb

Institutional Review Board
909 N Koyukuk Dr. Suite 212, P.O. Box 757270, Fairbanks, Alaska 99775-7270

August 8, 2014

To:	Gary Kofinas, PH.D Principal Investigator
From:	University of Alaska Fairbanks IRB
Re:	[392962-3] Documenting Traditional Knowledge of Migratory Behavior of Western Arctic Herd Caribou

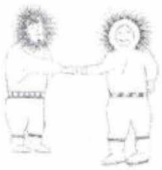
Thank you for submitting the Continuing Review/Progress Report referenced below. The submission was handled by Exempt Review. The Office of Research Integrity has determined that the proposed research qualifies for exemption from the requirements of 45 CFR 46. This exemption does not waive the researchers' responsibility to adhere to basic ethical principles for the responsible conduct of research and discipline specific professional standards.

Title:	Documenting Traditional Knowledge of Migratory Behavior of Western Arctic Herd Caribou
Received:	August 8, 2014
Exemption Category:	*2*
Effective Date:	August 8, 2014

This action is included on the August 6, 2014 IRB Agenda.

Prior to making substantive changes to the scope of research, research tools, or personnel involved on the project, please contact the Office of Research Integrity to determine whether or not additional review is required. Additional review is not required for small editorial changes to improve the clarity or readability of the research tools or other documents.

Appendix B



NATIVE VILLAGE OF NOATAK
P.O. BOX 89
NOATAK, ALASKA 99761
PHONE: (907) 485-2173
FAX: (907) 485-2137

Resolution 13-42

Resolution on the Caribou Traditional Knowledge Project

Whereas there is a long-standing concern among local subsistence users in the Northwest Arctic Region about the effects of non-local sport hunters dropped off by air taxis and transporters on caribou migration and local caribou hunting;

Whereas the Noatak Caribou Traditional Knowledge Project is studying 1) caribou hunting 2) caribou hunters experiences and perspectives and 3) traditional knowledge of caribou;

Whereas Traditional Knowledge is defined as the collective body of lived experiences, information and observations about the land and it's systems as interpreted by Noatak residents;

Whereas the National Park Service (NPS) contracted Professor Gary Kofinas from the University of Alaska Fairbanks (UAF) and graduate student, Gabriela Halas to work collaboratively with the Noatak IRA and Noatak residents to complete the project;

Whereas the UAF researchers will focus on the Noatak homelands and traditional use areas and collaborate with Noatak to document the traditional knowledge of local residents;

Whereas the Caribou Traditional Knowledge Project established a three-person project advisory committee to help guide the project activities;

Whereas the Caribou Traditional Knowledge Project will compensate local knowledge holders for their participation in interviews and surveys;

Whereas the Caribou Traditional Knowledge Project will share project findings with the Noatak Council for its use and review;

Whereas the Caribou Traditional Knowledge Project will work the Native Village of Noatak to protect against the release of sensitive information to non-local organizations;

Whereas the Caribou Traditional Knowledge Project has approval from the Northwest Arctic Borough but does not require a Title 9 permit under NW Borough Planning Department mandate, the US Office of Management and Budget (NPS Federal Permit), and the Institutional Review Board (IRB) at UAF to do the study;

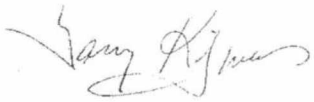
Whereas the Caribou Traditional Knowledge Project will provide video copies of Elder's interviews to each Elder, as well as a full set of the videos to the local school and Native Village of Noatak;

Whereas the Caribou Traditional Knowledge Project will provide any and all raw data to the Noatak Council upon its request;

The Noatak IRA therefore agrees to partner with the University of Alaska Fairbanks in undertaking the Caribou Traditional Knowledge Project.

***Signatories for University of Alaska Fairbanks*:**

Gary Kofinas (Professor, UAF and project Principal Investigator/Leader)



Date: *November 10, 2013*

Signature on behalf of the Native Village of Noatak (IRA):

Vernon Adams Sr. (President)

Date: NOV. 18, 2013

Appendix C
Active Hunter Survey

Noatak Caribou
Traditional Knowledge Project
Hunter Survey

School of Natural Resources and Agricultural Sciences
Department of Humans and the Environment
PO Box 757200
Fairbanks, AK 99775-7200
If you have any questions about this questionnaire, contact
Gabriela Halas (UAF Grad Student), ghalas@alaska.edu,
Kyle Joly (NPS), Kyle_Joly@nps.gov
Gary Kofinas (Project Leader) gary.kofinas@alaska.edu (907 474 7078),

Interview number_____

Interviewer _____

Date of interview_____

Start time _____

End time _____

Paperwork Reduction Act Statement: The National Park Service is authorized by 16 U.S.C. 1a-7 to collect this information. We will use this information to document the traditional knowledge on caribou for the village of Noatak and to inform NPS decision making on hunting caribou in the Noatak Preserve area.

Your response is voluntary and anonymous. Your name will never be associated with your responses. Please do not put your name or contact information on this questionnaire. A Federal agency may not conduct or sponsor and you are not required to respond to, a collection of information unless it displays a currently valid OMB Control Number.

We estimate that it will take 30-60 minutes to complete this questionnaire. You may send comments concerning the burden estimate or any aspect of this information collection to: Gary Kofinas (Project Leader) at gary.kofinas@alaska.edu or call him at 907 4575725

OMB Control Number 1024-0224

Expiration Date: 8/31/2014

Informed Consent
Noatak Caribou Traditional Knowledge Project
Hunter Survey

[Read to participant before the start of the interview.
Provide the participant with a printout of this statement]

Description of Study:
We are interviewing caribou hunters of Noatak for the ***Noatak Traditional Knowledge of Caribou Project***. The purpose of this project is to document the traditional knowledge of local Noatak residents about caribou.

This project is part of a larger study on caribou hunting sponsored by the National Park Service that will include interviews with sport hunters. The project is being led by the University of Alaska Fairbanks. The findings of the traditional knowledge study will be used in a master's thesis at University of Alaska Fairbanks (UAF), a report, and several published papers.

Risks and Benefits:
We anticipate this interview will take about 30-45 minutes, depending on the length of your answers. Your responses are completely voluntary and will remain anonymous. Your name will not appear in any reports or publications associated with this study. No one will financially profit from the project. Working with the Noatak Tribal Council, we hope that your community and others will benefit from the project's documentation of your knowledge.

Compensation: At the end of the interview you will receive $50 for your participation in the project.

Language: If you do not speak English, a language interpreter will be provided.

Contacts and Questions:
If you have questions now, please ask them. If you have questions later, you may call Gabriela Halas at ghalas@alaska.edu (email) or (907) 699-0612 (phone); or contact Gary Kofinas at gary.kofinas@uaf.edu (email) or (907) 474-7078 (phone). Gabriela is a graduate student and Gary is a professor at the School of Natural Resources, University of Alaska Fairbanks.

If you have questions or concerns about your rights as a research participant, you can contact the UAF Office of Research Integrity at 474-7800 (Fairbanks area) or 1-866-876-7800 (toll-free outside the Fairbanks area) or fyirb@uaf.edu (email).

Thank you! Taikuu!

Do you agree to be interviewed?
□ Yes □ No

Are you a caribou hunter?
□ Yes □ No

Questionnaire for Hunters

Questions about you:

1. In what year were you born? _____

2. Where were you born? _____

3. Have you lived in any other communities other than Noatak?
   □ Yes □ No

   If yes, in what years did you live elsewhere? _____

4. Type of employment you had during the past 12 months
   □ Unemployed / No job for money
   □ Part time
   □ Seasonal
   □ Full time

5. How old were you when you started hunting caribou? _____

6. Did you hunt caribou in (year)?

Year	*Yes or No*	*August-Oct.* *Did you harvest caribou:* *Yes or No*	*Nov.-March.* *Did you harvest caribou:* *Yes or No*	*April – July* *Did you harvest caribou:* *Yes or No*
a. 2013				
b. 2012				
c. 2011				
d. 2010				

7. Do you consider the last year (last 12 months) to be a successful year for your caribou hunting?

□ Yes → *If yes*, Why?

□ No → *If no*, Why not?

8. I will read a list of events, please tell me which scenario represents a successful caribou hunt *for you*?

		Level of importance
a.	Bringing home a caribou	high ---------medium ----------low
b.	Bringing home more than one caribou	high ---------medium ----------low
c.	Being on the land and camping	high ---------medium ----------low
d.	Being on the land with family or friends	high ---------medium ----------low
e.	Having good weather	high ---------medium ----------low
f.	Coming home safely	high ---------medium ----------low
g.	Seeing friends and other local people out hunting	high ---------medium ----------low
h.	Not seeing non-local people while hunting	high ---------medium ----------low
i.	(people from ANC, FAI, Kotzebue, and other communities)	
j.	Going to a favorite spot to go hunting	high ---------medium ----------low
k.	Other:	
l.	_____	high ---------medium ----------low
m.	_____	high ---------medium ----------low
n.	_____	high ---------medium ----------low
o.	_____	high ---------medium ----------low

Last year's caribou hunts (last 12 months):

9. What is the best time for you to go harvest caribou? fall – winter – spring – summer

10. How do you know what is the best time to go out caribou hunting? (*information sources and or observed environmental signals)*

11. Please provide information about last year's caribou hunting:

	Fall	*Winter*	*Spring*
a. How many caribou did you harvest?			
b. How many caribou hunting trips did you take in the….			
c. How many days total did you spend hunting?			
d. What was the average (typical) distance you traveled per trip when caribou hunting?			
e. Did you take mostly day trips (DT), overnights (O), or multi-day trips (MDT)?			
f. Did you hunt Alone (A), With other hunters from your household (YH), With hunters from other households (OH),			

12. Please answer these questions about changes in caribou and your caribou hunting in the last five years?

a. Number of caribou you harvest fewer----------no change----------more------DK

b. Number of caribou hunting trips fewer----------no change----------more------DK

c. Length of trips shorter----------no change----------longer------DK

d. Timing of trips earlier----------no change----------later------DK

e. Number of total day's caribou hunting fewer----------no change----------more------DK

f. Fat/condition of caribou less fat---------no change---------fatter--------DK

g. Health of caribou (diseases, parasites) less healthy----no change------ healthier-----DK

h. Number of people you see while hunting: fewer----------no change----------more------DK

13. Has the change in the cost of gasoline affected your caribou hunting?

□ No □ Yes (if yes ask) ->

In how many hunting trips you take? .....fewer --------- no change------more

In the length of time on trips.....shorter ------- no change ----- longer

In when you go?... Fall trips .....fewer --------- no change------more

Winter trips.....fewer ------- no change------more

Spring trips……fewer --------- no change-----more

Summer trips…fewer --------- no change------more

How far you go? ……closer ------ no change----- further

In where you go?…… □ No □ Yes (if yes, describe change)

Type of gear you use ……□ No □ Yes (if yes, describe change)

Impacts to caribou and your caribou hunting success

14. Next, I would like to ask about possible impacts to caribou and the second asks about what affects your caribou hunting. Of the following things, what <u>is likely to have a negative impact</u> on the caribou herd?

	Impact to migration of caribou	**Impact to your caribou hunting**	
	No negative impact; low; medium; high; don't know	No negative impact; low; medium; high; don't know	Comments
a. Wolves			
b. Bears			
c. Other animals			
d. The Red Dog Road			
e. Local hunters			
f. Non-local hunters			
g. Small airplanes			
h. Helicopters			
i. Motorized boats			
j. Non-motorized boats			
k. Collars on caribou			

l. Biologists who track wildlife in planes			
m. Warming climate			
n. Pollution/Contamination			
o. Habitat Change (food)			
p. Other			

Caribou Population and Migration

15. Has the population of Western Arctic Herd changed in the past ten years?

□ More --- □ No change ---□ Fewer ---□ Don't know

Why?

16. Has caribou migration (where caribou go) changed in the last ten years?

□ Changed a lot

□ Changed a little

□ No change

□ Don't know

If changes ask Please describe changes (when / where)

Why has it changed?

Your encounters with other hunters last fall

If hunted last fall:

17. How many other hunters or groups of hunters did you encounter (within sight or sound) when caribou hunting last fall? Please tell me about the encounters you had after leaving Noatak.

		This level of encounters was…		
Type of encounter	Number of encounters:	**What expected:** 1-Fewer than expected 2-What was expected 3-More	**Number affects quality?** 1-Greatly reduced quality 2- Somewhat reduced 3- No influence 4- Slightly improved 5- Greatly improved	**Behavior affect your success or experience:** 1-Greatly reduced quality 2-Somewhat reduced 3-No influence 4-Slightly improved 5-Greatly improved
a. Guided hunters	_____ or □ DK			
b. Hunters that used a transporter	_____ or □ DK			
c. Other hunters from Noatak	_____ or □ DK			
d. Hunters from other villages, including Kotzebue	_____ or □ DK			
e. Airplanes landing or in flight	_____ or □ DK			
f. ATVs	_____ or □ DK			
g. Motorized boats	_____ or □ DK			
h. Non-motorized boats (rafts or canoes)	_____ or □ DK			

18. Of the encounters you mentioned, can you estimate the percentage of them were negative?

If negative was mentioned: Of the negative experiences you mentioned, where did they occur?

Why were they negative?

If positive was mentioned: Of the positive experiences you mentioned above, why were they positive?

Caribou Management

19. If you had a question about the population or migration of caribou, who would you ask?

20. If you had a question or concern about caribou management, who would you ask?

21. Have you heard of the Western Arctic Herd Working Group?

□ No

□ Yes → *If yes,* do you know the name of the Noatak's representative for that group?

_____

22. If the people of Noatak had a concern about caribou hunting, do you feel that it would be seriously considered by the

	not likely	somewhat likely	likely	very likely	DK
Western Arctic Herd Working Group					
The Alaska Board of Game					
Federal Subsistence Board					
NANA Corporation					
Noatak IRA					
National Park Service					

Alaska Department of Fish and Game					
US Fish and Wildlife Service					

23. Where do you get your information about caribou population and migration?

□ Family members

□ Friends/neighbors

□ Biologists

□ Caribou Trails Newsletter

□ CB Radio

□ Elders

□ Other _____

24. Where do you get your information about caribou management?

□ Family members

□ Friends/neighbors

□ Biologists

□ Caribou Trails Newsletter

□ CB Radio

□ Elders

□ Other_____

25. What are your suggestions for improving management of caribou hunting in the Noatak Area?

26. Do you have other comments or suggestions on caribou management and non-local hunters in the Noatak area that you would like to share?

Appendix D
Knowledgeable Hunters Interview

Noatak Caribou

Traditional Knowledge Project

Knowledgeable Hunters Interview

School of Natural Resources and Agricultural Sciences
Department of Humans and the Environment
PO Box 757200
Fairbanks, AK 99775-7200
If you have any questions about this questionnaire, contact:
Gary Kofinas gary.kofinas@alaska.edu (907 474 7078),
Gabriela Halas, ghalas@alaska.edu,
Or Kyle Joly, Kyle_Joly@nps.gov

Respondent ID: _____
Map ID: _____
Date of Interview: _____
Start time: _____
End time: _____
Interviewer: _____

Paperwork Reduction Act Statement: The National Park Service is authorized by 16 U.S.C. 1a-7 to collect this information. We will use this information to document the traditional knowledge on caribou for the village of Noatak and to inform NPS decision making on hunting caribou in the Noatak Preserve area.

Your response is voluntary and anonymous. Your name will never be associated with your responses. Please do not put your name or contact information on this questionnaire. A Federal agency may not conduct or sponsor and you are not required to respond to, a collection of information unless it displays a currently valid OMB Control Number.

We estimate that it will take 90 minutes to complete the interview associated with this interview. You may send comments concerning the burden estimate or an aspect of this information collection to: Gary Kofinas at gary.kofinas@alaska.edu (email) or call him at 907 457 5725.

OMB Control Number 1024-0224 Expiration Date: 8/31 2014

Informed Consent
Noatak Caribou Traditional Knowledge Project
Knowledgeable Hunters Interview

[The interviewer will read to participant before the start of the interview. Provide the participant with a printout of this statement]

Description of Study:

We would like to interview you for the ***Noatak Traditional Knowledge of Caribou Project***. This purpose of this project is to document the local and traditional knowledge of Noatak residents about caribou and caribou hunting. We will ask about caribou migration and population, what affects caribou body condition, health and abundance, as well as hunting conditions and hunting conflicts.

This project is part of a larger study on caribou hunting funded by the National Park Service. The project is being led by the University of Alaska Fairbanks. The findings of the study will be used in a master's thesis at University of Alaska Fairbanks (UAF), a report, and several published papers.

Risks and Benefits:

We anticipate that this interview will take 90 minutes, depending on the length of your answers. Your responses are completely voluntary and will remain anonymous, unless you decide to share your name with us in the reports. No one will financially profit from the project. Working with the Noatak Tribal Council, we hope that your community and others will benefit from the project's documentation of your knowledge.

Compensation: You will be paid $75 for the first hour of interviewing and $25 per half hour after that. There is a maximum of $150 to be paid for each interview.

Language: If you do not speak English, a language interpreter will be provided.

Contacts and Questions:

If you have questions now, please ask them. If you have questions later, you may call Gabriela Halas at ghalas@alaska.edu (email) or (907) 699-0612 (phone); or contact Gary Kofinas at gary.kofinas@uaf.edu (email) or (907) 474-7078 (phone). Gabriela is a graduate student and Gary is a professor at the School of Natural Resources, University of Alaska Fairbanks.

If you have questions or concerns about your rights as a research participant, you can contact the UAF Office of Research Integrity at 474-7800 (Fairbanks area) or 1-866-876-7800 (toll-free outside the Fairbanks area) or fyirb@uaf.edu (email).

Statement of Consent

I understand the information described above. I agree to participate in the interview. I am over 18 years of age at the time of signing. By signing, I intend to release and discharge UAF (and affiliated parties) from any and all claims that I may have.

Release:

Do you agree to be interviewed?

□ Yes □ No

Would you like your name to appear in the acknowledgements and thank you section of the report?

□ Yes □ No

I give the University of Alaska Fairbanks (UAF) permission to photograph, videotape and record me. I waive any right I may have to view and/or approve the finished product in which the images may be used.

□ Agree to release of images publicly □ Do not release images publicly

_____ _____

Signature of Participant & Date Signature of Person Obtaining Consent & Date

NAME: _____

ADDRESS: _____

CITY: _____STATE _____ ZIP _____

EMAIL: _____

PHONE NUMBER: _____

INTERVIEW GUIDE FOR *Knowledgeable Hunters Interview*

Reader to person being interviewed:

This interview uses maps to locate your knowledge of caribou and caribou hunting. To do that we ask that you please help us identify specific places by pointing to areas when you answer our questions. As you answer the questions, we will be writing on the map and saying the names of codes so we can hear them later on our recording of the interview. To get good information, we ask that you be as specific as you can when locating places on the map.

1. When did you shoot your first caribou?

2. Tell us the story of shooting your first caribou?

3. What are the three most important things you were taught -

3.1. about caribou hunting

3.2. about caribou

4. Using the map, show us the areas you have used for caribou hunting

4.1. in your entire life time

4.2. last five years

Fall Migration

Staring with August 1st, show me where caribou go each season of the year…

4.3. What are the fall migration routes that are typically used each year by caribou?

4.3.1.Are there other areas used in the fall migration?

4.4. What are the river crossing typically used each fall?

4.4.1.Are there other river crossings used in the fall migration?

4.5. Why do the caribou not use some areas?

5. What affects the timing of fall migration?

6. Are there leaders in the fall migration?

6.1. If yes, who are the leaders?

6.1.1.What do leaders do? How do caribou move with leaders?

7. Why are some fall migration routes used in some years and other routes used in other years?

7.1. What causes migration to be different?

8. Have there been changes in fall migration

8.1. What have been the changes?

8.2. When?

8.3. Where?

8.4. Why?

9. Do you have stories or observations about fall migration you want to share?

<u>Caribou hunting use areas</u>

10. Where are the areas most used by Noatak hunters?

10.1. Have there been changes in these Noatak's use area?

11. Where are the areas most used by non-local caribou hunters?

12. Where are the places most used by transporters to bring in hunters

13. Do you interact with

13.1. Caribou hunting guides?

13.1.1. If yes, please describe your interactions?

13.1.2. Were they positive or negative?

13.2. Self-guided / non-local hunters?

13.2.1. If yes, please describe your interactions?

13.2.2. Were they positive or negative?

13.3. Transporters?

13.3.1. If yes, please describe your interactions?

13.3.2. Were they positive or negative?

14. How do each of these groups :

14.1. Affect caribou?

14.2. Affect Noatak hunting?

15. *If problem areas mentioned:* Are there areas where there have been problems with Noatak hunters encountering nonlocal hunters?

15.1. Where are these areas?

15.2. Please share your stories or observations of problem encounters that occurred with Noatak and non-local caribou hunting in the past.

15.2.1. Where did they occur?

16. Are there other disturbances to caribou or caribou hunting that you want to talk about?

Winter areas

17. What areas are used by the winter?

18. Why do caribou use areas in some years, and use other areas used other years?

18.1. What makes them select some winter areas over others?

Spring migration

18.2. What are the spring migration routes that are typically used each year?

18.2.1. Are there other routes used in the spring migration?

18.3. Why do the caribou not use some areas for the spring migration?

19. What affects the timing of spring migration?

20. Are there leaders in the spring migration?

20.1. If yes, what's their role?

21. Why some spring migration routes are used by caribou some years and other routes in other years?

21.1. What causes them to be different?

22. Have there been changes in spring migration areas?

22.1. What changes?

22.2. Where?

22.3. When?

22.4. Why?

23. Do you have stories or observations of spring migration you want to share?

Summer-time

24. On the map, show me where caribou go in the summer.

24.1. Where are the calving areas?

24.2. Areas used after calving?

25. What affects how many calves are born in the summer?

26. Has summer use areas of caribou changed?

26.1. When?

26.2. Why?

Important Areas

27. You have told us about the area caribou use throughout the year. Where are the most important areas for the health of the caribou herd?

27.1. Why?

Caribou condition, health, population

28. Have you noticed changes in amount of forage or quality of forage?

29. What affects caribou body condition (i.e. skinny or fat)?

29.1. Have you noticed changes in body condition?

29.1.1. Why?

30. What affects caribou general health (sick or not sick)?

30.1.1. Changes? Why?

31. What determines how many caribou there are in the whole caribou herd?

31.1. Have there been changes? Why?

31.2. What makes the number of caribou in the herd go up or down?

32. Are there areas that are particularly used by predators?

32.1. Wolves?

32.1.1. Where?

32.2. Bears?

32.2.1. Where?

32.3. Other predators?

32.3.1. Where?

Suggestions for Change in management

33. What are your ideas on how best to manage caribou hunting and caribou use of hunting areas in the Noatak area?

33.1. Managing conflicts with non-local hunters?

33.2. Managing changes in size of caribou herds?

33.3. How locals are involved in caribou management?

34. How should Traditional Knowledge be used in decision making about caribou management?

35. What are the most important things that need to communicate to the public about caribou and caribou hunting?

36. Are there other things you want to say?

37. Are there questions I didn't ask that I should have asked that I didn't?

Appendix E
Complete Active Hunter Survey Responses

Gender of Survey Respondents:

Gender	Percent
Women	17.7
Men	82.3
n=	62

1. **In what year were you born? (age)**

Age Class	Percent	n=
<24	16.1	-
25-49	48.4	-
>50	35.5	-
Total	100.0	62

2. **Where were you born?**

Location	Percent
Noatak	24.2
Kotzebue	48.4
Anchorage	9.7
Other Alaska	11.3
Other	6.5
n=	62

3. Have you lived in any other communities other than Noatak?

Lived other than Noatak	Percent
Yes	62.9
No	37.1
n=	62

4. Type of employment you had during the past 12 months

Employment	Percent
Unemployed	25.8
Part-time	33.9
Seasonal	22.6
Full-time	12.9
Total	95.2
n=	57

7. How old were you when you started hunting caribou? _____

AGE	AGE STARTED HUNTING
0-10	47.5
11-20	41.0
21-30	4.9

31-40	3.3
41-50	3.3
51-60	0.0
61-70	0.0
71-PLUS	0.0
n=	61

8. Did you hunt caribou in (year)?

Hunted in Year	Percent	n=
2010	91.94	57
2011	96.77	60
2012	93.55	58
2013	79.03	49

Annual Active Hunter Breakdowns

A)

Harvested in 2013	Aug-Oct	Nov-Mar	Apr-July
% no	45.16	71.67	93.44
% yes	54.84	28.33	6.56
n=	62	60	61

B)

Harvested in 2012	Aug-Oct	Nov-Mar	Apr-July
% no	25.81	56.45	90.16
% yes	74.19	43.55	9.84
n=	62	62	61

C)

Harvested In 2011	Aug-Oct	Nov-Mar	Apr-July
% no	16.13	66.13	91.80
% yes	83.87	33.87	8.20
n=	62	62	61

D)

Harvested In 2010	Aug-Oct	Nov-Mar	Apr-July
% no	13.11	73.77	90.16
% yes	86.89	26.23	9.84
n=	61	61	61

7. Do you consider the last year (last 12 months) to be a successful year for your caribou hunting?

Last Year a Success?	Percent
No	56.67
Yes	40.00
n=	60

8. I will read a list of events, please tell me which scenario represents a successful caribou hunt *for you*?

	Percent of Respondents			
Level of Importance	**High**	**Medium**	**Low**	**n=**
A	85.48	12.90	1.61	62
B	82.26	16.13	1.61	62
C	64.52	35.48	0	62
D	77.42	20.97	1.61	62
E	51.61	37.10	11.29	62
F	95.16	3.23	1.61	62
G	75.81	20.97	3.23	61
H	31.15	37.70	31.15	62
I	51.67	31.67	16.67	21

9. What is the best time for you to go harvest caribou? fall – winter – spring – summer

Best Season	Percentage
Fall	82.26
Winter	3.23
Spring	0.00
Summer	1.61
Fall &Winter	9.68
Fall % Spring	3.23
n=	62

10. How do you know when is the best time to go caribou hunting? (QUALITATIVE)

11. Please provide information about <u>last year's</u> caribou hunting: (2013)

A)

Number of Caribou Harvested	Fall	Winter	Spring
	Percent of Respondents		
0-3 caribou	62.75	42.31	77.78
4-7 caribou	23.53	23.08	22.22
8-11 caribou	11.76	30.77	0
12-15 caribou	1.96	3.85	0
n=	51	26	9

B)

Number of Trips	Fall	Winter	Spring
	Percent of Respondents		
0-10	81.63	78.57	100
11-20	16.33	17.86	0
21-30	2.04	0	0
31+	0	3.57	0
n=	49	28	6

C)

Total Days Spent Hunting	Fall	Winter	Spring
	Percent of Respondents		
0-10	62	77.78	100
11-20	24	14.81	0
21-30	12	0.00	0
31+	2	3.70	0
n=	50	27	6

D)

Average Distance Travelled Per Trip	Fall	Winter	Spring
One-Way River Miles	Percent of Respondents		
0-50	24.44	100	0
51-100	31.11	0	0
101-150	35.56	0	0
151-200	8.89	0	0
200+	0	0	0
n=	45	10	0

E)

Day Trips, Overnights, Multi-Day Trips?	Fall	Winter	Spring
Percent of Respondents			
Day Trips	21.57	96.15	83.33
Overnight	9.80	0.00	0.00
Multi-Day Trips	41.18	0.00	0.00
more than one combination	27.45	3.85	16.67
n=	51	26	6

F)

Hunt Alone, With Other Hunters from Your Household, Other Households	Fall	Winter	Spring
	Percent of Respondents		
Alone	0.00	30.56	66.67
Your Household	19.61	11.54	0.00
Other Households	47.06	26.92	33.33
more than one combination	33.33	19.23	0
n=	51	26	6

12. Please answer these questions about changes in <u>caribou and your caribou hunting in the last five years?</u>

Changes to Caribou & Caribou Hunting in the Last 5 Years, n=62				
	Percent of Respondents			n=
	Fewer	No Change	More	
Number of caribou harvested	72.6	19.4	8.1	62
	Fewer	No Change	More	
Number of trips	25.8	35.5	37.1	62
	Shorter	No Change	Longer	
Length of trips	14.5	33.9	51.6	62
	Earlier	No Change	Later	

Timing of trips	11.3	41.9	46.8	62
	Fewer	No Change	More	
Number of total days caribou hunting	19.4	40	40.3	62
	Fewer	No Change	More	
Number of people seen while hunting	13.1	31.1	54.1	61
	Less Fat	No Change	More Fat	
Body condition of caribou	28.3	61.7	10.0	60
	Less Healthy	No Change	More Healthy	
Health of caribou	8.8	86.0	5.3	57

13. Has the change in the cost of gasoline affected your caribou hunting?

Gas Impact	Percent of Respondents
Yes	83.87
No	16.13
n=	62

Change in Gas Cost and Impact to Hunting				n=
	Percent of Respondents			
	Fewer	No Change	More	
How Many Hunting Trips Taken	57.69	19.23	23.08	53

	Shorter	No Change	Longer	
Length of Time on Trips	26.92	23.08	50.00	53
	Fewer	No Change	More	
When Hunters Go : Fall	37.25	27.45	35.29	53
Winter	51.43	40.00	8.57	35
Spring	58.82	29.41	11.76	17
Summer	28.57	57.14	14.29	7
How Far Hunters Go	Closer	No Change	Further	
	22.64	24.53	52.83	53

Does Gas Price Change Where Hunters Go	
Percent of Respondents	
No	21.15
Yes	78.85
n=	42

Does Gas Price Change What Gear Hunters Use	
Percent of Respondents	
No	59.18
Yes	40.82
n=	49

14. Impacts to caribou and your caribou hunting success

Negative Impact to Caribou Migration, n= 62					
	No Negative	Low	Medium	High	Don't know
Wolves	4.84	6.45	38.71	43.55	6.45
Bears	12.90	14.52	20.97	38.71	12.90
Red Dog Road	38.71	20.97	19.35	8.06	12.90
Local Hunters	51.61	27.42	12.90	1.61	6.45
Non-Local Hunters	8.06	8.06	20.97	56.45	6.45
Small Airplanes	3.23	3.23	14.52	77.42	1.61
Helicopters	43.55	9.68	12.90	8.06	25.81
Motorized Boats	40.32	30.65	20.97	3.23	4.84
Non-Motorized Boats	67.74	19.35	4.84	3.23	4.84
Collars on caribou	41.94	8.06	8.06	1.61	40.32
Biologists who track wildlife in planes	37.10	14.52	9.68	11.29	27.42
Warming Climate	6.45	19.35	35.48	32.26	6.45
Pollution/Contamination	41.94	20.97	11.29	3.23	22.58
Habitat Change	16.13	8.06	32.26	27.42	16.13

Negative Impact to Caribou Hunting, n= 62					
	No Negative	Low	Medium	High	Don't know
Wolves	16.13	16.13	24.19	35.48	8.06
Bears	14.52	20.97	22.58	33.87	8.06
Red Dog Road	45.16	24.19	9.68	9.68	9.68
Local Hunters	64.52	14.52	12.90	3.23	4.84
Non-Local Hunters	11.29	8.06	19.35	54.84	6.45
Small Airplanes	8.06	3.23	14.52	74.19	0.00
Helicopters	46.77	11.29	11.29	8.06	22.58
Motorized Boats	41.94	25.81	27.42	3.23	1.61
Non-Motorized Boats	64.52	20.97	8.06	3.23	3.23
Collars on caribou	48.39	12.90	4.84	0.0	0.0
Biologists who track wildlife in planes, n=61	42.62	9.84	4.84	14.75	29.51
Warming Climate, n=61	14.75	16.39	22.95	42.62	3.28
Pollution/Contamination	47.54	21.31	8.20	4.92	18.03
Habitat Change	17.74	16.13	25.81	25.81	14.52

15. Has the population of Western Arctic Herd changed in the past ten years?

Caribou Population Change – Last 10 Years	
Percent of Respondents	
Fewer	41.94
No Change	14.52
More	8.06
Don't know	35.48
n=	62

16. Has caribou migration (where caribou go) changed in the last ten years?

Caribou Migration Change – Last 10 Years	
Percent of Respondents	
Changed a little	33.87
No Change	3.23
Changed a lot	56.45
Don't know	6.45
n=	62

17. Your encounters with other hunters last fall

***This portion was the survey was changed in analysis. Categories of hunters were combined or grouped according to local understandings of who is represented.**

- **Guided hunters AND hunters that used a transporter = "non-local hunters"**
- **Other hunters from Noatak AND Motorized Boats= "local hunters"**
- **The rest of the categories remained the same**

	Number of Encounters Had by Noatak Hunters; Percent of Respondents				
	Zero	**1-9**	**10-19**	**20+**	n=
Non-Locals	31.25	46.88	12.50	9.38	32
Locals	2.56	25.64	51.28	20.51	39
Hunters from other Villages	73.17	26.83	0.0	0.0	41
Airplanes	8.16	65.31	16.33	10.20	49
ATVs	80.85	14.89	2.13	2.13	47
Non-motorized Boats	11.43	82.86	5.71	0.0	36

	Expectations on Encounters by Local Hunters; Percent of Respondents			
	What Was Expected	Fewer Than Expected	More Than Expected	n=
Non-Locals	35.17	11.90	52.38	42
Locals	72.55	15.69	11.76	51
Hunters from other Villages	22.22	66.67	11.11	18
Airplanes	32.61	10.87	56.52	47
ATVs	66.67	22.22	11.11	9
Non-motorized Boats	50.00	39.13	10.87	46

	Frequency of Encounters and Impact to Quality of Hut for Locals Hunters					
	Greatly Reduced	Somewhat Reduced	No Influence	Slightly Improved	Greatly Improved	n=
Non-Locals	36.59	31.71	31.71	0.0	0.0	41
Locals	0.0	5.88	80.39	11.76	1.96	51
Hunters from other Villages	0.0	11.11	77.78	11.11	0.0	18
Airplanes	40.43	31.91	27.66	0.0	0.0	47
ATVs	0.0	0.0	100	0.0	0.0	10

Non-motorized Boats	0.0	4.35	89.13	4.35	2.17	46

	Behavior of Encounters and Impact to Success for Local Hunters					
	Greatly Reduced	Somewhat Reduced	No Influence	Slightly Improved	Greatly Improved	n=
Non-Locals	34.15	31.71	34.15	0.0	0.0	41
Locals	2.0	6.0	76.0	12.0	4.0	50
Hunters from other Villages	0.0	11.76	88.24	0.0	0.0	17
Airplanes	47.83	32.61	19.57	0.0	0.0	47
ATVs	0.0	0.0	100	0.0	0.0	9
Non-motorized Boats	0.0	2.22	91.11	4.44	2.22	45

18. Of the encounters you mentioned, can you estimate the percentage of them were negative?

If negative was mentioned: **Of the negative experiences you mentioned, where did they occur?**

Why were they negative?

If positive was mentioned: **Of the positive experiences you mentioned above, why were they positive?**

19. If you had a question about the population or migration of caribou, who would you ask?

Concerns or Questions about the Population or Migration of Caribou, n= 62	
Percent of Respondents	
Local Resident	30.62
Agencies	27.42
Biologist/Jim Dau	27.42
Elders	16.13
Don't Know	8.06
Expert Hunters	4.84
Other	4.84
Local Working Groups (Unit 23 or WAHWG)	3.23
Local Hunting License Employee	0.00

20. If you had a question or concern about caribou management, who would you ask?

Concerns or Questions on Caribou Management, n=62	
Percent of Respondents	
Agencies	25.81
Local Resident	22.58
Biologist/Jim Dau	19.35
Other	14.52
Don't Know	14.52
Local Hunting License Employee	6.45
Local Working Groups (Unit 23 or WAHWG)	4.84
Elders	1.61
Expert Hunters	0.00

21. Have you heard of the WACHWG?

Respondents Who Have Heard of the Western Arctic Herd Working Group, n=62	
Percent of Respondents	
No	74.19
Yes	25.81

22. If the people of Noatak had a concern about caribou hunting, do you feel that it would be seriously considered by the

Agency n=62	not likely	somewhat likely	likely	very likely	DK
Western Arctic Herd Working Group	3.23	14.52	25.81	22.58	33.87
The Alaska Board of Game	8.06	17.74	22.58	16.13	35.48
Federal Subsistence Board	4.84	16.13	22.58	14.52	41.94
NANA Corporation	14.52	22.58	22.58	22.58	17.74
Noatak IRA	9.68	11.29	30.65	40.32	8.06
National Park Service	3.32	30.65	25.81	22.58	17.74
Alaska Department of Fish and Game	4.84	11.29	33.87	37.10	12.90
US Fish and Wildlife Service	9.68	12.90	22.58	20.97	33.87

23. Where do you get your information about caribou population and migration?

Respondents Information for Caribou Migration and Population Information, n=62	
Percent of Respondents	
Family/friends	58.06
Friends/Neighbors	72.58
Biologists	24.19
Caribou Trails Newsletter	22.58

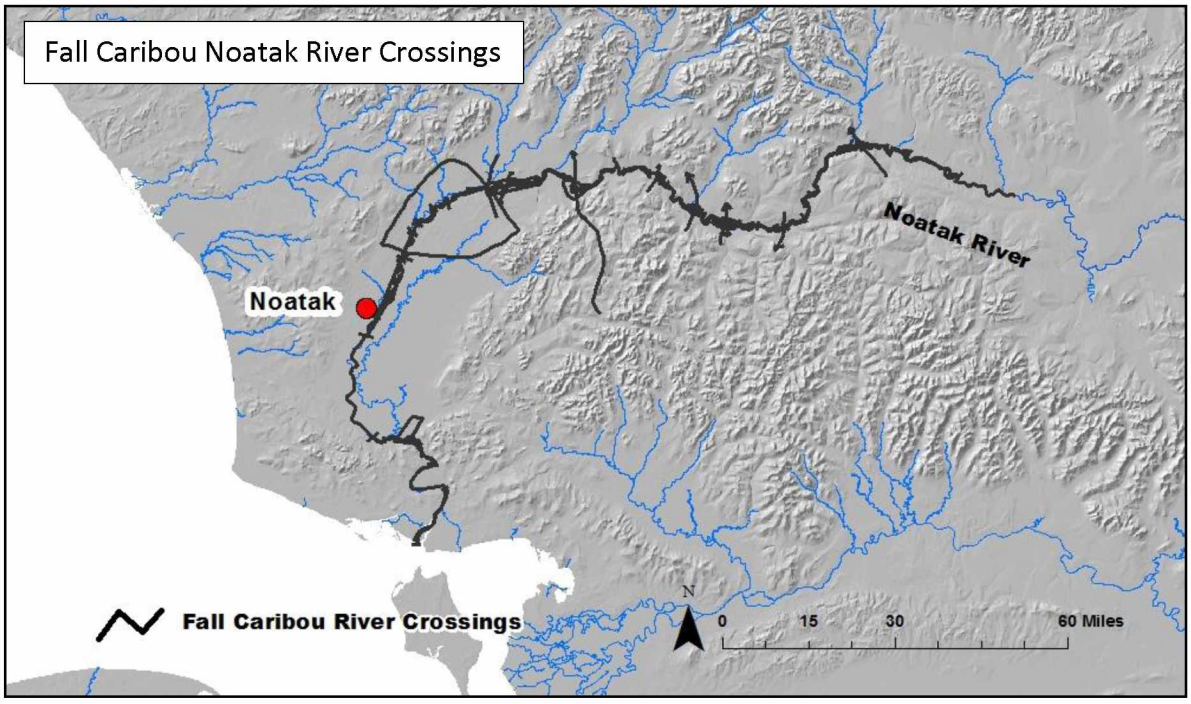
CB Radio	19.35
Elders	53.23
Other	11.29

24. Where do you get your information about caribou management?

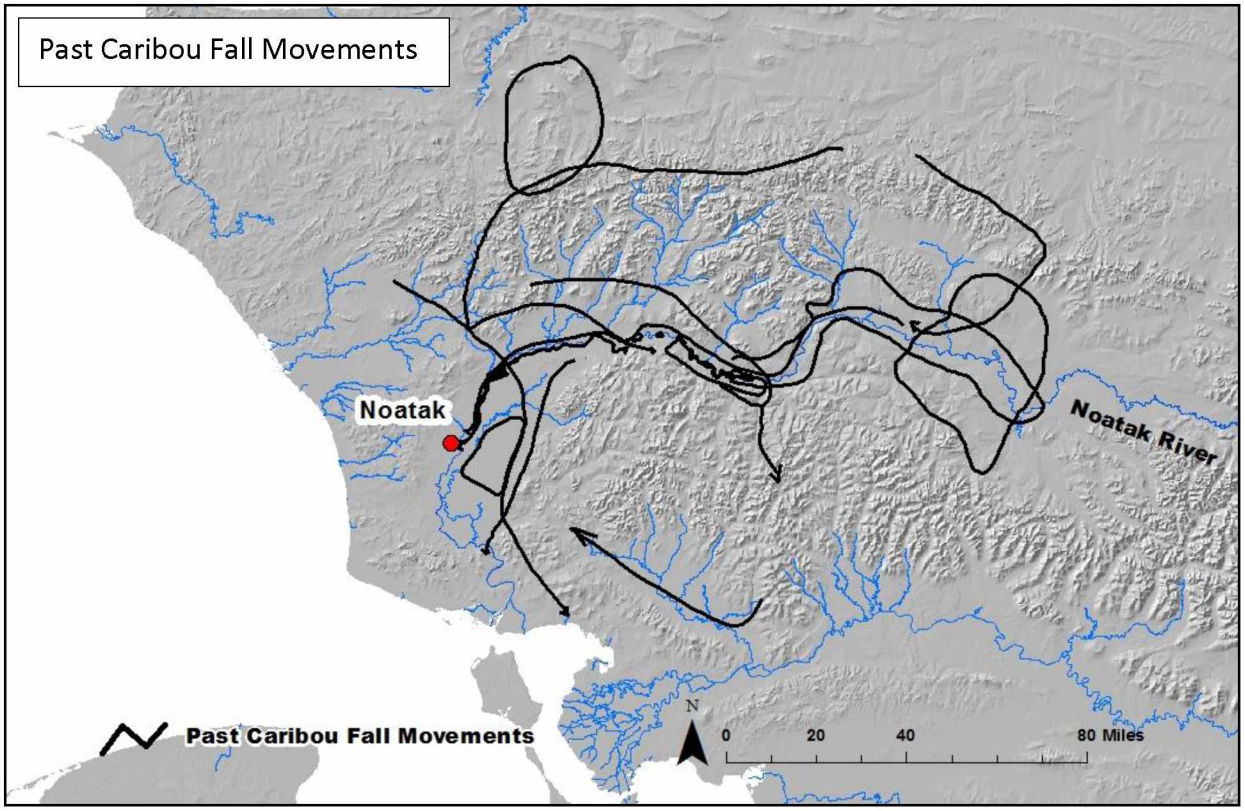
Respondents Information for Caribou Migration and Population Information, n=62	
Percent of Respondents	
Family/friends	25.81
Friends/Neighbors	32.26
Biologists	20.97
Caribou Trails Newsletter	24.19
CB Radio	9.68
Elders	24.19
Other	17.74

Appendix F

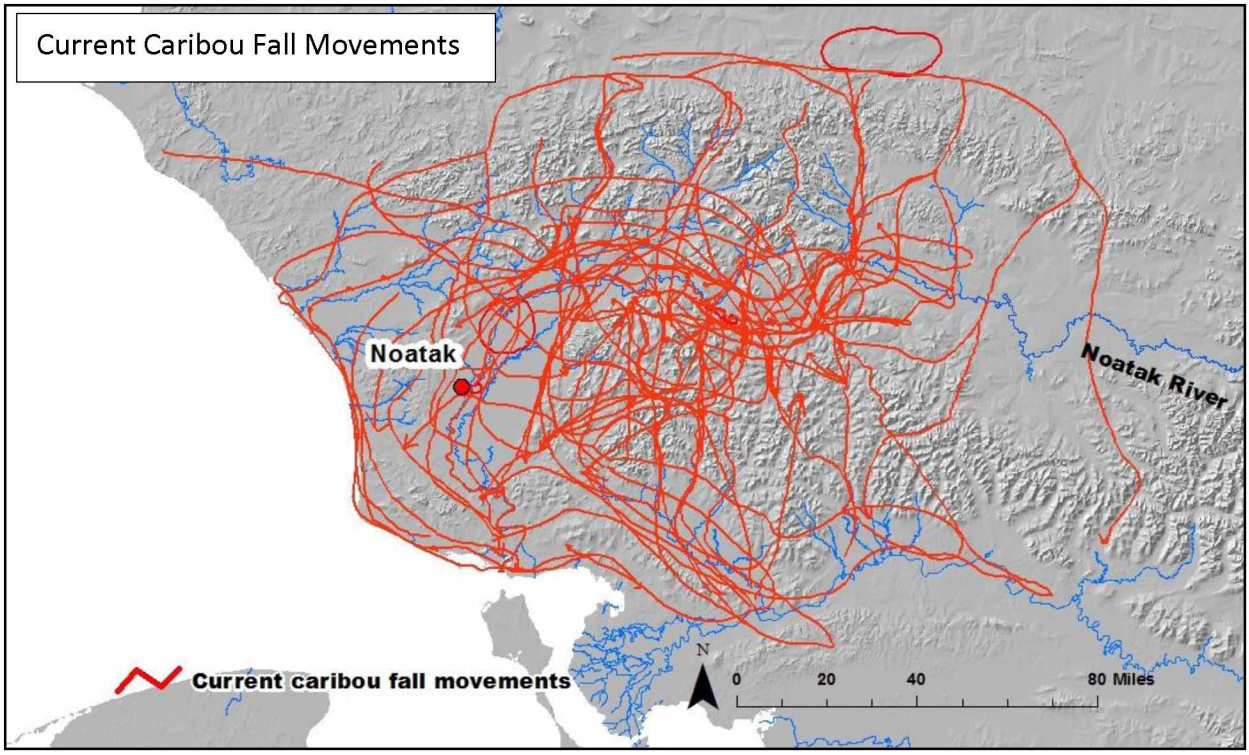
Maps from Knowledgeable Hunter Interviews



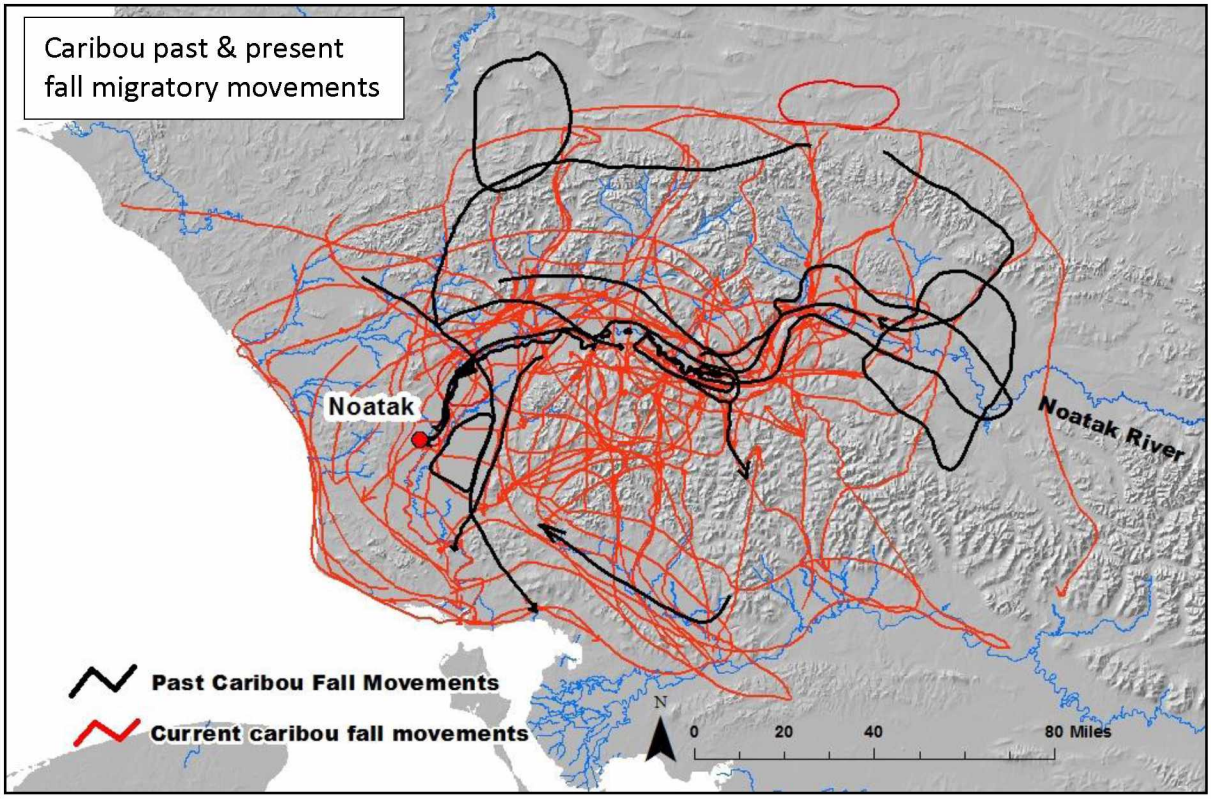
Map 1. Current caribou Noatak River crossings as reported by Noatak respondents.



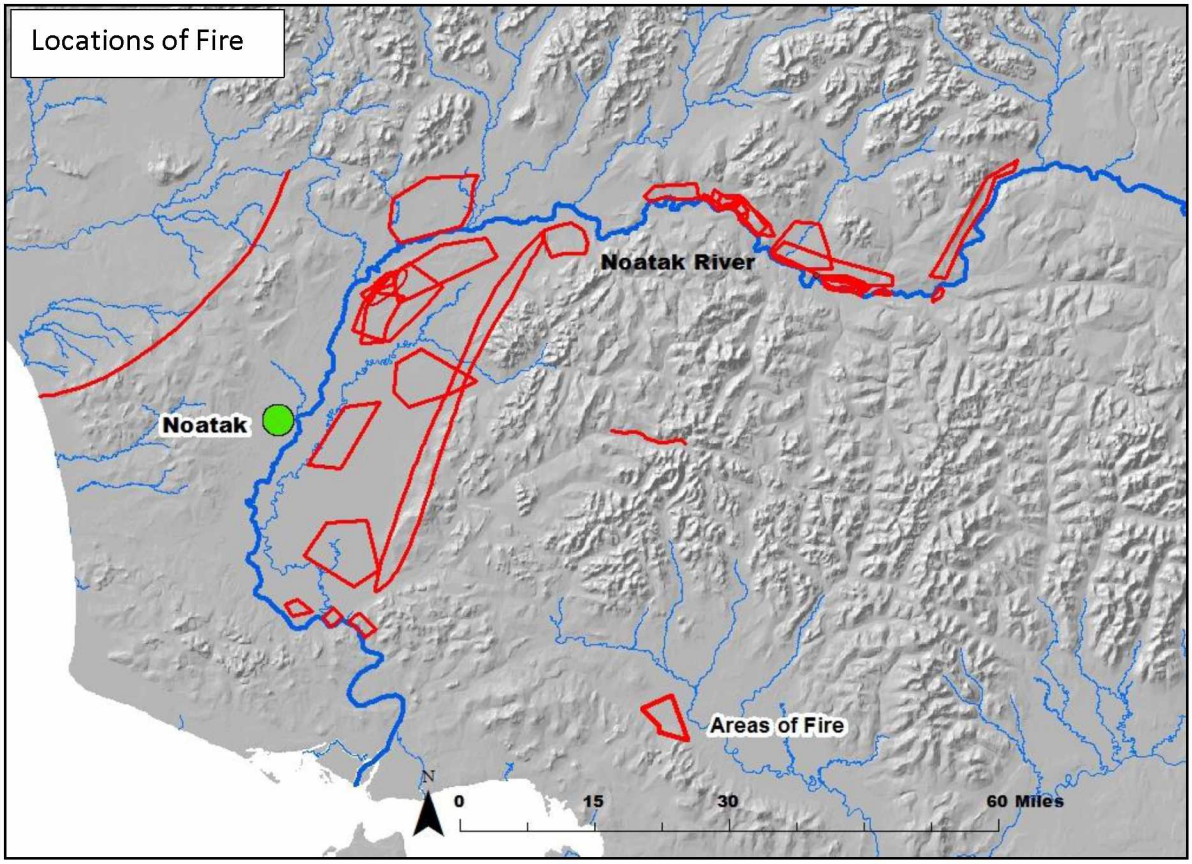
Map 2. Past caribou fall migration routes and locations as reported by Noatak interview respondents.



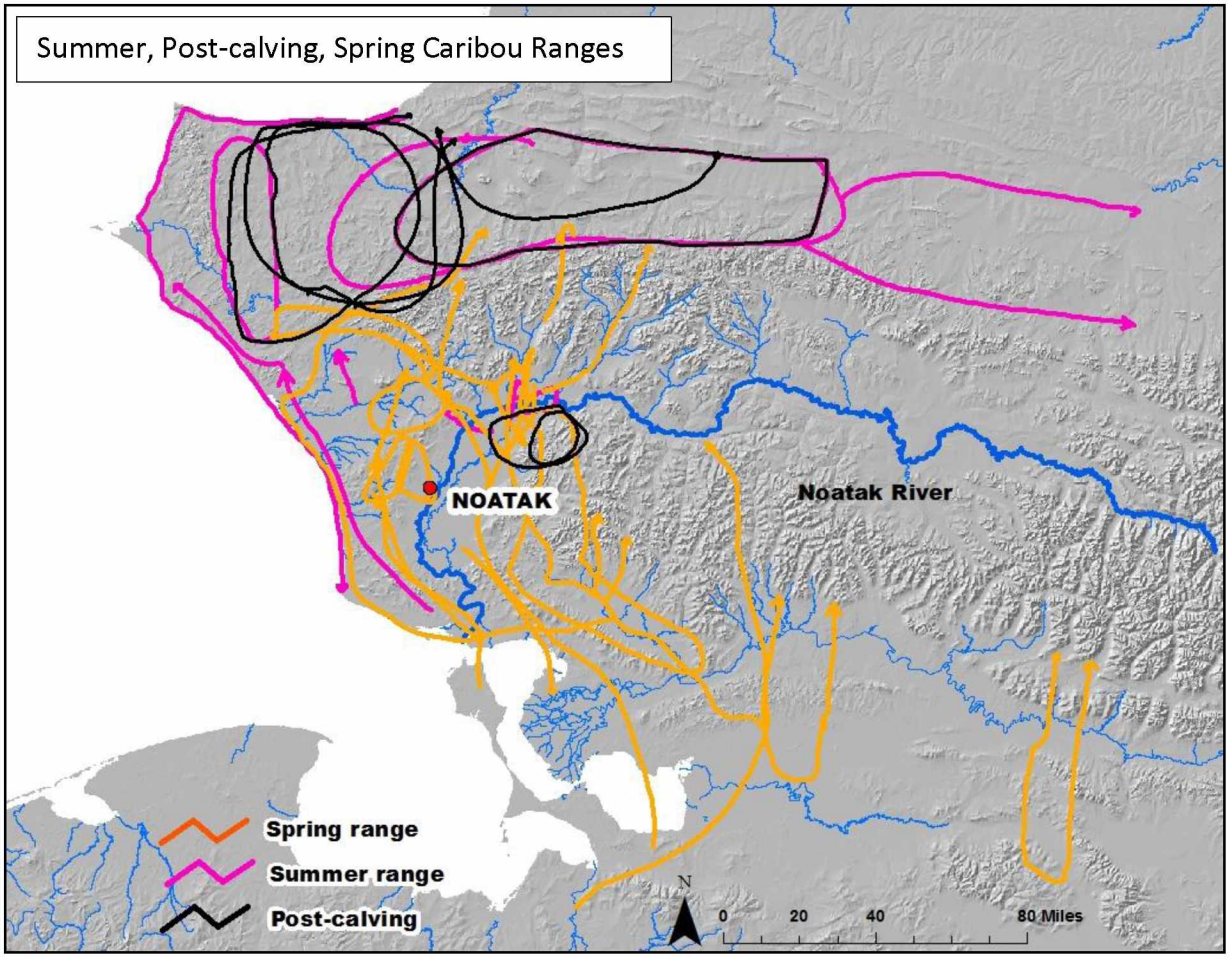
Map 3. Current caribou fall migratory routes and locations reported by Noatak interview respondents.



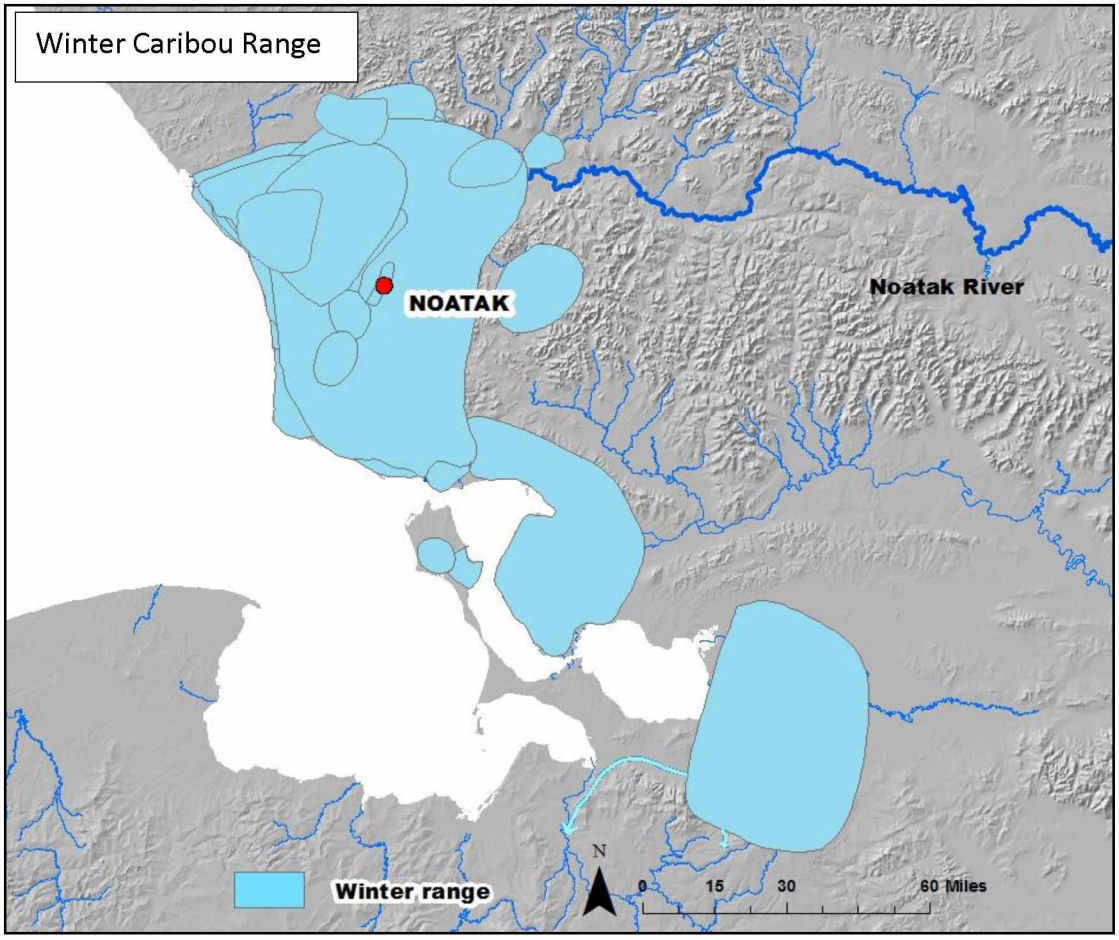
Map 4. Current and past caribou fall migration patterns as reported by Noatak respondents.



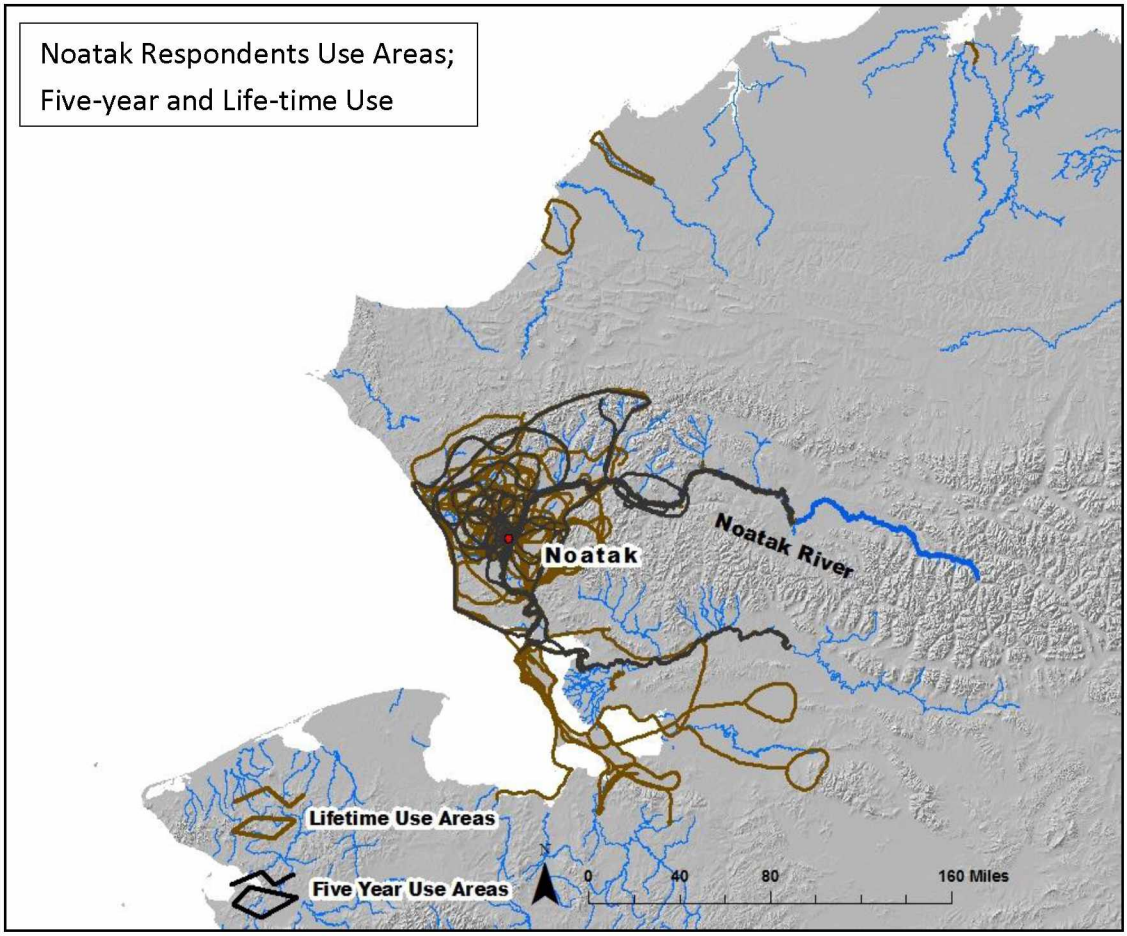
Map 5. Areas of fire reported by Noatak interview respondents.



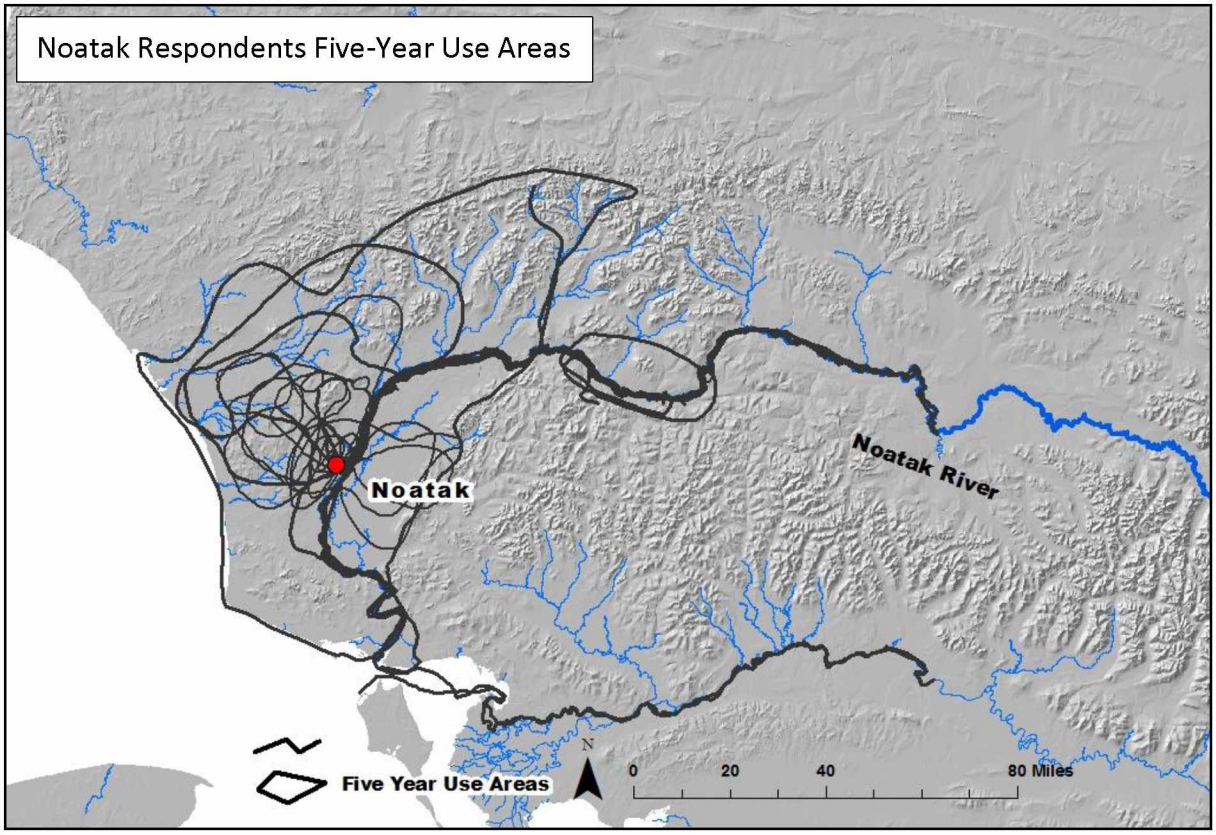
Map 6. Caribou summer, post-calving, and spring use areas as reported by Noatak interview respondents.



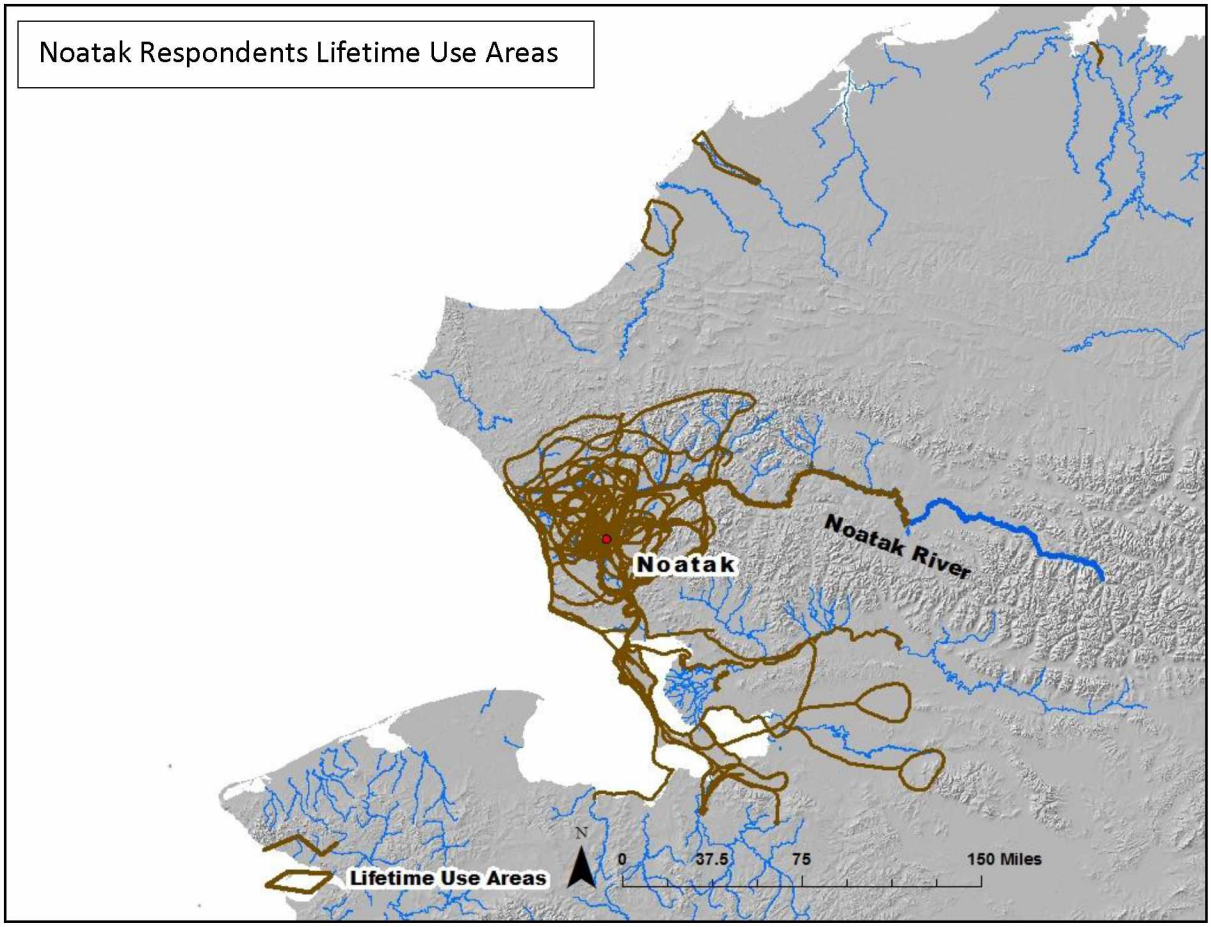
Map 7. Caribou winter use areas as reported by Noatak interview respondents.



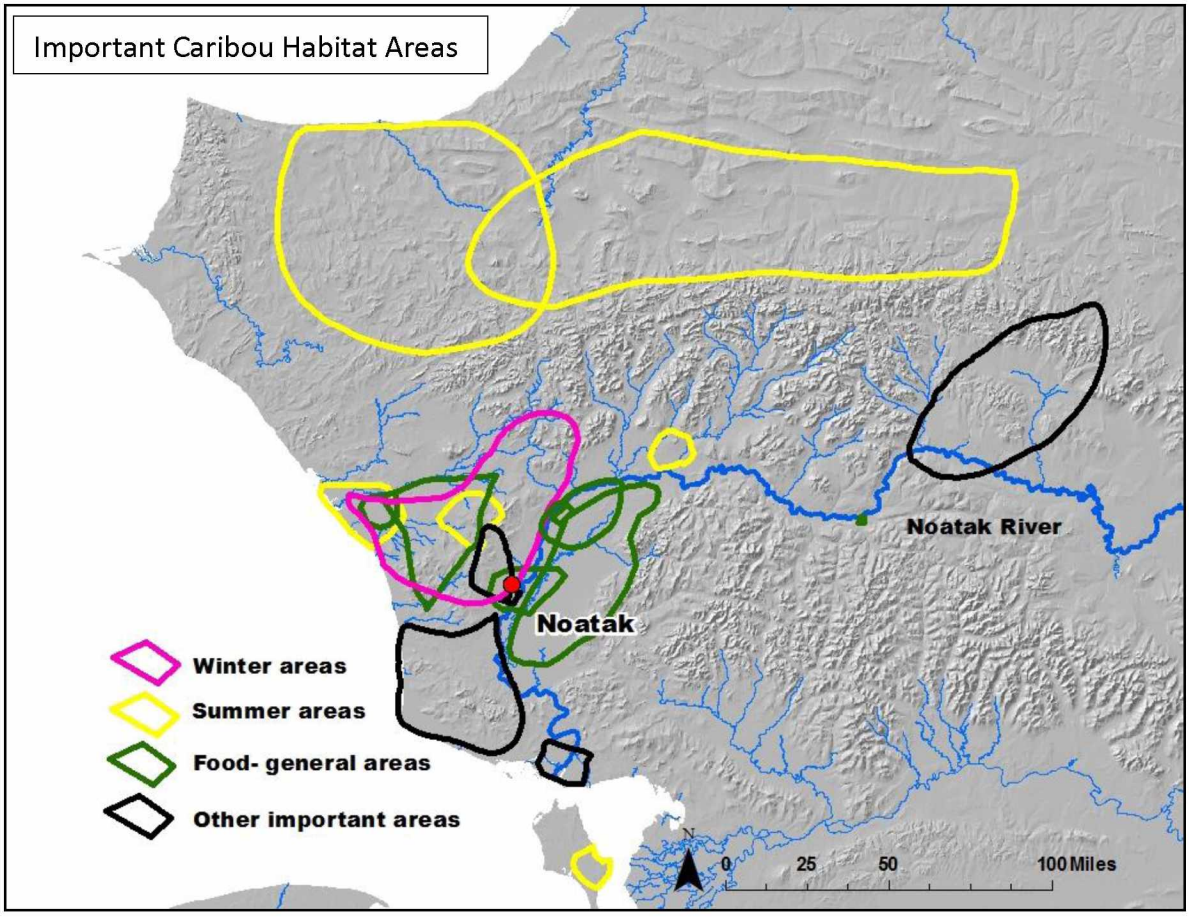
Map 8. Use comparison for caribou hunting between five-year and lifetime use areas as reported by Noatak interview respondents.



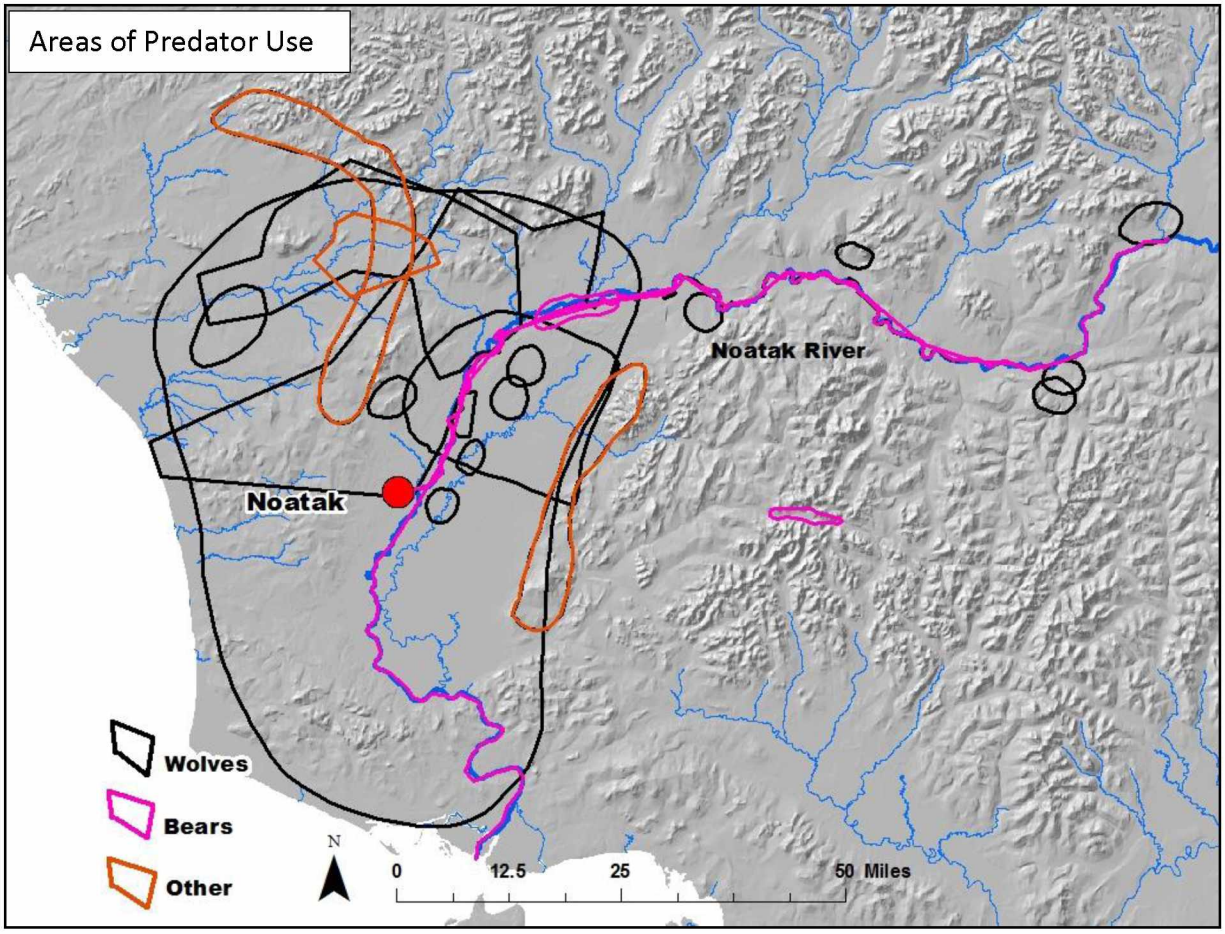
Map 9. Noatak respondents' five-year use areas for caribou hunting.



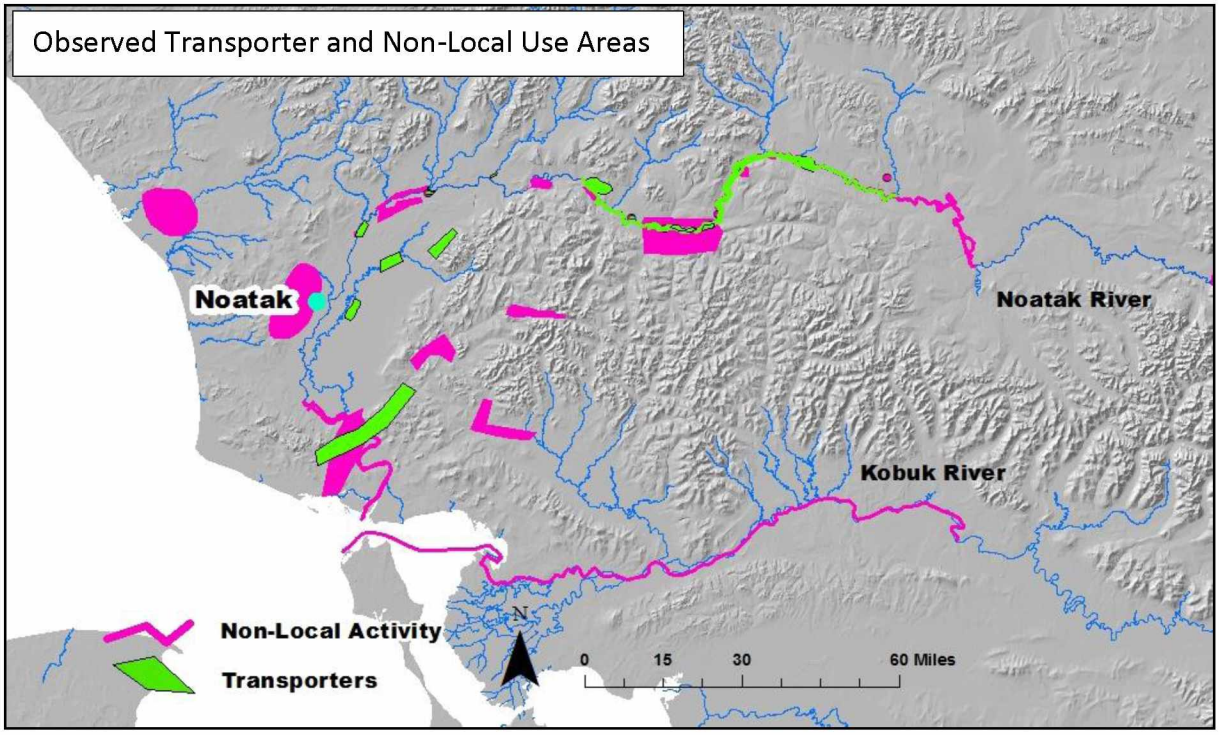
Map 10. Noatak respondents' lifetime use areas for caribou hunting.



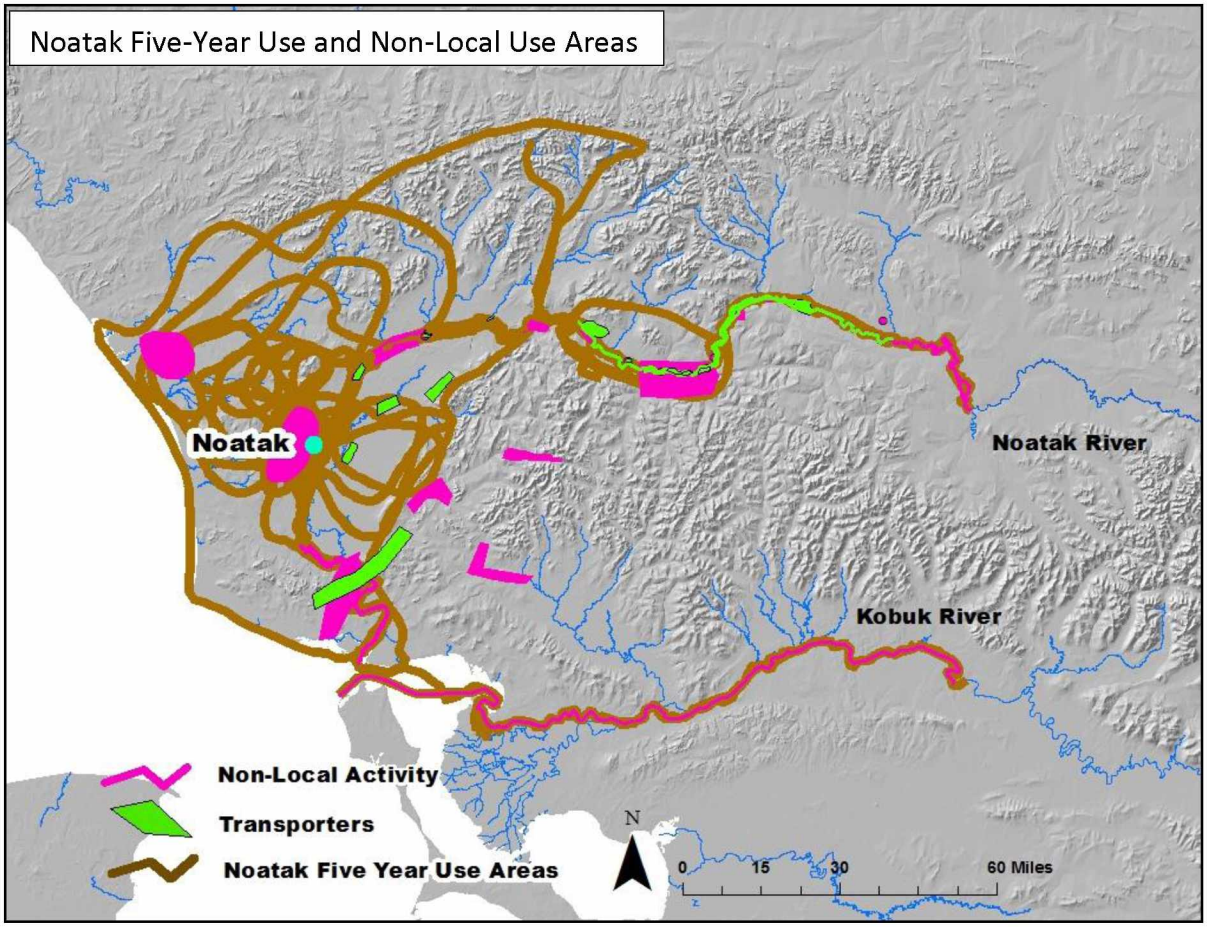
Map 11. Important areas for caribou reported by Noatak interview respondents.



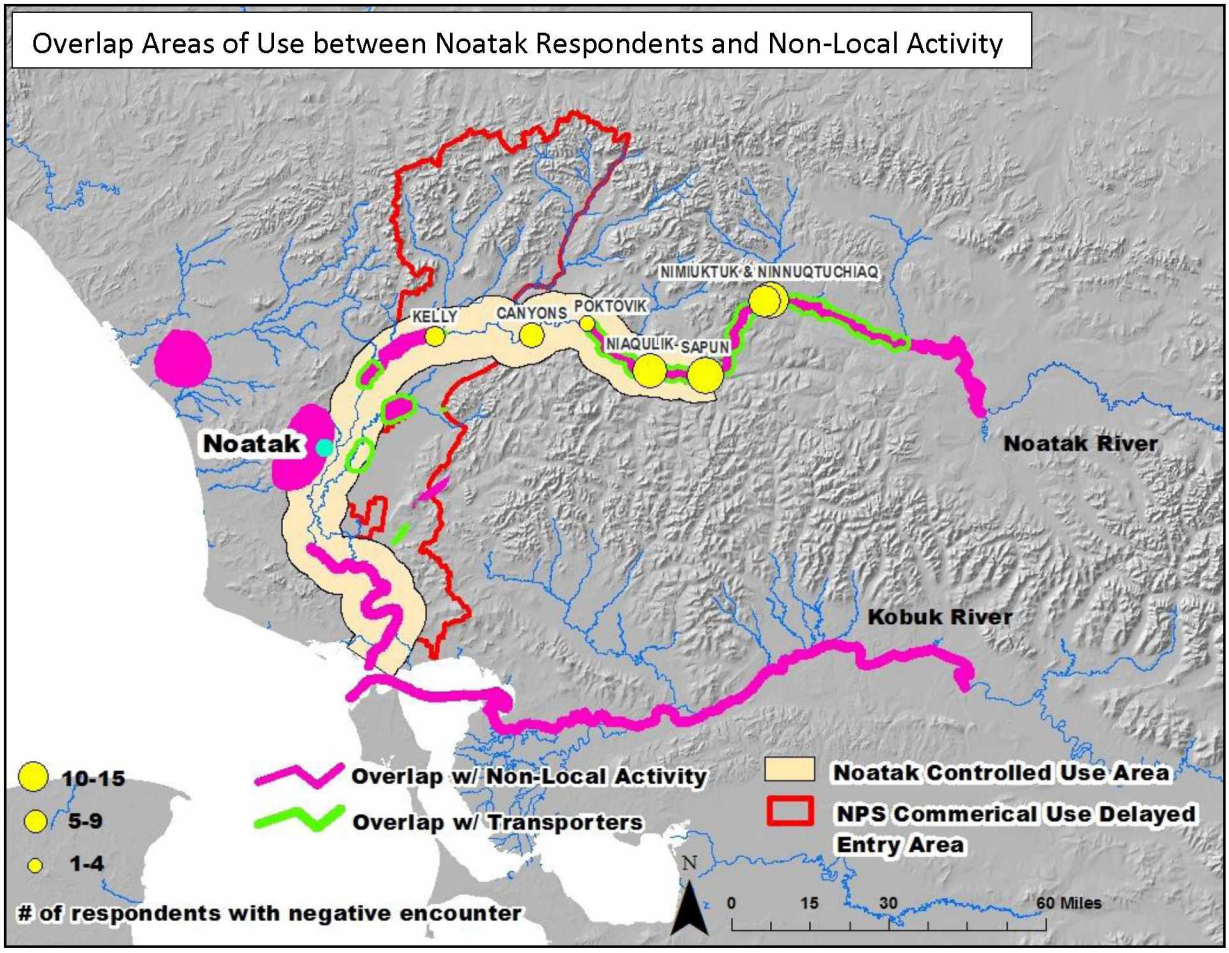
Map 12. Locations of observed predators by Noatak interview respondents. 'Other'; wolverine, fox.



Map 13. Locations observed by Noatak interviews respondents on transporter aircraft and non-local use areas.



Map 14. Comparison use areas for Noatak respondents' five-year use areas and non-local activity.



Map 15. Areas of overlap use between Noatak interview respondents' and non-local users. Green lines and polygons delineate overlap areas with transporters. Pink lines and polygons are overlap areas with non-local users. Yellow circles represent the number of respondents who had a negative encounter with non-locals in specified locations.

Appendix G

A Selection of Specific Comments by Respondents on Managing Caribou and Caribou Hunting in the Noatak Area

Boundaries & Limits

1. Let 1000 caribou pass before hunting, no camping on migration route, appropriately space campsites on the land, close Aggie River corridor.

2. Make Noatak CUA boundaries larger north of Sapun Creek.

3. Allow first bunch of caribou to cross, big game hunters should hunt other species (such as bear); but no predator control/state control of predators.

4. Change five mile CUA (no-fly zone) along river to 10-15 miles out of river, let first caribou herd cross, put signs on river, let people hunt wolves/bears

5. Sports hunters should camp and hunt below village.

6. Planes should fly behind mountains so caribou can cross the River.

Non-local Hunter Recommendations

1. Transporters should take hunters up when locals not hunting; should stop when subsistence hunting is going.

2. Let sport hunters fly at a different times; change the timing of hunting for sports hunters, sports hunters given own time to hunt after locals hunt.

3. Need more guided hunters.

4. Make sure non-locals have all their papers, up to date regulations and licenses; improve safety for boaters, life vests, GPS, radios.

5. Get permission to hunt “on Noatak land”.

6. Let locals know when and why sports hunters are in the area.

7. Restrict time for sports hunters; wait until village gets its meat.

8. Use local guides in boats: “We could interact and they could learn our ways. We need a list of transporters/non-locals who go up river.”

9. Training for non-locals: “to understand local hunting rules, these are the same rules of good conduct. They are guests in our home, it is our home they are coming into.”

10. Working together: “If transporters can't be reduced the residents have to find a way to work with them; we don’t want to mess with them [transporters/sports hunters] as they have deep pockets.”

11. Monitoring: “Have NANA trespass [NANA private property security officers] stationed up-river or a subsistence hunter up river stationed monitor activity between hunters.

Better Local Management

1. Respondent feels like there are “too much” regulations: “One year we didn’t get caribou and had to live on beef and pork; non-native foods make kids go hungry. We got to have seal oil and native foods, store-bought food is not fulfilling. It is out inherent right, our Aboriginal right, but now we have to follow rules and regulations. We survived before the white/Western world arrived, we have always been here.”

2. More exposure to issues (via notices), have own representative in WAHWG for Noatak.

3. More frequent letters from agencies stating how herd is moving and changing, collar data, newsletters

4. Involve residents in co-management: “need to expand co-management as it’s not really happening now. Like to see Unit 23 co-managed by tribes and residents, WAHWG focuses on caribou but no other wildlife. Noatak is eclectic in the sense that we hunt beluga, seal, geese, fish, caribou etc. We need a bigger role. We're responsible for a lot as a group and take it seriously. There is very little waste by our community.”

5. Respondent in reference to the WAHWG; “We are working with so many different agencies who don’t view Native preference on subsistence. The State sees “shared resources” for all of AK. The State of AK has control of subsistence, and the local ADF&G are trying to improve the rules and regulations. Letting the 1st caribou herd cross would help change caribou hunting. There is high importance to fill my freezer, but also to hunt for Elder’s.”

6. Respondent: “Work closely with the IRA, proposals were made in the past and things changed. But don't have too many "Boards" out there, we have enough representation”.

Economy

1. More local jobs for people

2. More grants and money for hunters and low income people

3. Give meat to village, need to donate to Elders and village

4. Gas prices need to be lower, used to be discounted for hunting season